SPECIFICATIONS

May 2018

SKYE CANYON DETENTION BASIN 2

PREPARED FOR:

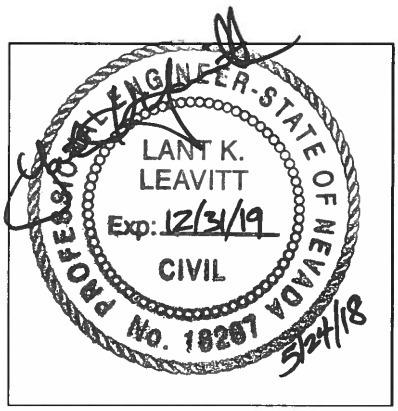
NINETY-FIVE MANAGEMENT LLC

PREPARED BY:

SLATER HANIFAN GROUP

SKYE CANYON DETENTION BASIN 2

SPECIFICATIONS



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(1) SPECIFICATIONS, PAGES SP-100-1 THROUGH SP-729-1

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SECTION 100 – GENERAL PROJECT REQUIREMENTS

100.01 REFERENCE SPECIFICATIONS AND DRAWINGS

A. Work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications or the applicable codes. Wherever references are made in the contract, standards or codes in accordance with which work under this contract is to be performed or tested, the latest edition or latest revision(s) of the standards or codes shall apply.

B. **"Uniform Standard Drawings for Public Works Construction, Clark County Area, Nevada Volume I and Volume II"**, also referred to as the "Uniform Standard Drawings" or "USD" and shall be adhered to except where otherwise provided herein or otherwise shown on the Contract Drawings. Copies may be obtained from the Regional Transportation Commission of Southern Nevada, 600 S. Grand Central Parkway, Suite 350, Las Vegas, Nevada 89106 or online at www.rtcsouthernnevada.com

C. **"Manual on Uniform Traffic Control Devices"**, also referred to as "MUTCD" and shall be adhered to except where otherwise provided herein or otherwise shown on the Contract Drawings. Copies may be obtained from the U.S. Government Printing Office, Washington, D.C. 20402 or online at mutcd.fhwa.dot.gov

D. **"State of Nevada Department of Transportation Standard Specifications for Road and Bridge Construction"**, also referred to as the "NDOT Standard Specifications" or the "State of Nevada Standard Specifications" and shall be adhered to when specifically referenced herein or as shown on the Contract Drawings. NDOT is located at 123 E. Washington Blvd., Las Vegas, Nevada 89101; Phone (702) 385-6500 or online at www.nevadadot.com/business/contractor/standards/

E. **"State of Nevada Department of Transportation Standard Plans for Road and Bridge Construction"**, also referred to as the "NDOT Standard Drawings" or the "State of Nevada Standard Plans" and shall be adhered to when specifically referenced herein or as shown on the Contract Drawings. NDOT is located at 123 E. Washington Blvd., Las Vegas, Nevada 89101; Phone (702) 385-6500 or online at www.nevadadot.com/business/contractor/standards/.

F. **"Nevada Work Zone Traffic Control Handbook"**, also referred to as the "Work Zone Handbook". Copies may be obtained from Lisa Cody, University of Reno Nevada, (775) 784-1433.

G. **"American Society for Testing and Materials"**, also referred to as the "ASTM". ASTM is located at 100 Barr Harbor Drive, Conshohocken, Pennsylvania, 19428-2959; Phone (610) 832-9585 or online at www.astm.org

H. **"Uniform Design and Construction Standards for Water Distribution Systems"**, also referred to as the "Water District Standards" or "UDACS". Copies may be obtained from the Las Vegas Valley Water District, 1001 South Valley View Boulevard, Las Vegas, Nevada 89153 or online at http://www.lvvwd.com/html/eng_udacs.html

I. **"LVVWD Design Guidance Documents"**, Copies may be obtained from the Las Vegas Valley Water District, 3700 W. Charleston Blvd., Las Vegas, Nevada 89153.

J. **"Design and Construction Standards for Wastewater Collection Systems – Southern Nevada Current Edition"**, also referred to as the "Sewer Specifications" or "DCSWCS". Issued by the Clark County Water Reclamation District, 5857 E. Flamingo Blvd., Las Vegas, Nevada, 89122; Phone (702) 668-8160.

END OF SECTION 100

SECTION 101 – DEFINITIONS AND TERMS

101.01 ABBREVIATIONS

AGA	American Gas Association
AI	The Asphalt Institute
AIEE	American Institute of Electrical Engineers
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ATSSA	American Traffic Safety Services Association
CFR	Code of Federal Regulations
CPM	Critical Path Method
CRSI	Concrete Reinforcement and Steel Institute
EPA	Environmental Protection Agency (USA)
IMSA	International Municipal Signal Association
IPCEA	Insulated Power Cable Engineers' Association
ITB	Instructions to Bidders
NBFU	National Board of Fire Underwriters
NCPI	National Clay Pipe Institute
NDEP	Nevada Department of Environmental Protection
NDOT	Nevada Department of Transportation
NOAA	National Ocean and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRS	Nevada Revised Statutes
OSHA	Occupational Safety and Health Standards
PCA	Portland Cement Association
SSPC	Steel Structures Painting Council
UBC	Uniform Building Code, International Conference of Building Officials
USS	Uniform Standard Specifications for Public Works' Construction Off-Site Improvements, Clark County Area Nevada
USD	Uniform Standard Drawings for Public Works' Construction Off-Site Improvements, Clark County Area Nevada, Volumes I & II

101.02 ADDENDUM

A. A supplemental addition or deletion to the contract documents prior to the advertised bid opening.

101.05 AWARD

A. The acceptance by the Owner of a bid.

101.06 BASE COURSE

A. The layer or layers of specified or selected material of designated thickness on a subgrade to support a surface course.

101.07 BIDDER

A. An individual, partnership, firm, corporation, or any acceptable combination thereof, or joint venture, submitting a bid for the advertised work.

101.12 CHANNEL

A. A natural or artificial water course.

101.16 CONTRACTOR

A. The person, firm, partnership, corporation, permittee, subdivider, or other entity who has entered into a contract or agreement with the Owner. Where work is done under permit issued by the Owner, the permittee shall be construed to be the Contractor. Also,a subdivider who does land development and other work under contract with the Owner.

101.18 CULVERT

A. Any structure not classified as a bridge which provides an opening under the roadway.

101.19 DETOUR

A. A temporary route for traffic around a closed portion of road.

101.22 DRAWINGS

A. That part of the Contract Documents prepared or approved by the Contracting Agency which graphically shows the scope, intent, and character of the Work to be performed by the Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

101.23 EMPLOYEE

A. Any person working on the project mentioned in the contract of which these specifications are a part, and who is under the direction and control, or received compensation from the Contractor or the Contractor's subcontractor.

101.24 ENGINEER

A. The signing engineer on record drawings or other person designated by the Owner acting directly and through the signing engineer’s duly authorized representative.

101.25 EQUIPMENT

A. All machinery and equipment, together with the necessary supplies for upkeep and maintenance, also tools and apparatus necessary for the proper construction and acceptable completion of the work.

101.27 FRONTAGE ROAD OR FRONTAGE STREET

A. A local street or road auxiliary to and located generally on the side of an arterial highway for service to abutting property and adjacent areas and for control of access.

101.31 HYDRAULIC CEMENT

A. An inorganic material or a mixture of inorganic materials that sets and hardens by chemical reaction with water by formation of hydrates, and is capable of doing so under water.

101.32 INSPECTOR

A. The Engineer's or Contracting Agency's authorized representative assigned to make detailed inspections of contract performance.

101.34 LABORATORY

A. The testing laboratory of the Contracting Agency or of any other testing laboratory which may be designated by the Engineer.

101.36 MATERIALS

A. Any substances specified for use in the construction of the project and its appurtenances.

101.41 PAVEMENT STRUCTURE

A. The combination of base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

101.44 PLANS

A. The approved project plans and Standard Drawings, profiles, typical cross sections, and supplemental drawings, or exact reproductions thereof, which show the location, character, dimensions, and details of the work to be performed. All such documents are to be considered as a part of the plans whether or not noted in the Special Provisions.

B. In the above definition, the following terms are defined as follows:

1. Standard Drawings - The Standard Drawings of the Contracting Agency.

2. Project Drawings - The Project Drawings are specific details and dimensions peculiar to the work and are supplemented by the Standard Drawings insofar as the same may apply.

101.45 PROFILE GRADE

A. The trace of a vertical plane intersecting the top surface of the proposed structural section as shown on the plans. Profile grade means either elevation or gradient of such trace according to the context.

101.46 PROJECT

A. The specific improvement to be constructed together with all appurtenances and construction to be performed thereon at the prices quoted.

101.50 QUALITY ASSURANCE (QA)

A. Planned and systematic operations conducted to ensure that the operations and/or product meets specifications. QA encompasses the Engineer's review and oversight of the Contractor's "Quality Control"; verifying the results of "Quality Control"; and inspecting for conformance to plans and specifications. QA is the responsibility of the "Engineer."

101.51 QUALITY CONTROL (QC)

A. Planned and specified operations necessary to construct items that will meet the requirements for quality and performance as specified. QC includes, but should not be limited to controlling the quality of raw materials, produced materials assemblies, components, finished product, and construction process. QC is the responsibility of the "Contractor."

101.52 RIGHT-OF-WAY OR EASEMENT

A. A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to a highway or other improvements.

101.60 SIDEWALK

A. That portion of the roadway primarily constructed for the use of pedestrians.

101.61 SPECIAL PROVISIONS

A. Special Provisions means the written descriptions of the requirements for the Work incorporated as a part of the Contract.

101.62 SPECIFICATIONS

A. The directions, provisions, and requirements contained in the Specifications and supplemental specifications as modified by the Special Provisions. Whenever the term "these specifications" is used in this book, it means the provisions set forth in this book.

101.64 SUBCONTRACTOR

A. Any individual, firm, or corporation to whom the Contractor, with the consent of the Contracting Agency, sublets any part of the contract.

101.66 SUBSTRUCTURE

A. All of that part of the structure below the bearings of simple and continuous spans, skewbacks or arches, and tops of footings or rigid frames, together with backwall, wingwalls, and wing protection railings.

101.67 SUPERINTENDENT

A. The Contractor's authorized representative in responsible charge of the work, present on the work at all times during the progress to supervise and direct the construction, to receive and fulfill instructions from the Engineer, and to accept orders for changed and extra work.

101.68 SUPERSTRUCTURE

A. The entire structure except the substructure.

101.70 SUPPLEMENTAL SPECIFICATIONS

A. Additions and revisions to the Specifications that are approved subsequent to the issuance of the published specifications.

101.72 SURFACE COURSE

A. The top layer of an improvement.

101.75 UNSUITABLE MATERIAL

A. Soils that fail to meet the AASHTO Soil Classification System (AASHTO M145) A-1 through A-7 classifications; are highly organic; or are determined to be contaminated.

101.76 UTILITY

A. Tracks, overhead or underground wires, pipelines, conduits, ducts, or structures, sewers, or storm drains owned, operated, or maintained in or across a public right-of-way or private easement.

101.79 BOARD

A. Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the Contractor is required to submit to the Engineer for approval. Working Drawings are not part of the Contract Documents.

B. In order to avoid cumbersome and confusing repetition of expressions in these specifications, it is provided that whenever anything is, or is to be, done, if, as, or, when, or where "contemplated, required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable suitable, accepted, satisfactory, unsatisfactory, sufficient, insufficient, rejected, or condemned," it shall be understood as if the expression were followed by the words "by the Agency."

101.81 AGENCY

A. The governing body to which a work or facility will be dedicated upon successful completion. Agency may be one or more of the following entities: City of Las Vegas, Nevada; City of North Las Vegas, Nevada; Las Vegas Valley Water District, Las Vegas, Nevada; Clark County Sanitation District, Las Vegas, Nevada; Clark County, Nevada; and state of Nevada Department of Transportation.

101.83 CERTIFIED ENVIRONMENTAL MANAGER (CEM)

A. One who is certified by Nevada Department of Environmental Protection as an Environmental Manager.

101.85 DEWATERING

A. The removal and/or lowering of any surface or subsurface water by a method chosen by the Contractor and acceptable to the Engineer, which results in a ground moisture content which enables construction to be carried out under relatively dry and stable conditions. Unless specifically indicated elsewhere in these specifications, no separate payment will be made for dewatering but shall be included in other items of work.

101.88 NOMINAL DIAMETER

A. The inside diameter of a standard pipe as specified by the manufacturer.

101.91 SERVICE CONNECTION LATERAL

A. All or any portion of a utility, including pipe, conduit, wire, cable or duct, including meters between a utility distribution (or collection) line and an individual customer or customers.

END OF SECTION 101

SECTION 104 – SCOPE OF WORK

104.00 LOCATION AND SCOPE OF WORK

A. LOCATION: Iron Mountain Road and Puli Drive

B. SCOPE OF WORK: The project is located at the intersection of Iron Mountain Road and Puli Drive, with improvements extending approximately 2,630 feet south of Iron Mountain Road along the Puli alignment. The project consists of a 76.3 acre-foot detention basin with a portion of the interior slope soil cement lined, an emergency overflow spillway structure, a debris dewatering tower, a basin outlet structure consisting of 60-inch RCP storm drain pipe, a 750 linear foot concrete collector channel into a 205-foot long by 25-foot min. wide by 4.5-foot high chute and baffle block south stilling basin, a 85-foot long by 25-foot to 60-foot wide by 4.5-foot high chute and baffle block north stilling basin, approximately 800 linear foot of 7-foot wide by 6-inch height concrete low flow u-channels, Type II and concrete access roads/ramps around the entire perimeter and into the detention basin, graded native path for NV Energy access, a flood threat recognition station, riprap erosion control, block and cable fencing around the basin perimeter and flood warning signs.

104.05 RIGHTS IN AND USE OF MATERIALS FOUND ON THE PROJECT

A. The Contractor with the approval of the Engineer, may use on the project such stone, gravel, sand, or other material determined suitable by the Engineer, as may be found in the excavation and will be paid for both the excavation of such materials at the corresponding contract unit price and also at the contract unit price for the pay item for which the excavated material is used. At no additional cost to the Owner, the Contractor shall replace with other acceptable material all of that portion of the excavation material so removed and used which was needed for use in the embankments, backfills, approaches, or otherwise. No charge for the materials so used will be made against the Contractor. The Contractor shall not excavate or remove any material from within the project location which is not within the grading limits, as indicated by the slope and grade lines, without written authorization from the Engineer.

B. Unless otherwise provided, the material from any existing old structure may be used temporarily by the Contractor in the erection of the new structure. Such material shall not be cut or otherwise damaged except with the approval of the Engineer.

END OF SECTION 104

SECTION 105 – CONTROL OF WORK

105.01 AUTHORITY OF THE ENGINEER

A. The Engineer will decide all questions that may arise as to the quality and acceptability of materials furnished and work performed and as to the rate of progress of the work; and all questions that may arise as to the interpretation of the plans and specifications.

B. The Engineer will have the authority to suspend the work wholly or in part due to the failure of the Contractor to correct conditions unsafe for the workmen or the general public; for failure to comply with the technical provisions of the contract; for failure to carry out orders; for such periods as the Engineer may deem necessary due to unsuitable weather; and for conditions considered unsuitable for the prosecution of the work.

C. Whenever the Contractor fails to carry out orders of the Engineer, the Engineer will have executive authority to enforce such orders and the Engineer's decision shall be final.

D. Decisions of the Engineer shall be subject to appeal to the Board, whose decisions shall be final and conclusive.

E. The Engineer shall not direct Contractor’s means, methods, techniques, sequences or procedures of construction, or the safety precautions and program incident thereto and will not be responsible for Contractor’s failure to perform the work in accordance with the Contract.

F. Engineer will not be responsible for the acts or omissions of the Contractor, or any Subcontractor or any of his or their agents or employees or any other persons at the site or otherwise performing any of the work.

105.02 PLANS AND WORKING DRAWINGS

A. The contract plans and drawings do not purport to show all the details of the work. These documents are intended to illustrate the character and extent of the performance desired under the contract; therefore, they may be supplemented or revised from time to time, as the work progresses, by the Engineer or (subject to approval of the Engineer) by the Contractor. The Contractor will keep one set of plans available on the work at all times.

B. The plans may be supplemented by such working drawings as are necessary to adequately control the work. Working drawings for structures shall be furnished by the Contractor. Working Drawings shall include stress sheets, shop drawings, erection plans, fabrication sheets, falsework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data required by the Engineer. Unless otherwise specified, all working drawings shall be submitted in triplicate 10 days prior to start of related work and approved by the Engineer. Such approval shall not relieve the Contractor of any of the Contractor's responsibility under the contract for the successful completion of the work. It is mutually agreed that the Contractor shall be responsible for agreement of dimensions and details as well as for conformity of the Contractor's working drawings with the approved plans and specifications.

D. The Contractor shall make submittals for all materials prior to use. All submittals shall be via electronic communication (pdf at ≥ 300 dpi) unless otherwise approved by the Engineer.
   1. All submittals made and signed by the Contractor shall be accompanied by a submittal coversheet with the Contractor's review stamp and the Contractor's standard transmittal form, containing, at a minimum, the bid item to which the submittal pertains. All submittals are to be numbered by specification section then sequential submittal number (e.g. 203-001, 203-002, etc.).
   2. Any submittals not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for re-submittal.
   3. Items submitted by anyone other than the Contractor will be returned, without action, for resubmission by the Contractor.
   4. All submittals shall be carefully reviewed by an authorized representative of the Contractor prior to submission to the Engineer.
   5. Each submittal shall be dated, signed and certified by the Contractor as being correct and in strict conformance with the Contract Documents.
   6. All non-certified submittals will be returned to the Contractor without action taken by the Engineer and any delays caused thereby shall be the total responsibility of the Contractor.

E. The Contractor shall submit any City of Las Vegas acceptance letters for asphalt concrete, aggregate and Portland Cement Concrete in lieu of test data.
   1. If the asphalt concrete, aggregate or Portland Cement Concrete mix designs are not on the current IQAC list of approved materials, a mix design for asphalt or Portland Cement Concrete or test data must be signed and approved by a Nevada Licensed P.E.
   2. The Contractor shall establish its bid price according to the mix designs that are delineated on the current IQAC list of approved materials.
   3. Any additional costs arising from mix designs submitted by the Contractor that are rejected for not meeting the IQAC criteria for any reason whatsoever shall be borne solely by the Contractor.
   4. All mix designs are to be submitted thirty (30) days prior to anticipated material placement.

F. The Engineer's review of working drawings submitted by the Contractor will cover only general conformity to the drawings, specifications and special provisions, external connections and dimensions which affect the layout. Unless otherwise specified within the Special Provisions, allow Owner fifteen (15) Working Days for each submittal review.
   1. The Engineer's review does not indicate a thorough review of all dimensions, quantities and details of the material, equipment, devices or items shown.
   2. The Engineer's review of submittals shall not relieve Contractor from responsibility for errors, omissions, or deviations, or responsibility for compliance with the Contract Documents.
   3. Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

G. If a submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS AS NOTED", formal revision and resubmission of said submittal will not be required.

H. If a copy of the submittal is returned to the Contractor marked "AMEND – RESUBMIT", or "REJECTED – RESUBMIT" the Contractor shall revise said submittal and shall resubmit to the Engineer.
   1. When corrected copies are submitted, the Contractor shall indicate any revisions not made and any revisions made other than those called for by the Engineer on previous submissions.
   2. Manufacture, fabrications or purchasing of items prior to final acceptance is at the Contractor's own risk.

105.03 CONFORMITY WITH PLANS AND SPECIFICATIONS

A. Work performed and materials furnished shall be in conformity with the lines, grades, cross sections, dimensions, and materials requirements, including tolerances, shown on the plans or indicated in the specifications.

B. In the event the Engineer finds the materials or the finished product in which the materials are used not in conformity with the plans and specifications, but that acceptable work has been produced, the Engineer shall then make a determination if the work shall be accepted and remain in place. In this event, the Engineer will document the basis of acceptance by plans modification concurred in by the Agency.

C. In the event the Engineer finds the materials or the finished product in which the materials are used or the work performed are not in conformity with the plans and specifications and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by the Contractor at no additional cost to the Owner.

D. In the event the Contractor desires to perform work that does not conform with the plans and specifications, the Contractor will make a written request to the Engineer for review and approval.

E. As a minimum, the written request will address the following:
   1. The Contractor will demonstrate that the performed work is of equal or greater value than the work specified in the plans and specifications.
   2. Various requests may require the seal and signature of approval from a licensed Nevada Professional Engineer. Prior to submitting a request, the Contractor shall inquire as to whether the Owner will require the approval of an Engineer, and if so, the Contractor will be responsible for the associated costs of this review.

105.04 COORDINATION OF PLANS, SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS, AND SPECIAL PROVISIONS

A. The specifications, supplemental specifications, plans, special provisions, and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. These documents are intended to be

complementary and to describe and provide for a complete work. In case of discrepancy, the following precedence will govern:

1. Permits from other agencies as may be required by law.
2. Plans.
3. Specifications.

B. Change orders, supplemental agreements, and approved revisions to plans and specifications will take precedence over Items 2 and 3 listed above. Detailed plans shall have precedence over general plans.

C. The Contractor shall take no advantage of any apparent error or omission in the plans or specifications. In the event the Contractor discovers such an error or omission, the Contractor shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications.

105.05 COOPERATION BY CONTRACTOR

A. The Contractor will be supplied with a minimum of 4 sets of approved plans and contract assemblies including specifications, one set of which the Contractor shall keep available on the work at all times. Additional copies of plans and specifications may be obtained by the Contractor upon written request to the Owner.

B. The Contractor shall give the work constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer, the Agency's inspectors, and other contractors in every way possible.

C. The Contractor shall provide his own mobile telephone, capable of making and receiving both local and long distance calls to allow communication with the Engineer and Resident Project Representative at all times. The contractor shall provide his own electronic device capable of receiving and sending e-mails from the field. The Contractor shall also provide his own electric power, potable water, construction water and sanitary facilities required in the performance of the work under the contract. All costs associated with these items shall be the responsibility of the Contactor. :

D. The prime Contractor shall have on the work at all times, as the Contractor's agent, a competent superintendent capable of reading and thoroughly understanding the plans and specifications and thoroughly experienced in the type of work being performed, who shall receive instructions from the Engineer or the Engineer's authorized representatives. Such superintendent shall be designated in writing before starting work. The superintendent shall have full authority to execute orders or directions of the Engineer without delay, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. Such superintendent shall be furnished irrespective of the amount of work sublet.

E. Whenever the Contractor or the Contractor's authorized representative is not present on any particular part of the work where it may be desired to give direction, orders will be given by the Engineer to the Contractor's superintendent, foreman, or other person in

charge of the operation, who is present, and these orders shall have the same force and effect as if given to the Contractor or the Contractor's designated representative.

F. Any order given by the Engineer, not otherwise required by the specifications to be in writing, will on request of the Contractor be given or confirmed by the Engineer in writing.

105.06 COOPERATION WITH UTILITIES

A. The Permittee, in the case of private contract, and the Agency, in the case of cash contract or Special Improvement District contract, will search known substructure records which describe the location of utility substructures, and will indicate on the plans for the project those substructures, except for service connections, which may affect the work.

B. Where underground main distribution conduits such as water, gas, sewer, electric power, telephone, or cable television are shown on the plans, the Contractor, shall assume that every property parcel will be served by a service connection for each type of utility.

C. At least 2 working days before entering on the work, the Contractor shall notify all the utility owners to mark or otherwise indicate the approximate location of their subsurface facilities including, but not limited to, structures, main conduits, and service connections. This requirement will not apply to sewer and storm drain installations where their location and depth are shown on the plans for the project.

D. It shall be the Contractor's responsibility to determine the location and depth of all utilities, including service connections, for which approximate locations have been marked by the respective owners and which the Contractor believes may affect or be affected by the Contractor's operations. If no pay item is provided in the contract for this work, full compensation for such work shall be considered as included in the prices bid for other items of work.

E. The Contractor shall not interrupt the service function or disturb the supporting base of any utility without authority from the owner or an order from the Agency.

F. Where protection is required to ensure support of utilities, the Contractor shall, unless otherwise provided, furnish and place the necessary protection at no additional cost to the Owner.

G. Upon learning of the existence and location of any utility omitted from or shown incorrectly on the plans, or not properly marked, the Contractor shall immediately notify the Engineer in writing.

H. The Contractor shall immediately notify the Owner and the utility owner if the Contractor disturbs or damages any utility. The Contractor shall bear the costs of repair or replacement of any utility damaged if properly located as provided.

I. When placing concrete around or contiguous to any utility installation, the Contractor, at no additional cost to the Contracting Agency, shall (1) furnish and install a 2-inch cushion of expansion joint material or other similar resilient material; or (2) provide a sleeve or other opening which will result in a 2-inch minimum clear annular space between the concrete

and the utility; or (3) provide other acceptable means to prevent embedment in or bonding to the concrete. The standards of the affected utility company shall prevail. Where concrete is used for backfill or for structures which would result in embedment, or partial embedment, of a metallic utility installation, or where the coating, bedding, or other cathodic protection system is exposed or damaged by the Contractor's operations, or as may be required by the work, the Contractor shall notify the Engineer and arrange to secure the advice of the affected utility owner regarding the procedures required to maintain or restore the integrity of the system.

J. Unless otherwise specified, the Contractor shall remove all interfering portions of utilities shown on the plans or indicated in the bid documents as "abandoned" or "to be abandoned in place." Before starting removal operations, the Contractor shall ascertain from the Contracting Agency whether the abandonment is complete, and the costs involved in the removal and disposal shall be absorbed in the bid for the items of work necessitating such removals.

K. When feasible, the owners responsible for utilities within the area affected by the work shall complete their necessary installations, relocations, repairs or replacements before commencement of work by the Contractor. Utilities that are relocated in order to avoid interference with the proposed permanent work shall be protected in their relocated position and the cost of such protection shall be absorbed in the various items of the contract.

L. A utility company installing a new line is responsible for relocation of other utility company facilities if the new line conflicts with existing locations.

M. When the plans or specifications provide for the Contractor to alter, relocate, or reconstruct a utility, all costs for such work shall be included in the bid for the items of work necessitating such work. Temporary or permanent relocation or alteration of utilities requested by the Contractor for the Contractor's own convenience shall be the Contractor's responsibility, and the Contractor shall make all arrangements and bear all costs.

N. The utility owner will relocate service connections as necessary within the limits of the work or within temporary construction or slope easement unless otherwise specified. When directed by the Engineer, the Contractor shall arrange for the relocation of service connections as necessary between the meter and property line, or between a meter and the limits of temporary construction or slope easements. The Contractor may, for the Contractor's own convenience or to expedite the work, agree with the owner of any utility to disconnect and reconnect interfering service connections. The Agency will not be involved in any such agreement.

O. The Contractor shall notify the Agency of the Contractor's construction schedule insofar as it affects the protection, removal, or relocation of utilities.

P. The Contractor will not be entitled to damages attributable to utility relocations or alterations if correctly located, noted, and completed.

Q. When necessary, the Contractor shall so conduct the Contractor's operations as to permit access to the work site and provide time for utility work to be accomplished during the progress of the contract work.

R. The Owner and Engineer do not guarantee that all existing utilities are shown on the contract drawings, or that the utilities are shown in their exact locations. The Owner may or may not have indicated utility service connection laterals on the Contract Drawings. The Contractor shall be responsible for verifying that each utility has responded to each notification.

S. During all time periods when any utility valve, manhole, vault, or pull box may be buried or otherwise rendered inaccessible, the Contractor shall have personnel and equipment on standby (respond within 1 hour) to uncover any valve, manhole, vault or pull box when requested by the Engineer or owning agency.

1. All utility valves, manholes, vaults, or pull-boxes which are buried shall be conspicuously marked in a fashion acceptable to the owner and Engineer by the Contractor to allow their location to be determined by the Engineer or utility personnel under adverse conditions, (inclement weather or darkness).

2. All cost for providing standby personnel and equipment and for uncovering buried facilities shall not be paid for separately but shall be considered incidental to the items of work associated with the burial.

If, during the course of paving operations, the Contractor paves over water and/or gas distribution valves, the Contractor shall have no more than 48 hours to remove the asphalt over the valves and adjust the valves to grade. The Contractor shall be responsible for adequately marking all such valves prior to paving operations so as to readily locate them after paving. Adjustment of valves may require a temporary adjustment to dense grade prior to the permanent final adjustment to the top of finish grade.

T. The Contractor shall pothole to determine the exact vertical and horizontal location of all existing utilities indicated on the Drawings, or marked in the field, crossing or potentially impacting the proposed reinforced concrete box, pipeline, mains, and laterals, at least (10) days in advance of the construction of any underground facility.

1. Contractor shall provide Engineer all pothole information obtained including measurements, dimensions, elevations, types and sizes of utilities within one working day following the potholing.

U. During the performance of contract work, the owner of any utility affected by the work shall have the right to enter, when necessary, upon any portion of the work for the purpose of maintaining service and of making changes in, or repairs to said utility.

W. The Contractor shall not shut off the water supply to a hydrant, nor in any way, prevent access to a fire hydrant until he has secured permission to do so from the proper authorities.

105.07 COOPERATION BETWEEN CONTRACTORS

A. The Agency reserves the right at any time to contract and perform other or additional work on or near the work covered by the contract.

B. When separate contracts are let within the limits of any one project, each Contractor shall conduct Contractor's work so as not to interfere with or hinder the progress or completion of the work being performed by the other Contractors. Contractors working on the same project shall cooperate with each other as directed.

C. Each Contractor involved shall assume all liability, financial or otherwise, in connection with Contractor's contract and shall protect and save harmless the Contracting Agency from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced by Contractor because of the presence and operations of other Contractors working within the limits of the same project.

D. The Contractor shall arrange Contractor's work and shall place and dispose of the materials being used so as not to interfere with the operations of other Contractors within the limits of the same project. Contractor shall join Contractor's work with that of the others in an acceptable manner and shall perform the work in proper sequence to that of the others.

105.08 CONSTRUCTION STAKES, LINES AND GRADES

A. Construction staking work shall be required of the Contractor, as indicated in ***Section 622 "Construction Surveying by the Contractor"*** of these Specifications, and shall conform to all requirements therein.

105.09 RECORD DOCUMENTS

A. General Instructions
   1. Ensure entries are complete and accurate. Current Progress Record Documents shall be available for review by the Owner, Owner's Consulting Engineer and the Owner's Construction Management Consultant (if applicable) at all times during the progress of the work.
   2. Store Progress Record Documents separate from documents used for construction.
   3. Neatly record information concurrent with construction progress. Maintain Progress Record Documents in a clean and orderly manner. The Contractor shall not conceal any work until the required record information has been recorded on the record document set. The Contractor shall bear the cost of uncovering any prematurely concealed work for required record documentation.
   4. Progress Record Documents shall be made available to the Owner, the Owner's Consulting Engineer and the Owner's Construction Management Consultant (if applicable) for review at the site, at progress meetings and during Owner's review of the monthly progress bill requesting payment
   5. Failure of the Contractor to maintain a current record of information on the Progress Record Documents shall entitle the Owner to withhold payment until corrected. The release of payment to the Contractor shall be contingent upon the Contractor's diligent performance as required herein.

B. Progress Record Documents - The Contractor shall maintain the following documents, which constitute the Progress Record Documents, at the job site during construction:
   1. Drawings – Owner shall provide a full size copy of the approved set of drawings on bond paper for use as the Progress Record Document drawings prior to starting the work.
      a. The Contractor will supplement the drawing set with approved drawings submitted as deferred submittals. The Contractor shall insert approved Addenda and revision sheets in front of the original sheet
      b. The Contractor shall legibly mark each sheet to record actual construction including (but not limited to):
         i. Measured horizontal and vertical locations of underground installations, utilities and appurtenances referenced to permanent surface improvements;
         ii. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work;
         iii. Field changes of dimension and detail;
         iv. Details not on original Contract Drawings
   2. Specifications – The Contractor shall legibly mark and record at each product section description of actual products installed, including (but not limited to) the following:
      a. Manufacturer's name and product model and number
      b. Product substitutions or alternates utilized;
      c. Changes made by addenda and modifications.
   3. The Contractor shall keep copies of and maintain a record of all Change Orders and any other modifications to the Contract.
   4. The Contractor shall keep copies of and maintain a record of all reviewed Shop Drawings, Product Data and Samples.
   5. The Contractor shall keep copies of and maintain a record of all Manufacturer's instructions for assembly, installation and adjusting.

C. Final Record Documents - Upon completion of the work, including all punch list items and prior to Release of Retention, the Contractor shall provide to Owner a complete set of Final Record Documents. The Final Record Documents shall include (but not limited to) the following:
   1. Final Drawings
      a. The Contractor will supplement the drawing set with approved drawings submitted as deferred submittals. The Contractor shall insert approved Addenda and revision sheets in front of the original sheet including any revisions required for completion of the punch list
      b. The Contractor shall legibly mark each sheet to record actual construction including, (but not limited to):
         i. Measured horizontal and vertical locations of underground installations, utilities and appurtenances referenced to permanent surface improvements;
         ii. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work;
         iii. Field changes of dimension and detail;
         iv. Details not on original Contract Drawings;
         v. Changes made during completion of the punch list.

c. The Contractor shall mark each sheet as “Record” or “As-Built”

2. Specifications
   a. Manufacturer’s name and product model and number
   b. Product Substitutions or alternates utilized
   c. Changes made by Addenda and modifications
   d. Changes made during completion of the punch list.
3. Contractor shall keep copies of and maintain a record of all Change Orders and any other modifications to the Contract including any changes made during completion of the punch list.
4. The Contractor shall keep copies of and maintain a record of all reviewed Shop Drawings, Product Data and Samples including any additional shop drawings, product data and samples required for completion of the punch list.
5. The Contractor shall keep copies of and maintain a record of all Manufacturer’s instructions for assembly, installation and adjusting and any Manufacturer’s instructions for assembly, installation and adjusting required for completion of the punch list.

105.10 DUTIES OF THE INSPECTOR

A. Inspectors for the Agency will be authorized to inspect all work done and all materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector will not be authorized to issue instructions contrary to the plans and specifications, or to act in any capacity for the Contractor.

105.11 INSPECTION

A. All materials and each part or detail of the work shall be subject to inspection by the Engineer. The Engineer shall be provided acceptable access to all parts of the work and shall be furnished with such information and assistance by the Contractor as required to make a complete and detailed inspection.

B. Any work done or materials used without inspection by an authorized Engineer’s representative may be ordered removed unless the material meets the specifications and shall be replaced at no additional cost to the Owner unless the Engineer representative failed to inspect after having been given notice in writing that the work was to be performed. If the noninspected work or material proves acceptable the work or material may remain, but any expenses entailed in a late inspection shall be the Contractor's.

C. If the Engineer requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing and the replacing of the covering, or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing and replacing of the covering, or making good of the parts removed will be at no additional cost to the Owner.

D. When facilities of any unit of government or political subdivision or of any railroad corporation or public utility corporation are adjusted or constructed as a part of the work covered by this contract, its respective representatives shall have the right to inspect the work. Such inspection shall in no sense make any unit of government or political subdivision or any railroad corporation or public utility corporation a party to this contract, and shall in no way interfere with the rights of either party thereunder.

E. A full time third party special inspector and testing agency shall be hired and provide weekly reports to the City of Las Vegas Building Department – Offsite Inspections and Testing. The special inspector and testing agency is required to be listed on the current Quality Assurance Agency list issued by Clark County Building Department for the applicable work and inspection. City of Las Vegas is required to review and verify the list of special inspectors and agencies hired by the owner, prior to the start of construction. The current Quality Assurance Agency list of approved personnel is found at the below webpage.

http://www.clarkcountynv.gov/building/engineering/Approved%20Listings/qaainsp_list.pdf

105.12 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK

A. All work which does not conform to the requirements of the contract will be considered as unacceptable work, unless otherwise determined acceptable under the provisions in ***Subsection 105.03, "Conformity with Plans and Specifications."***

B. Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause, found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner.

C. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the plans, or as given except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at no additional cost to the Owner.

D. Upon failure on the part of the Contractor to comply forthwith with any order of the Engineer, made under the provisions of this article, the Owner will have authority to cause unacceptable work to be remedied or removed or replaced and unauthorized work to be removed and to withhold the costs from any money due or to become due to the Contractor.

105.13 LOAD AND SPEED RESTRICTIONS

A. The Contractor shall be responsible for all damage to the work caused by Contractor's hauling equipment.

B. In hauling material for incorporation in portions of the project, loads which are in excess of the limits set by the Agency will not be permitted on any existing bridge or new and

existing bituminous base and surface, cement treated base, or Portland cement concrete paving which is to remain in place for vehicular traffic within the project or between the project and the pits or other sources of materials. Load limits established by the Contracting Agency for the project shall be complied with regardless of the source of materials, whether from described pits, approved pits, or commercial sources. Unless otherwise stated in the Special Provisions, the maximum loads shall not exceed the limits set forth in Chapter 484, "Traffic Laws," of the Nevada Revised Statutes and all acts amendatory thereto or supplementary thereto.

C. Construction loads greater than legal loads may be carried over any new bridge structure within the project providing the Contractor complies with all of the following limitations and provisions:

1. Concrete in any such structure shall have attained designed strength as shown on the structure plans.

2. The gross load of the vehicle shall not exceed 108,000 pounds.

3. Gross load on any individual axle shall not exceed 48,000 pounds.

4. The gross load on any individual set of tandem axles spaced not more than 6 feet apart shall not exceed 72,000 pounds.

5. The center to center spacing of individual axles or center to center spacing of pairs of tandem axles shall not be less than 14 feet.

6. No more than one lane of vehicles shall operate over any structure.

7. The speed of any vehicle approaching or traveling on any structure shall not exceed 10 mph.

8. The roadway surface approaching any structure shall be kept smooth and uniformly graded for 150 feet each side of the structure and shall be maintained to provide a uniform transition onto the structure.

9. A cover of 6 inches $\pm$ 1 inch shall be placed and maintained on the decks of all structures. Cover material shall not include rocks of diameter greater than 2 inches.

D. The limitations specified in items 2, 3, 4, 5, 6, 7, 8, and 9 above may be waived for all reinforced concrete box culverts providing that the depth of fill compacted and in place over the reinforced concrete box culvert is equal to or greater than the distance between inside faces of outside walls measured along center line of roadway. Fill may be placed not to exceed profile grade elevation.

E. Construction loads greater than legal loads may be carried over structures within the project which have spans of 10 feet to 20 feet only when the Contractor complies with the above Subparagraph C, numbers 3 through 9, inclusive; however, the limitations as set forth in Subparagraph C, numbers 3 through 5, inclusive, may be waived by the Engineer for reinforced concrete box structures which are adequately supported by shoring. The

Contractor shall submit Contractor's proposed shoring details and the actual loads and axle spacings to the Engineer for review prior to the planned hauling. Approval will be based on a review of the shoring details and a physical inspection of the shoring complete and in place.

F. The Engineer shall make sufficient checks to satisfy Engineer that the Contractor is complying with all limitations, and any violation shall result in denying the Contractor use of the structure until the violation has been corrected to the satisfaction of the Engineer.

G. The provision that the Contractor may haul construction loads greater than legal loads on new structures shall not relieve the Contractor of Contractor's responsibility for all damage caused by Contractor's hauling equipment.

H. The Engineer may, for the protection of the traveling public, establish speed limits on or adjacent to the project. Such limitations of speed shall be strictly observed by the Contractor.

105.14 MAINTENANCE DURING CONSTRUCTION

A. The Contractor shall maintain the work during construction and until the project is accepted, except as provided for in ***Subsection 107.15, "Relief from Maintenance and Responsibility."*** This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that the roadway and structures are at all times, to be kept in a condition satisfactory to the Engineer.

B. In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

C. Except as provided for in ***Subsection 107.15, "Relief from Maintenance and Responsibility,"*** all costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various pay items and the Contractor will not be paid an additional amount for such work.

D. The Contractor shall maintain a temporary AC patch over backfilled pipe trenches, subject to traffic, during the course of the project to the satisfaction of the Engineer.

1. The temporary patch shall be permanently repaired or removed as soon as the Contractor's operations allow. Temporary asphalt patching will not be allowed to remain longer than 30 calendar days before permanent paving is placed.

2. Should areas of temporary pavement fail and become hazardous, the Contractor shall repair at the Engineer's direction and at the Contractor's expense.

105.15 FAILURE TO MAINTAIN ROADWAY OR STRUCTURE

A. If the Contractor, at any time, fails to comply with the provisions of ***Subsection 105.14, "Maintenance During Construction,"*** the Engineer will immediately notify the Contractor in writing of such noncompliance. If the Contractor fails to remedy unsatisfactory

maintenance within 24 hours after receipt of such notice, the Engineer may immediately proceed to maintain the project, and the entire cost of this maintenance will be deducted from money due or to become due the Contractor.

B. If a condition develops that is dangerous to public safety in the opinion of the Engineer, such condition may be immediately remedied with whatever means is available and the cost of this maintenance will be deducted from money due or to become due to the Contractor.

105.16 FINAL ACCEPTANCE

A. Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer will make an inspection. Upon receipt of Record Drawings, and if all construction and final cleanup provided for and contemplated by the contract are found completed to Engineer's satisfaction, the inspection shall constitute the final inspection and the Engineer will so advise the governing body or commission. The Contractor will be notified in writing of the acceptance of the contract as of the date of the final inspection. Such notice will not be given to the board or commission until all work, including required Record Drawings has been completed to the satisfaction of the Engineer.

END OF SECTION 105

SECTION 106 – CONTROL OF MATERIALS

106.01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS

A. The Contractor shall furnish all materials required to complete the work.

B. No materials or supplies under this contract shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage, conditional sale contract or other security interest, or other agreement by which an interest is retained by the seller. The Contractor warrants that Contractor has good title to all materials and supplies used by the Contractor in the work, free from all liens, claims, or encumbrances.

C. Only materials conforming to the requirements of the specifications shall be incorporated in the work except as provided in ***Subsection 105.03, "Conformity with Plans and Specifications."***

D. The materials furnished and used shall be new, except as may be provided elsewhere in these specifications, on the plans or in the Specifications. The materials shall be manufactured, handled, and used in a workmanlike manner to ensure completed work in accordance with the plans and specifications.

E. The Contractor shall furnish the Engineer a list of the Contractor's sources of materials. The list shall be submitted to the Engineer prior to any official "Notice to Proceed" and in sufficient time to permit proper inspecting and testing of materials to be furnished from such listed sources in advance of their use.

F. The listings of materials that are posted on the Interagency Quality Assurance Committee (IQAC) web page are automatically considered a qualified source. However, this does not remove the responsibility of the Contractor to provide inspection and testing on the project as specified herein. The address for the IQAC webpage is:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

G. If it is found after trial that sources of supply for previously approved materials do not produce uniform and satisfactory products, or if the product from any source proves unacceptable at any time, which includes IQAC listed materials, the Contractor shall furnish satisfactory materials from other sources.

H. The Contractor shall furnish without charge such samples as may be required by the Engineer. The primary inspection and testing shall be made by the Contractor or the Contractor's designated representative, with Engineer oversight. However, it is understood that such inspections and tests, if made at any point other than the point of incorporation in the work, in no way shall be considered as a guarantee of acceptance of such materials nor of continued acceptance of material presumed to be similar to that upon which inspections and tests have been made.

I. Manufacturer's warranties, guarantees, instruction sheets, and parts lists, which are furnished with certain articles or materials incorporated in the work, shall be delivered to the Engineer before acceptance of the completed contract.

J. Contractor's reports and records of inspections made and tests performed shall be submitted to the Engineer as required in these specifications. The Engineer's inspection and testing records, when available at the site of the work, may be examined by the Contractor.

106.02 LOCAL MATERIALS

A. Local material is defined as rock, sand, gravel, earth, or other mineral material, other than local borrow or selected material, obtained or produced from sources in the vicinity of the work specifically for use on the project. Local material does not include materials obtained from established commercial sources.

B. Local materials shall be furnished by the Contractor from any source the Contractor may elect, except when a mandatory source is designated in the Special Provisions.

C. Aggregates for base, surface, and concrete may be the products of approved commercial producers, provided they meet specification requirements.

D. The furnishing of local materials from any source is subject to the provisions of ***Subsection 106.03, "Possible Local Material Sources."*** Material deposits shall not be excavated at locations where their resulting scars will present an unsightly appearance from any street or highway, unless such excavation is approved in writing by the Engineer.

E. Generally, local material deposits will not be approved if located within 1,000 feet of right-of-way line. In any case the Contractor's pit operations shall not encroach within 25 feet of the right-of-way. Payment will not be made on material obtained in violation of these provisions.

F. The Contractor shall, at no additional cost to the Contracting Agency, make any and all arrangements necessary for hauling over local, public, or private roads or property from any source. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals; for doing all the work involved in conforming to the provisions in this subsection; and for furnishing and producing materials from any source shall be considered as included in the price paid for the contract item of work involving such material and no additional compensation will be allowed.

G. The Contractor or the Contractor's representative shall attest to the content of the submitted materials that have been reviewed against the Contract Documents, and that the materials are in compliance thereto. Submitted materials that are to be evaluated as “Or Equal” or “Substitution” shall include sufficient information to enable the Engineer to make the determination for approval.

106.03 POSSIBLE LOCAL MATERIAL SOURCES

A. If the Contractor desires to use materials from local sources the Contractor shall, at no additional cost to the Owner, acquire the necessary right to take material and shall obtain all other necessary permits and approvals and shall comply with all the requirements and stipulations in effect by other governing agencies having jurisdiction over the area, and pay all costs involved, including any which may result from an increase in length of haul. All costs of exploring and developing, including inspection and testing such alternate sources shall be borne by the Contractor and the use of material from such sources will not be permitted until representative samples taken by the Engineer have been approved and written authority issued for the use thereof.

B. The Contractor's attention is especially directed to Title 43, "Code of Federal Regulations," Part 23, "Surface Exploration, Mining and Reclamation of Lands," which pertains to all exploration, developing, and obtaining material from said alternate deposits located upon land under the jurisdiction of the Bureau of Land Management.

C. BLANK

D. BLANK

E. BLANK

F. BLANK

G. BLANK

H. BLANK

I. BLANK

J. BLANK

K. Where the Owner has obtained the right to remove materials from lands owned or controlled by the U.S. Government, by withdrawal or otherwise, and these areas are set forth as optional or mandatory local material sources in the Special Provisions, the Contractor on the project may enter and remove materials for use on subject project only without further permission. The Contractor may not enter on or remove materials from any other areas withdrawn or otherwise obtained by the Contracting Agency from the U.S. Government which are not specifically designated for the project without prior written approval from the Contracting Agency.

L. Should the Contractor enter upon any of the areas withdrawn or otherwise obtained by the Contracting Agency from the U.S. Government, it shall be the Contractor's responsibility to determine the rights of others in the area. The Contractor shall not encroach on easements of others without their written permission and shall assume the responsibility for any damages due to the Contractor's entering said area. In addition, the Contractor shall be bound by the terms, conditions, and reservations contained in the approved application for withdrawal.

M. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and producing specified materials from possible local material sources, including the construction of any access roads or fences and any clearing, grubbing, and stripping of material sources, and all processing of whatever nature and extent required, shall be considered as included in the price paid for the contract item of work involving such material and no additional compensation will be allowed.

106.04 SAMPLES AND TESTS

A. Sampling for final acceptance of materials will be as required in the appropriate specifications sections, contract special provisions, and in general shall comply with the AASHTO requirements, where applicable, and with the following sampling criteria:

1. Aggregates for roadmix bituminous mixtures (including base or surface) will be sampled after the material has been placed on the roadbed and processed and prior to adding the bituminous binder.

2. Aggregate for plantmix bituminous open-graded will be sampled from the laydown machine, or by “belt-cut” sample at the production plant at the Engineer’s discretion.

3. Aggregate for screenings will be sampled from the loaded truck just prior to placing, or by “belt-cut” sample at the production plant at the Engineer’s discretion.

4. Aggregate for plantmix bituminous mixtures (base or surface) will be sampled for acceptance behind the paver. Samples for plasticity tests will be taken at the bins.

5. Sampling of bituminous materials, intended for use in prime, tack or seal coats, surface treatments, and base, binder, or surface course mixtures shall be done after the bituminous material has arrived at job destination and before or at the time of unloading the materials.

    a. Two samples shall be taken from each railroad tank car or truck transport of material by the Contractor or the Contractor's designated representative under the observation of and complying with the requirements and in a manner approved by the Engineer. Where delivery is made in smaller hauling units than those cited above such as a distributor, or where the contents of a storage tank are sampled, the required 2 samples shall be taken to represent a maximum of 10,000 gallons. The Contractor shall take the samples during the established job working hours, unless arrangements are made for a representative of the Contracting Agency to witness the taking of the samples at another time.

    b. All sampling devices and sample containers shall be furnished by the Contractor. Immediately after filling the sample container, it shall be tightly sealed, properly marked for identification, and presented to the Engineer.

    c. One of the 2 samples, taken from each load, shall be submitted to the Contractor's Material Source laboratory for testing and the other sample retained by the Engineer. If the first sample tested complies with requirements, the second may be discarded.

    d. Where less than 80 percent of the asphalt deliveries are used on the project, samples shall be taken just prior to delivery to the mixer. Samples shall be taken for every 25 tons of asphalt delivered to the project.

6. Tests for the aforementioned materials produced under conditions other than contemplated herein shall be taken at the time and place deemed by the Engineer to be most appropriate.

7. All field and laboratory testing technicians shall be Nevada Alliance for Quality Transportation Construction (NAQTC) certified, including ACI certification. Information regarding training, examinations and certification is available from the Nevada T2 Center/257, NAQTC, University of Nevada, Reno, 1664 N. Virginia Street, Reno, Nevada, 89557-0179.

106.05 CERTIFICATE OF COMPLIANCE

A. The Engineer may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance stating that the materials involved comply in all respects with the requirements of the specifications. The certificates shall be signed by the manufacturer of the material or the fabricator of assembled materials. A Certificate of Compliance shall be furnished with each lot of material delivered to the work and the lot so certified shall be clearly identified in the certificate with attached applicable test results for that lot in accordance with the specification section.

B. All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance

shall not relieve the Contractor of responsibility for incorporating material in the work which conforms to the requirements of the plans and specifications and any such material not conforming to such requirements will be subject to rejection whether in place or not.

C. The Agency reserves the right to refuse to permit the use of material on the basis of a Certificate of Compliance.

D. The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

106.06 CITED SPECIFICATIONS

A. The Nevada Department of Transportation has developed test methods for testing the quality of materials and work. These test methods are identified by the prefix Nev. followed by the serial number. Copies of individual test methods are available at the Materials Division, Nevada Department of Transportation, Carson City, Nevada.

B. Whenever a reference is made in the specifications to a test method by Nev. or Cal. number, it shall mean the test method in effect on the date of the advertisement for bid.

C. Whenever a reference is made in the specifications to a specification or test designation either of ASTM International, AASHTO, federal specifications, or any other recognized national organization, and the number or other identification accompanying the test designation representing the year of adoption or latest revision of the test is omitted, it shall mean the test method in effect on the date of advertisement for bid.

D. When requested by the Engineer, the Contractor shall furnish, without charge, samples of all materials entering into the work, and no material shall be used prior to approval by the Engineer, except as provided in ***Subsection 106.05, "Certificate of Compliance."*** Samples of material from local sources shall be taken by or in the presence of the Engineer; otherwise, the samples will not be considered for testing.

106.07 PLANT INSPECTION

A. The Engineer may inspect the production of material or the manufacture of products at the source of supply. The Contractor and material producer shall assure the Engineer of their cooperation and assistance to perform plant inspection prior to production of materials for the project. The Engineer or the Engineer's authorized representative shall have free entry at all times to such parts of the plant as concerns the manufacture or production of the materials. Adequate facilities shall be furnished free of charge to make the necessary inspection.

B. It is understood that the Owner reserves the right to retest all materials prior to incorporation into the work which have been tested and accepted at the source of supply after the same have been delivered and to reject all materials which, when retested, do not meet the requirements of these specifications, or the requirements of the contract documents.

106.08 STORAGE OF MATERIALS

A. Materials shall be so stored as to ensure the preservation of their quality and fitness for the work. When considered necessary by the Engineer, materials shall be stored in waterproof buildings, placed on wooden platforms or other hard, clean surfaces, and not on the ground, and shall be covered when directed.

B. Stored materials, even though approved for use before storage, may be inspected prior to their use in the work, and materials shall meet the requirements of the specifications at the time of this proposed use. Stored materials shall be located so as to facilitate their prompt inspection.

C. Upon approval of the Engineer, that portion of the right-of-way not required for public travel may be used for storage purposes and for placing of the Contractor's plant and equipment, but any additional space required therefor shall be provided by the Contractor at no additional cost to the Owner. Private or public property shall not be used for storage purposes without written permission of the owner or lessee.

D. All storage sites shall be restored to their original condition by the Contractor at no additional cost to the Owner. This shall not apply to the stripping and storing of top soil or to other material salvaged from the work or specifically prescribed under the specifications. Construction materials may not be stored in streets, roads, or highways for more than 5 days after unloading. All materials or equipment not installed or used in the construction within 5 days after unloading shall be stored elsewhere by the Contractor at no additional cost to the Owner unless the Contractor is authorized additional storage time.

E. Construction equipment shall not be stored at the work site before its actual use on the work nor for more than 5 days after it is no longer needed on the work unless the Contractor is authorized additional storage time. Time necessary for repair or assembly of equipment may be authorized by the Engineer.

F. Excavated material, except that which is to be used as backfill in the adjacent trench, may not be stored in public streets, roads, or highways unless otherwise permitted. After placing backfill, all excess material shall be removed immediately from the site.

106.09 HANDLING MATERIALS

A. All materials shall be handled in such manner as to preserve their quality and fitness for the work.

B. Aggregates shall be transported from the storage site to the work in tight vehicles so constructed as to prevent loss or segregation of materials after loading and measuring in order that there may be no inconsistencies in the quantities of materials intended for incorporation in the work as loaded, and the quantities as actually received at the place of operation.

106.10 GUIDANCE ANALYSIS OF NONCOMPLYING MATERIALS

A. In the event of a non-compliance of a produced or placed material, the Contractor is responsible for submitting a recommendation report to the Engineer for the determination of the basis of acceptance of the material by the Engineer based on AASHTO R-9, this section, and/or other industry practices as approved by the Engineer. This report shall be performed by a Nevada Professional Engineer. The receiving of the report by the Engineer does not imply acceptance of the report recommendations.

B. The policy of the Engineer is that a project shall have been constructed "... in reasonably close conformity with the approved plans and specifications..." to be eligible for full payment of the material and installation. However, there will be instances when test results, as a result of the above noted variability may indicate apparent nonconformance

to the specification limits, yet the construction product may be acceptable for the use intended at full or reduced pay. In these cases, an analysis of the materials and/or materials test results will be necessary by the Contractor through a professional engineer before payment is made.

C. As a general guidance and unless otherwise stipulated in other specification sections or contract Special Provisions, if more than 10 percent of the test values for any construction product are outside of the applicable specifications, there may be a question of "reasonably close conformity." In these cases, an analysis of the test values should be made to determine the magnitude and extent of the nonconforming materials.

106.11 OWNER FURNISHED MATERIAL

A. The Contractor shall furnish all materials required to complete the work, except those specified to be furnished by the Owner. Material furnished by the Owner will be delivered or made available to the Contractor at the points specified in the Special Provisions.

B. The cost of handling and placing all materials after they are furnished to the Contractor shall be considered as included in the contract price for the item in connection with which they are used.

C. The Contractor will be held responsible for all material furnished to the Contractor, and deductions will be made from any money due to the Contractor to make good any shortages and deficiencies, from any cause whatsoever, and for any damage which may occur after such delivery and for any demurrage charges. The responsibility by the Contractor includes any project inspection and testing that is required in these specifications.

END OF SECTION 106

SECTION 107 – LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.01 LAWS TO BE OBSERVED

A. The Contractor shall keep fully informed of all federal and state laws, all local bylaws, ordinances, and regulations, and all orders and decrees of bodies or tribunals having jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, bylaws, ordinances, regulations, orders, and decrees, and shall protect and indemnify the Contracting Agency and its representative against any claim or liability arising from or based on the alleged violation of any such law, bylaw, ordinance, regulation, order, or decree, whether by the Contractor, the Contractor's employees, or agents.

107.02 PERMITS, LICENSES, AND TAXES

A. The Contractor shall obtain all permits and licenses, and give all notices necessary and incident to the due and lawful prosecution of the work, including vehicular registration or prorate registration and carrier licensing as applicable. Privilege taxes are in addition to the above fees.

B. The Contractor shall obtain Grading and/or Stockpile permits for on-site storage or disposal of materials from the City of Las Vegas Building Department prior to beginning the work.

C. It shall be the Contractor's responsibility to determine if the permit requirements of Section 637 “Pollution Control” shall be required.

D. The Contractor shall obtain a permit from the Las Vegas Valley Water District to use a hydrant as a water source.

E. The contract documents detail the right-of-way and construction easement/AEPs and in some cases staging areas the contractor may occupy during the duration of the project and traffic control requirements associated with the occupation of said areas. If the contractor desires to use any areas outside the limits described in the drawings and specifications, he shall be responsible for meeting the requirements of Title 19 (The Zoning Code) or applicable requirements for jurisdictions outside of the City. The contractor shall obtain all permits required for the use of private property and provide copies to the City prior to any use of the site. If a temporary commercial permit is required for work performed on private property, the Contractor shall ensure that a temporary commercial permit is obtained through the City of Las Vegas Planning Department or other applicable jurisdictions prior to any use of the site. All work, fees, and scheduling associated with compliance to this subsection shall be borne entirely by the contractor and shall not be a justification for delay claims.

107.03 PATENTED DEVICES, MATERIALS, AND PROCESSES

A. If the Contractor employs any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement

with the patentee or owner. The Contractor and the surety shall indemnify and save harmless the Owner, and affected third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which the Owner may be obliged to pay by reason of any alleged infringement, at any time during the prosecution or after the completion of the work.

107.04 RESTORATION OF SURFACES OPENED BY PERMIT

A. The right to construct or reconstruct any utility service in the public right-of-way, or to grant permits for same, at any time, is hereby expressly reserved by the Agency or the proper authorities of the municipality or other political subdivision in which the work is done and the Contractor shall not be entitled to any damages either for the digging up of the street or for any delay occasioned thereby.

B. Any individual, firm, or corporation wishing to make an opening in the highway or street must secure a permit from the proper authority. The Contractor shall allow parties bearing such permits, and only those parties, to make openings in the highways or streets. The Contractor shall, when ordered by the Engineer, make in an acceptable manner, all necessary repairs due to such openings, and such necessary work will be paid for as extra work, or as provided in these specifications, and will be subject to the same conditions as original work performed.

C. The Owner, the Contractor, and each of such workmen, contractors, and others shall coordinate their operations and cooperate to minimize interference.

D. BLANK

E. BLANK

107.05 SAFETY

A. General: Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The name and telephone number of the Contractor's safety officer shall be provided to the Contracting Agency. He shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. All employees engaged in the work and the other persons who may be affected thereby;
2. All the work and all materials or equipment to be incorporated therein, whether in storage or on the project site, and
3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of the work.

B. Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect, install, employ and maintain, as required by the

conditions and progress of the work, all necessary safeguards. Contractor's duties and responsibilities for the safety and protection of the work shall continue until such time as all the work is completed and a "Notice of Completion" has been issued to the Contractor by the Engineer.

C. Trench Safety: Trench Safety shall be per Subsection 208.03.01.

107.06 SANITARY PROVISIONS

A. The Contractor shall provide and maintain in a neat, sanitary condition, such accommodations for the use of the Contractor's employees as may be necessary to comply with the requirements and regulations of the Southern Nevada Health District and of other bodies or tribunals having jurisdiction thereover. The Contractor shall commit no public nuisance.

107.07 TRAFFIC AND ACCESS

A. The Contractor's operations shall cause no unnecessary inconvenience. The access right of the public shall be considered at all times. Unless otherwise authorized, traffic shall be permitted to pass through the work, or an approved detour shall be provided.

B. Safe and adequate pedestrian and vehicular access shall be provided and maintained to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, hospitals, and establishments of similar nature. Access to these facilities shall be continuous and unobstructed unless otherwise approved by the Engineer.

C. Safe and adequate pedestrian zones and pedestrian crossings of the work at intervals not exceeding 300 feet shall be maintained unless otherwise approved by the Engineer.

1. When the Contractor’s construction operations encroach upon a sidewalk, walkway, or crosswalk area, the Contractor shall take special precautions to protect the pedestrian's safety including provisions to separate pedestrian traffic from the work area and vehicular traffic.
    a. When pedestrian traffic is routed onto the roadway, at other than existing crosswalk locations, the Contractor shall use portable precast concrete barrier rails to separate the pedestrian traffic from the work area and vehicular traffic.
    b. All portable precast concrete barrier rails shall be butted tight and pinned in accordance with the requirements of the NDOT Standard Drawing R-8.7.1, entitled “Portable Precast Concrete Barrier Rail.”

D. Safe and adequate access shall be maintained to existing bus or transit stops throughout duration of road construction in accordance with the following minimum requirements:

1. Unless otherwise specified in the Special Provisions, no public bus or transit stop shall be temporarily closed without the written consent of the Regional Transportation Commission of Southern Nevada (RTC) General Manager or the RTC General Manager's designee. The Contractor shall not close down any two consecutive bus

stops on routes for buses traveling in the same direction. The RTC shall be notified at least 10 working days prior to the proposed temporary closure of any bus or transit stop, including those listed in the Special Provisions.

2. No bus stops at transfer points shall be closed during construction. Bus stops at transfer points can, however, be temporarily relocated with the approval of the RTC.

3. Temporary bus stops may be considered upon approval by the RTC. The Contractor may call the RTC with any questions. A map of bus stop locations may be obtained from the RTC. If bus or transit stop is temporarily relocated, the existing bus or transit stop sign panels shall be relocated to temporary bus or transit stops and shall remain until temporary stop is removed. Temporary relocation of sign panels shall conform to ***Subsection 627.03.05, "Relocation."*** The Contractor shall relocate existing bus-stop signs at designated areas into existing sidewalk, and the sign relocation shall be incidental to other items of work.

4. The Contractor shall maintain access that is in conformance to the requirements of the Americans with Disabilities Act to and from bus or transit stops which remain open at all times during construction.

E. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time. If backfill has been completed to such extent that safe access may be provided, and the street is opened to local traffic, the Contractor shall immediately clear the street and driveways and provide and maintain access.

F. The Contractor shall cooperate with the various parties involved in the delivery of mail and the collection and removal of trash and garbage to maintain existing schedules for these services.

G. Grading operations, roadway excavation, and fill construction shall be conducted by the Contractor in a manner to provide a satisfactory surface for traffic. When rough grading is completed, the roadbed surface shall be brought to a smooth, even condition satisfactory for traffic.

H. Unless otherwise authorized, work shall be performed in only one half the roadway at one time. One half shall be kept open and unobstructed until the opposite side is ready for use. If one half a street only is being improved, the other half shall be conditioned and maintained as a detour.

I. The Contractor shall absorb in the Contractor's bid all costs for the above requirements.

J. The Contractor shall comply with all applicable state, county, and city requirements for closure of streets. Traffic work zone technicians on the project shall be certified in the work zone traffic control at least at the "Technician" level by ATSSA, IMSA, or NICET. The Contractor shall provide barriers, guards, lights, signs, temporary bridges, flagmen, and watchmen, advising the public of detours and construction hazards. The Contractor shall also be responsible for compliance with additional public safety requirements that may arise

during construction. The Contractor shall furnish and install, and upon completion of the work, promptly remove all temporary signs and warning devices.

K. Notifications:

1. The Contractor shall cooperate with, and give written notice to all emergency agencies, public entities, each resident, homeowner, homeowner association, business or school that will be affected by any part of the construction process, particularly concerning temporary interruptions to vehicular access.

2. This notice of the approximate schedule and explanation of work shall be distributed at least fourteen (14) days prior to commencement of work in the area.

3. A second written notice, as well as a verbal notice, including door-to-door communication shall be made at least twenty-four (24) hours prior to construction to remind all affected parties of the construction to take place.

4. The Contractor shall notify by phone the following agencies:

METRO DISPATCH	702-795-3111
FIRE DEPARTMENT DISPATCH	702-382-3001
AMBULANCE DISPATCH CENTER	702-384-3400
RTC – Bus Stop Closures, when applicable Contact Carl Scarborough, per SP 624.01.71	702-676-1608
RTC TRANSIT, when applicable	702-676-1731
CLARK COUNTY SCHOOL DISTRICT	702-799-8100 X 5395
NEVADA DEPT. OF TRANSPORTATION (NDOT), when applicable	702-385-6588
CLV - DEPT. OF PUBLIC WORKS	
PUBLIC INFORMATION SPECIALIST	702-229-6581
TRAFFIC ENGINEERING DIVISION	702-229-6327
UNITED STATES POSTAL SERVICE	1-888-275-8777
REPUBLIC SERVICES	702-735-5151 X 314

5. The Owner shall receive a copy of all notifications for acceptance.

L. All costs involved shall be absorbed in the Contractor's bid. All barricades, warning signs, lights, temporary signals, and other protective devices shall conform with the Traffic Control Plans for Highway Work Zones for the Clark County Area and the current edition of the Manual on Uniform Traffic Control Devices.

M. Construction materials may not be stored in streets, roads or highways for more than five days after unloading. All materials or equipment not installed or used in the construction within five days after unloading shall be stored elsewhere by the Contractor at his expense unless he is authorized additional storage time.

N. Construction equipment shall not be stored at the work site before its actual use on the work nor for more than five days after it is no longer needed on the work. Time necessary for repair or assembly of equipment may be authorized by the Engineer.

O. Excavated material, except that which is to be used as backfill in the adjacent trench, may not be stored in public streets, roads or highways unless otherwise permitted. After placing backfill, all excess material shall be removed immediately from the site.

B. Wherever possible the contractor shall use high early strength concrete for final utility grade adjustments to facilitate reopening the road to traffic.

107.08 BLANK

107.09 BLANK

107.10 EXPLOSIVES

A. Explosives may be used only when authorized in writing by the Engineer, or as otherwise stated in the Special Provisions. Explosives shall be handled, used, and stored in accordance with all applicable regulations.

B. The Engineer's approval of the use of explosives shall not relieve the Contractor from the Contractor's liability for claims caused by the Contractor's blasting operations.

C. All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the Engineer and in general not closer than 1,000 feet from the road or from any building or camping area or place of human occupancy.

D. The Contractor shall notify each public utility company having structures or pipelines in proximity to the site of the work of the Contractor's intention to use explosives. Such notice shall be given in writing a week in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury.

107.11 BLANK

107.12 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE

A. The Contractor shall be responsible for the preservation from injury or damage resulting directly or indirectly from the work under the contract of all public and private property, crops, trees, vegetation, monuments, fences, highway signs and markers, etc., along and adjacent to the project, and shall use every precaution necessary to prevent damage to waterlines,

sewers, and other underground structures, to poles, wires, cables, and other overhead structures, whether shown on the plans or not, shall protect carefully from disturbance or damage all land monuments and property marks until the Engineer has witnessed or otherwise referenced their location, and shall not remove them until directed. The Contractor shall not willfully or maliciously injure or destroy trees or shrubs, and the Contractor shall not remove or cut trees or shrubs without proper authority.

B. The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the work resulting from any act, omission, neglect, or misconduct in the Contractor's manner or method of executing said work, or at any time due to defective work or materials, and such responsibility shall not be released until the project shall have been completed and accepted.

C. The Contractor shall be responsible for the preservation of archeological and paleontological objects, including all ruins, sites, buildings, artifacts, fossils, or other objects of antiquity encountered during construction. When such objects are encountered, the Contractor shall immediately cease operations and notify the Engineer that such objects exist. Construction operations shall be rescheduled to avoid the section until the removal of the artifacts or the gathering of historical data has been accomplished by the appropriate authority. When directed by the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper authorities.

D. Extension of contract time will be allowed for any delay to the Contractor due to preservation of archeological and paleontological objects.

E. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the work, or in consequence of the nonexecution thereof on the part of the Contractor or the Contractor's agents, suppliers, or subcontractors, the Contractor shall restore at no additional cost to the Owner such property to a condition similar or equal to that existing before such damage or injury was done by repairing, rebuilding, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner. In case of failure on the part of the Contractor to restore such property or make good such damage or injury within 10 days, the Owner may, upon 48 hours' written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost thereof shall be deducted from any money due, or which become due the Contractor under the contract.

F. The Contractor shall restrict the movement of the Contractor's vehicles and other construction equipment and personnel to the construction area and designated roads. Every precaution shall be taken to prevent the marking of the natural ground with equipment tracks or other means outside of the staked area and in median areas where it is not required to disturb the existing ground. Where such markings of the natural ground are caused either by the Contractor's equipment, personnel, or operations, the Contractor, at no additional cost to the Contracting Agency, shall eradicate such marks to the satisfaction of the Engineer.

G. All roads used for construction operations shall be spaced at least 1,000 feet apart from flat bottom ditches and material deposits, except that such roads may also be located in ditch and dike areas. When roads are located in ditch and dike areas, equipment shall not be allowed to travel outside the area occupied by said ditch or dike, except as provided for in ***Subsection 203.03.13, "Channels."*** The crossing of median areas shall be at structures or areas approved by the Engineer.

H. Where there is a high potential for erosion and subsequent water pollution, the area of erosive land that may be exposed by construction operations at any one time shall be held to a minimum, and the duration of the exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion control features shall be constructed concurrently with other work and at the earliest practicable time.

I. Disturbance of the lands and of waters that are outside the limits of the construction as staked is prohibited, except as may be found necessary and approved by the Engineer.

J. Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the site in the performance of the work. Drainage facilities shall be adequate to prevent damage to the work, the site and the adjacent property.

K. Contractor shall prevent erosion of soil on the site and adjacent property resulting from his construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation or other operation that will disturb the natural protection of the soil.

107.13 FIRE PROTECTION

A. There shall be no open burning unless approval has been given in writing by the Clark County Air Pollution Control Officer and the Engineer has concurred. Before setting any fires whatsoever, the Contractor shall notify the responsible agency having jurisdiction for the area concerned. The Engineer shall have authority to enforce correction of any condition which is, in the Engineer's opinion, unsafe.

107.14 DISPOSAL OF MATERIAL OUTSIDE PROJECT RIGHT-OF-WAY

A. The Contractor shall make the Contractor's own arrangements for disposal of materials outside the project right-of-way at no additional cost to the Owner.

B. When any material is to be disposed of outside the project right-of-way, the Contractor shall first obtain a written permit from the property owner on whose property the disposal is to be made, and the Contractor shall file in writing with the Engineer said permit or the certified copy thereof together with a written release from the property owner absolving the agency of any and all responsibility in connection with the disposal of material on said property.

C. When material is disposed of as above provided and the disposal location is visible from the project, the Contractor shall dispose of the material in a neat and uniform manner to the satisfaction of the Engineer.

D. Unless otherwise provided in the Special Provisions, full compensation for all costs involved in disposing of material as specified in this section, including all costs of hauling, shall be considered as included in the price paid for the contract items of work involving such materials and no additional compensation will be allowed therefore.

107.15 RELIEF FROM MAINTENANCE AND RESPONSIBILITY

A. Upon the written request of the Contractor, or upon order of the Engineer, the Contractor may be relieved of the duty of maintaining and protecting certain portions of the work as described below, which have been completed in all respects in accordance with the requirements of the contract and to the satisfaction of the Engineer, and thereafter except with the Engineer's consent, the Contractor will not be required to do further work thereon. In addition, such action by the Engineer will relieve the Contractor of responsibility for injury or damage to said completed portions of the work resulting from use by the public traffic or from the action of the elements or from any other cause, but not from injury or damage resulting from the Contractor's own operations or from the Contractor's negligence.

B. Portions of the work for which the Contractor may be relieved of the duty of maintenance and protection as provided in the above paragraph include but are not limited to the following:

1. A bridge or other structure of major importance.

2. A complete unit of a traffic control signal system or of a highway or street lighting system.

3. Non-project facilities constructed for other agencies.

C. However, nothing in this subsection providing for relief from maintenance and responsibility will be construed as relieving the Contractor of full responsibility for making good defective work or materials found at any time before the formal written acceptance of the entire project by the Contracting Agency.

107.16 CONTRACTOR'S RESPONSIBILITY FOR THE WORK AND MATERIALS

A. Until the acceptance of the contract, the Contractor shall have the charge and care of the work and of the materials to be used therein and shall bear the risk of injury, loss, or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution or from the nonexecution of the work, except as provided in ***Subsection 107.15, "Relief from Maintenance and Responsibility."***

B. The Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the work or the materials occasioned by any cause before its completion and acceptance and shall bear the expense thereof, except as otherwise expressly provided in ***Subsection 203.03.11, "Slides and Slipouts,"*** for Object Markers and Guide Posts, and except for such injuries, losses, or damages as are directly and proximately caused by acts of the federal government or the public enemy. The Contractor shall, at no additional cost to the Contracting Agency, provide suitable drainage for the project and erect such temporary structures as are necessary to protect the work or materials from damage.

C. The suspension of the work from any cause whatever shall not relieve the Contractor of the Contractor's responsibility for the work and materials as herein specified. If ordered by the Engineer, the Contractor shall, at no additional cost to the Owner, properly store materials which have been fully or partially paid for and furnished by the Owner. Such storage by the Contractor shall be on behalf of the Owner and the Owner shall at all times be entitled to the possession of such materials, and the Owner shall promptly return the same to the site of the work when requested. The Contractor shall not dispose of any of the materials so stored except on written authorization from the Engineer.

107.17 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICE

A. At points where the Contractor's operations are adjacent to properties of railroad, telegraph, telephone, and power companies, or are adjacent to or in conflict with other property or utilities, damage to which might result in considerable expense, loss, or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.

B. The Contractor shall not begin any operations which may interfere with or impair the normal service being rendered by public or private utility operations, until such operators have been notified, and shall cooperate with the owners of any underground or overhead utilities in their removal and rearrangements operations in order that these operations may progress in a reasonable manner, and that duplication of rearrangements work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted. The Contractor will be held responsible for the protection of the property of public or private utilities within the limits of the work.

C. In general, the repair and adjustment of street structures such as waterlines, sewers, telephone, telegraph, gas, and electric lines, above or below the ground, will be made by the owners thereof as specified in ***Subsection 105.06, "Cooperation with Utilities."*** When included in the proposal, the adjustment of sewer manhole frames and covers, inlets and catch basin frames and covers and the like, will be within the Contractor's responsibility. The Contractor shall see that they are adjusted to conform to the lines, grades, and typical cross sections as shown on the plans, or as prescribed, without respect to whether the repairs and the roughing-in work have been performed by the Contractor or others.

D. Pipes or other construction shall be maintained in continuous service as far as practicable and shall be properly protected and supported. In no case shall interruption of the water service be allowed to exist outside of working hours.

E. Fire hydrants shall be accessible at all times to the fire department. No material or other obstruction shall be placed closer to a fire hydrant than permitted by ordinances, rules, or regulations, or within 15 feet of the fire hydrant in the absence of such ordinances, rules, or regulations.

F. The Contractor shall give notice in writing to the proper authorities in charge of streets, gas, water pipes, sewer lines, electric, and other conduits, railroads, poles, manholes, catch

basins, and all other property that may be affected by the Contractor's operations, at least 48 hours before breaking ground.

G. In the event of interruption to water or utility services as a result of accidental breakage, the Contractor shall promptly notify the proper authority. The Contractor shall cooperate with said authority in the restoration of service as promptly as possible.

H. Attention is directed to ***Subsection 105.06, "Cooperation with Utilities."***

I. All utility valves, manholes, vaults, pull boxes, etc., which are buried, shall be conspicuously marked by the Contractor to allow their location to be determined by the Engineer or utility personnel under adverse conditions (i.e. inclement weather or darkness).

107.18 FURNISHING RIGHT-OF-WAY

A. The Owner will be responsible for the securing of all right-of-ways shown in the plans. Any exceptions will be indicated in the contract.

B. Contractor shall provide copy of necessary permits and written consent from property owner(s) prior to entering or occupying any lands outside the right-of-way or easement or where no Authorization to Enter Property exists.

107.19 BLANK

107.20 NO WAIVER OF LEGAL RIGHTS

A. The Contracting Agency shall not be precluded or estopped by any measurements, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefor, from showing the true amount and character of the work performed, and materials furnished by the Contractor, nor from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor that the work or materials do not in fact conform to the contract. The Owner shall not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor or the Contractor's sureties, or both, such damages as it may sustain by reason of the Contractor's failure to comply with the terms of the contract. Neither the acceptance by the Contracting Agency, or any representative of the Contracting Agency, nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Contracting Agency, shall operate as a waiver of any portion of the contract or of any power herein reserved, or of any right to damages. A waiver of any breach of the contract shall not be held to be a waiver of any other or subsequent breach.

107.21 DUST CONTROL

A. Dust that originates from the Contractor's operations, either inside or outside the right-of-way, shall be controlled at all times by the Contractor in accordance with federal, state, and local laws, ordinances, and regulations at the sole expense of the Contractor.

B. A permit from the Clark County Air Pollution Officer shall be obtained by the Contractor prior to the start of construction operations.

C. Reference is made to ***Section 637, "Pollution Control."***

107.70 CONTRACTOR'S RESPONSIBILITY TO THE PUBLIC

A. The Contractor is responsible to answer and resolve any conflicts that may arise between a homeowner or business owner and himself during the construction process.

107.71 ALLOWABLE WORK HOURS

A. No work between the hours of 6 p.m. and 7 a.m. will be allowed in residential areas unless approved by the Engineer or otherwise stated in the Special Provisions. If work after the aforementioned hours is approved, then the Contractor shall provide each affected resident at least forty-eight (48) hours written notice explaining the reason for the work after hours and providing an approximate duration of the activity.

107.72 NATURAL DRAINAGE AND STORM WATER RUNOFF

A. The Contractor shall be responsible for protecting and preserving public and private property from damage directly or indirectly caused by drainage or storm water runoff leaving the project during construction of all improvements, including downstream properties if damage is a result of the Contractor's actions in diverting or redirecting existing natural runoff patterns.

END OF SECTION 107

SECTION 109 – MEASUREMENT AND PAYMENT

109.01 MEASUREMENT OF QUANTITIES

A. The measurements and determination of the number of units of each pay item will be made in general as prescribed hereinafter and specifically as set out under "Method of Measurement" and "Basis of Payment" in the specification of each pay item.

B. After the items of work are completed and before final payment is made, the Engineer will determine the quantities of the various items of work performed as the basis for final settlement for all other than lump sum contracts. In the case of unit price items, the Contractor will be paid for the actual amount of work performed and materials used in accordance with these specifications, as shown by the final measurements, unless otherwise specified.

C. Actual authorized quantities of work satisfactorily completed under the contract, shall be measured by the Engineer in accordance with United States Standard Measures, and well recognized engineering practices. Unauthorized wastings of material will be deducted and only such quantities as are actually incorporated in the completed work will be included in the final estimate. The planimeter shall be considered an instrument of precision adapted to the measurement of areas, but other acceptable methods may be used.

D. Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures having an area of 9 square feet or less. Unless otherwise specified, transverse measurements for area computation will be the neat dimensions shown on the plans or ordered in writing by the Engineer.

E. In computing volumes of excavation, embankment, and borrow, the average end area method will be used unless otherwise specified.

F. All items that are measured by the linear foot such as pipe culverts, underdrains, guardrails, etc., shall be measured parallel to the base or foundation upon which such structures are placed, unless otherwise shown on the plans.

G. Items may be measured by surface area, either square foot or square yard. The term "gage" when used in connection with the measurement of plates, shall mean the U.S. Standard Gage. When reference is made, however, to the measurements of galvanized sheets used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing, the term "gage" shall mean that specified in the respective test designation for the material as described in the "Materials" section of these specifications.

H. When the term "gage" refers to the measurement of wire, it shall mean the wire gage specified in the AASHTO M 32 for cold drawn steel wire for concrete reinforcement.

I. Unless otherwise specified, water meters shall be accurate to within 2 percent of the indicated amount. The frequency of checking water meters will be determined by the Engineer.

J. The term ton shall mean the short ton consisting of 2,000 pounds avoirdupois. All materials that are specified for measurement by ton shall be weighed on accurate, approved scales set at locations designated by the Engineer. All materials shall be weighed on platform scales with the following exception: In lieu of platform scales, the

Contractor may provide an automatic printer system that will print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching control system. Such a system shall issue a weigh ticket for each load. The Contractor shall have on hand not less than ten 50-pound standard weights for testing the scales.

K. Scales:

1. All scales shall be furnished by and at the expense of the Contractor and shall have a certificate of inspection by the Bureau of Weights and Measures. The scales shall be tested and inspected by the Bureau of Weights and Measures and a new inspection certificate required as often as the Engineer may deem necessary, and after each scale move, in order to ensure the accuracy of the scales. The cost of inspecting the scales shall be borne by the Contracting Agency.

2. Platform scales shall be of sufficient size and capacity to weigh, in one operation, the entire loaded vehicle. Combination vehicles may be weighed as separate units, provided the connecting device between vehicles is so constructed that no weight other than that of the device itself is transmitted to either vehicle. When combination vehicles are used, approaches to and from the scale platform shall be level for sufficient distance to accommodate that portion of the combination vehicle that is off the scale platform. In instances where combination vehicles are weighed, the approaches to and from the scale platform shall be level with the scale platform for a minimum distance of 50 feet from each end of the scale platform.

3. If combination vehicles are utilized, provisions shall be made to ensure that all braking devices are disengaged during weighing operations as insurance against stresses being transmitted between either vehicle.

4. The scale pit shall be of sufficient width to permit access to all scale components for purposes of inspection, repair, cleaning, and adjusting.

5. Support members for platform scales shall consist of 12-inch by 12-inch or 6-inch by 16-inch (minimum) timbers placed on a firm gravel foundation. Scales consisting of more than one section shall be supported with 12-inch by 12-inch or 6-inch by 16-inch (minimum) timbers at each end of each section to avoid settlement of the scale platform. Concrete support members conforming to the minimum timber size requirements may be utilized in lieu of timber at the Contractor's option.

6. Platform scales shall be equipped with weatherproof housing so constructed as to protect the recording device and permit the weighmaster convenient access to all beams and dials. The housing shall not be less than 6 feet wide, 8 feet long, and 7 feet high; shall have 2 windows, adjustable for ventilation with one facing the scales; and shall be equipped with an adequate shelf suitable to the Engineer. The Contractor shall provide heat and electric lights when requested by the Engineer.

7. Conveyor scales of an approved type may be used. The conveyor scales shall be furnished with 1 master counter to run continuously and 1 remote counter which will print the weight in individual loads, then reset to zero automatically. The remote unit shall be placed in a weatherproof house with 2 windows. One window shall face the point of loading and the conveyor scales. This window shall also be equipped with a shelf 2 feet wide and 6 feet long. A controlled method of heating shall be supplied for cold weather operations.

8. A locked door shall be provided on the access to the conveyor balances (where fine adjustment must be made). The key shall be in the hands of the Engineer and the door shall be opened only for maintenance and adjustment of conveyor scales to meet the accuracy of the platform scales. This door shall be locked at all times during the operation of the conveyor scales. If conveyor weighing equipment is used, the following procedures shall be followed:

    a. The conveyor scales shall be calibrated against the platform scales, which shall have a certificate of inspection.

    b. At the beginning and middle of each shift, or as requested by the Engineer, 2 consecutive loads of material weighed over the conveyor scales shall be reweighed on the platform scales. The total weight indicated by the conveyor scales on the 2 loads shall check with the platform scale weight within 0.5 percent. If the conveyor scales weigh out of this tolerance, all loads shall be weighed on the platform scales until the condition is rectified.

    c. Consecutively numbered, individual weigh tickets shall be used with conveyor scale weights stamped by the remote counter.

L. Unless otherwise specified, materials shipped by rail shall be weighed over the authorized project scales before incorporation into the work.

M. Cement will be measured by the barrel or ton. The term "barrel" will mean 376 pounds of cement.

N. Timber will be measured by the thousand feet board measure (Mfbm) actually incorporated in the structure with no allowance for any waste except beveled ends. Measurement will be based on nominal widths and thicknesses, and the extreme length of each piece.

O. When a complete structure or structural unit (in effect, "lump sum" work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

P. All materials for which measurements are obtained by the cubic yard "loose measurement" or "measured in the vehicle" shall be hauled in approved vehicles and measured therein at the point of delivery. No allowance will be made for the settlement of material in transit. Vehicles for this purpose may be of any size or type acceptable to the Engineer, provided that the body is of such shape that the actual delivered contents may be readily and accurately determined and will remain constant. Unless all approved vehicles on the work are of uniform capacity, each vehicle shall bear a plainly legible identification mark, indicating its specified approved capacity. All vehicles shall be loaded to at least waterlevel capacity. Loads not hauled in approved vehicles or of a quantity less than the specified approved quantity for the hauling vehicle will be subject to rejection and no compensation will be allowed for the hauling of the material.

Q. Liquid Asphalts, Asphalt Cement, and Asphaltic Emulsions:

1. The unit of measurement for liquid asphalts, asphaltic emulsions, and paving asphalts shall be a ton or gallon at 60 degrees F.

2. Quantities of bituminous binders wasted or disposed of in a manner not called for under these specifications, or remaining on hand after completion of the work, will not be paid for.

3. When permitted by the Engineer, pay quantities of bituminous binder may be determined from volumetric measurements of the bituminous binder, in which case the bituminous binder shall be delivered in calibrated tanks and each tank shall be accompanied by its proper measuring stick and a calibration card signed by a sealer of weight and measures, and pay quantities shall be determined in accordance with the following procedure.

4. Volumetric measurements at any temperature shall be reduced to the volume the material would occupy at 60 degrees F, before converting the volumetric measurements to weight.

5. The following tables shall be used to convert volumes from gallons to weight. All types, SC, MC, and RC of the same grade shall be considered to have equal weights and volume.

AVERAGE WEIGHTS AND VOLUMES OF LIQUID ASPHALT AT 60 DEGREES FAHRENHEIT

Grade of Liquid Asphalt	Gallons Per Ton	Pounds Per Gallon
70	253	7.90
250	249	8.03
800	245	8.16
3000	241	8.30

AVERAGE WEIGHTS AND VOLUMES OF ASPHALT CEMENT AT 60 DEGREES FAHRENHEIT

Grade	Gallon Per Ton	Pounds Per Gallon
AC-40	233	8.59
AC-30	235	8.51
AC-20	235	8.51
AC-10	237	8.43

AVERAGE WEIGHTS AND VOLUMES OF ASPHALTIC EMULSION AT 60 DEGREES FAHRENHEIT

Type of Emulsion	Gallon Per Ton	Pounds Per Gallon
All Grades	240	8.33

6. When converting the volume of liquid asphalt, asphalt cement, or asphaltic emulsion at any temperature to the volume of 60 degrees F, a conversion factor for correlation shall be used. Said conversion factors shall be those prescribed in The Asphalt Institute (Pacific Coast Division) publication "Asphalts -- Paving Liquids and Emulsions" (PCD-7).

R. Rental of equipment will be measured by time within 1/2 hour of actual working time and necessary traveling time of the equipment within the limits of the project. If equipment has been ordered on the job on a standby basis by the Engineer, half-time rates for the equipment will be paid.

S. BLANK

END OF SECTION 109

SECTION 201 – CLEARING AND GRUBBING

DESCRIPTION

201.01.01 GENERAL

A. This work shall consist of clearing, grubbing, removing, and disposing of all vegetation and debris within the limits of construction, except such objects as are designated to remain or be removed in accordance with other sections of these specifications. This work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.

CONSTRUCTION

201.03.01 GENERAL

A. The Engineer will establish clearing limits and designate all trees, shrubs, plants, and other things to remain. Areas to be cleared will be as set forth in ***Subsection 201.03.02, "Areas to be Cleared."*** The Contractor shall preserve all things designated to remain. Paint required for cut or scarred surfaces of trees or shrubs selected for retention shall be an approved asphaltum base paint prepared especially for tree surgery. ***Subsection 107.21, "Dust Control"*** shall be complied with.

201.03.02 AREAS TO BE CLEARED

A. Areas to be cleared shall be one or more of the following:

1. The entire area upon which the project construction is to be performed to the width of the excavation and embankment slope lines.
2. Ditch and dike areas to the width of the slope lines.
3. Areas on which service roads or ramps, streets, approaches, and all other accessory roads and connections are to be constructed, such areas to extend to the width of the excavation and embankment slope lines.
4. Designated material sites and designated borrow pits.
5. Areas designated in the plans or Special Provisions.

201.03.03 CLEARING AND GRUBBING

A. Surface objects and trees, stumps, roots, and other protruding obstructions, designated for removal, shall be cleared or grubbed or both. Unless otherwise specified, the Contractor may leave stumps and nonperishable solid objects provided they do not extend more than 6 inches above the ground line or low water level, and are a minimum of 3 feet below subgrade or embankment slope.

B. The Engineer may permit sound stumps to be cut off not more than 6 inches above the ground and to be left outside of the construction limits of cut and embankment areas, except in the area to be rounded at the top of backslopes where stumps are to be cut off flush with or below the surface of the final slope line.

C. Where feasible, trees shall be felled toward the center of the area to be cleared. Where trees cannot be felled without danger to traffic or injury to other trees, structures, or property, the trees shall be cut in sections from the top down.

D. There shall be no burning unless approval has been given in writing by the Clark County Air Pollution Control Officer and this approval concurred with by the Engineer. If perishable material is burned, it shall be burned under the constant care of competent watchmen at such times and in such a manner that anything designated to remain on the right-of-way, the surrounding forest cover, or other adjacent property will not be jeopardized. Burning shall be done in accordance with applicable laws, regulations, and ordinances.

E. When permitted by the Engineer, materials, debris, and perishable materials may be removed from the right-of-way and disposed of at locations off the project outside the limits of view from the project with the written permission of the property owner on whose property the materials and debris are placed. The Contractor shall make all necessary arrangements with property owners for obtaining suitable disposal locations and the cost involved shall be included in the unit price bid. Attention is directed to ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

F. Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable materials and compacted in accordance with ***Subsection 203.03.18, "Compaction, Dirt Embankment"*** or ***Subsection 203.03.19, "Compaction, Rock Embankment"*** if within the staked prism. Payment for backfilling and compacting will be considered subsidiary to other items of the work and no further compensation will be made therefor.

G. All merchantable timber in the clearing area shall become the property of the Contractor unless otherwise provided. Timber and debris may be stored or decked within the right-of-way only in areas approved by the Engineer and shall be removed prior to final acceptance of the project.

H. Low hanging branches and unsound or unsightly branches on trees or shrubs designated to remain shall be removed as directed. Branches of trees extending over the road shall be trimmed to give a clear height of 20 feet above the road surface. All trimming shall be done by skilled workmen and in accordance with good tree surgery practices.

I. Scalping shall include the removal of material such as brush, roots, sod, grass, residue of agricultural crops, sawdust, and decayed vegetable matter from the surface of the ground.

J. Unless otherwise permitted by the Engineer, the Contractor shall scalp areas where excavation or embankment is to be made, except that mowed sod need not be removed where the embankment to be constructed is 4 feet or more in height to subgrade elevation.

END OF SECTION 201

SECTION 202 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

DESCRIPTION

202.01.01 GENERAL

A. This work shall consist of the removal, wholly or in part, and satisfactory disposal of all buildings, fences, guardrails, structures, old pavement, abandoned pipelines, and any other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed of under other items in the contract. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes, and pits.

CONSTRUCTION

202.03.01 GENERAL

A. The Contractor shall raze, remove, and dispose of all buildings and foundations, structures, guardrail, culvert markers and guide posts, fences, and other obstructions, any portions of which are on the right-of-way, except utilities and those for which other provisions have been made for removal. All designated salvable material shall be removed, without unnecessary damage, in sections or pieces which may be readily transported, and shall be stored by the Contractor at specified places within the project limits. Unusable material shall be disposed of in accordance with ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."*** Basements or cavities left by structure removal shall be filled to the level of the surrounding ground and, if within the prism of construction, shall be compacted in accordance with ***Subsection 203.03.18, "Compaction, Dirt Embankment"*** or ***Subsection 203.03.19, "Compaction, Rock Embankment."***

202.03.02 REMOVAL

A. Bridges, culverts, and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic.

B. All operations necessary for the removal of any existing structure which might endanger the new construction shall be completed prior to the construction of the new work. No equipment or devices shall be used which might damage structures, facilities, or properties which are to be preserved and retained.

C. Unless otherwise directed, the substructures of existing structures shall be removed down to the natural stream bottom and those parts outside of the stream shall be removed down one foot below natural ground surface. Where such portions of existing structures lie wholly or in part within the limits for a new structure, they shall be removed as necessary to accommodate the construction of the proposed structure.

D. Operations necessary for the removal of an existing structure or obstruction, which may damage new construction, shall be completed prior to placing the new work.

E. Bituminous pavement shall be removed to clean straight lines. Saw cutting of edges to be joined is required. Where only the surface of existing bituminous pavement is to be removed by heater-planing, or by other approved methods, a minimum laying depth of

1 inch of new pavement material shall be provided at the joint line. Where bituminous pavement adjoins a trench, the edges adjacent to the trench shall be saw cut to neat straight lines before resurfacing.

F. Concrete pavement shall be removed to neatly sawed edges. Saw cuts shall be made to a minimum depth of 1-1/2 inches. If a saw cut in concrete pavement falls within 3 feet of a construction joint, cold joint, expansion joint, or edge, the concrete shall be removed to the joint or edge. The edges of existing concrete pavement adjacent to trenches, where damaged subsequent to saw cutting of the pavement, shall again be saw cut to neat straight lines for the purpose of removing the damaged pavement areas. Such saw cuts shall be either parallel to the original saw cuts or shall be cut on an angle which departs from the original saw cut not more than 1 inch in each 6 inches.

G. Concrete curb, walk, gutters, cross gutters, driveways, and alley intersections shall be removed to nearest score line or joint.

H. In removing manholes, catch basins, and inlets, any live sewers connected to item shall be rebuilt and properly reconnected and a satisfactory bypass service shall be maintained during such construction operations. When abandoning manholes, catch basins, and inlets, they shall be thoroughly cleaned and existing pipe connections shall be plugged with concrete of the class and grade specified for structures. The portions of the structures shall then be removed to the required elevations and any necessary backfill shall be placed and compacted to specifications.

202.03.03 EXTENSIONS

A. Where existing culverts and bridges are to be extended or otherwise incorporated in the new work, only such part or parts of the existing structure shall be removed as is necessary to provide a proper connection to the new work. The connecting edges shall be cut, shaped, and trimmed to the required lines and grades without weakening or damaging the part of the structure to be retained. Reinforcing bars which are to be left in place, so as to project into the new work as dowels or ties, shall not be injured during removal of concrete.

202.03.04 CLOSING CULVERTS

A. Existing culverts within construction limits, the top of which are 5 feet or more below finished roadway grade, shall be abandoned and closed unless otherwise noted on the plans. The headwalls of such culverts, or any part of the structure that is within 3 feet of the finished grade line shall be removed. The ends of the culvert shall be completely filled with satisfactory soil for a distance of at least 2 feet, plus the height of the opening of the structure.

202.03.05 SALVAGE

A. When specified, gravel, roadmix, or plantmix surface suitable for reuse shall be removed to the depth required and surfacing so removed shall be carefully salvaged and placed in compact stockpiles at locations approved by the Engineer. Care shall be exercised to prevent contamination of stockpiled material. Any remaining unsuitable material shall be scarified and incorporated in embankment as set forth in ***Section 203, "Excavation and Embankment."***

B. Fences and gates designated for reuse shall be removed in such a manner that all material can be salvaged. Wire shall be carefully removed from the posts and rolled in rolls of a size that can be conveniently handled. Posts shall be removed by methods that will keep breakage to a minimum.

C. Guardrail, culvert markers, and guide posts designated for reuse shall be removed in such a manner that all material can be salvaged. Bolts, supports, and other hardware shall be removed from all rails, plates, and posts and all parts shall be sorted and stored at the locations specified. Rail, plates, and posts shall be properly stacked and miscellaneous hardware shall be stacked or boxed and reasonable care exercised in handling, storage, and preservation of materials as will ensure the maximum salvage value for the entire operation. Attention is directed to ***Section 619, "Object Markers and Guide Posts."***

D. When specified for salvage, structural steel removed from old structures shall be stored in a neat and presentable manner on blocking and at locations suitable for loading. Structures or portions thereof which are specified for re-erection shall be stored in separate piles.

E. When re-lay culvert pipe is required, the Contractor shall remove the pipe in such a manner as not to damage the material in any way. If no particular pipe is noted for re-lay, the Contractor shall salvage and clean sufficient amount of the best available pipe to satisfy the re-lay pipe item.

F. Timber or piling from all structures designated to be salvaged shall have all nails and bolts removed therefrom and shall be stored in neat piles at locations suitable for loading.

202.03.06 DISPOSING OF MATERIALS

A. Unless otherwise provided, excavated material shall be used in backfilling excavations made in removing the structure, in constructing embankment, or otherwise disposed of in a manner satisfactory to the Engineer.

B. When the placement of riprap and similar structures is included in the proposal, suitable broken concrete or masonry removed from old structures may be used in such construction. Any concrete or masonry which cannot be placed in backfills or embankments or used as riprap, shall be disposed of in accordance with ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."*** The material shall not be placed where it will obstruct any drainage course.

C. When concrete or masonry is placed in embankments, it shall be placed in accordance with ***Subsection 203.03.16, "Embankment Materials."***

END OF SECTION 202

SECTION 203 – EXCAVATION AND EMBANKMENT

DESCRIPTION

203.01.01 GENERAL

A. This work shall consist of grading and excavating the roadway, excavating borrow pits, removing slide material, and excavating ditches and stream channels and satisfactorily disposing of all excavated material and all work necessary for the construction and completion of cuts, embankments, slopes, ditches, dikes, stream channels, approaches, parking areas, intersecting driveways and highways, and subsidiary work. Exceptions are slope rounding, structure excavation, or other separately designated pay items of work, which are made a part of the contract. All work shall be in conformity with the alignment, grades, and cross sections shown on the plans or established by the Engineer.

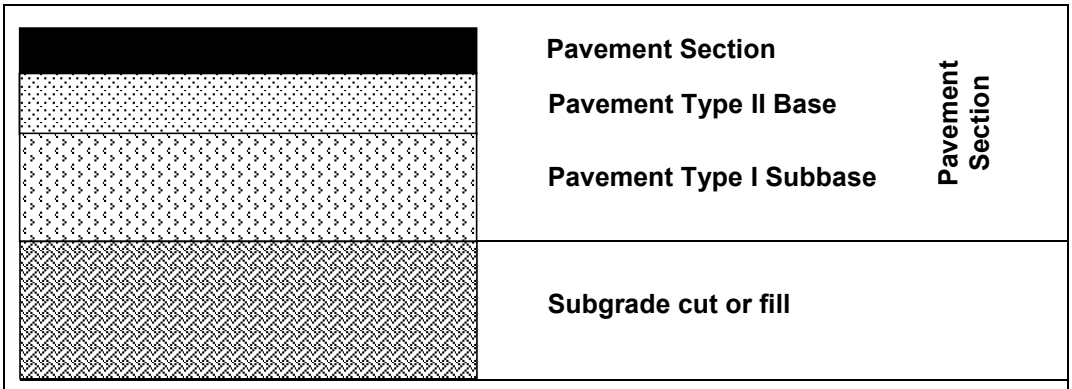


Figure 1- Definition of Terms

B. The compacted subgrade shall be maintained at optimum moisture content until placement of an aggregate base course.

MATERIALS

203.02.01 ROADWAY EXCAVATION

A. Roadway excavation shall consist of all excavation involved in grading and constructing the roadway and appurtenances, irrespective of the nature or type of material encountered; except excavation designated as structure excavation, drainage excavation, channel excavation, and borrow excavation when these items are provided as items of work under the contract. Dividing the project into construction stages shall not be construed as separate material classifications.

B. When cementitious material is encountered within the excavation limits, the treatment, removal, trimming, and working of that material shall be considered as incidental to the excavation work.

203.02.02 DRAINAGE EXCAVATION

A. Drainage excavation shall include all excavation in the construction of open ditches less than 12 feet in bottom width, excepting ditches that are part of the roadway prism as shown in the plans. The nature or type of material encountered shall have no bearing on the classification of material.

B. When cementitious material is encountered within the excavation limits, the treatment, removal, trimming, and working of that material shall be considered as incidental to the excavation work.

203.02.03 CHANNEL EXCAVATION

A. Channel excavation shall include all excavation in the construction of open ditches or stream channels with a bottom width of 12 feet or more with the exception of ditches that are part of the roadway prism as shown in the plans. The nature or type of material encountered shall have no bearing on the classification of material.

B. When cementitious material is encountered within the excavation limits, the treatment, removal, trimming, and working of that material shall be considered as incidental to the excavation work.

203.02.04 BORROW

A. Borrow shall consist of approved material excavated and used in the construction of fills, or for other construction purposes. Borrow shall be material that is excavated from sources specified in the Special Provisions or designated by the Engineer. The source of material to be excavated shall be approved in advance by the Engineer. Borrow shall be excavated to the lines and grades established by the Engineer.

B. The Contractor shall notify the Engineer, sufficiently in advance, of opening any borrow site so that adequate time will be allowed for testing the material and establishing cross section elevations and measurements of the ground surface. The widening of roadway cuts shall be considered as roadway excavation and not as borrow, unless otherwise specified. Borrow excavation will not be classified according to type or character of material encountered in the borrow area unless otherwise required in the Special Provisions.

203.02.05 SELECTED BORROW

A. Selected borrow shall consist of approved material required for the construction of embankments within the required limits shown on the plans or directed by the Engineer, and shall be obtained from approved sources.

B. Selected borrow shall conform to the requirements set forth in the Special Provisions.

CONSTRUCTION

203.03.01 ROADWAY EXCAVATION

A. All excavation shall be made true to lines and grades staked by parties under the supervision of a Nevada licensed professional land surveyor working for the Engineer or Contractor and shall be so conducted as to avoid removing or loosening any material outside the required slopes. If any material is so disturbed, it shall be replaced and thoroughly compacted to the required cross section, unless such replacement is impractical as determined by the Engineer.

B. The work done under this section shall begin at some definite point or points on the project subject to the approval of the Engineer, and the work shall progress toward completion in an orderly manner. The roadway shall be graded to full cross section width before placing base or surfacing of any type, unless otherwise specified.

C. Intersecting roads, service highways, ramps, approaches, and driveways shall be graded as shown on the plans or established by the Engineer.

D. All suitable material removed from the excavation shall be used as far as practicable in the formation of embankments, subgrade, shoulders, slopes, dikes, and backfill for structures, unless otherwise indicated on the plans or specifications herein or disposed of in a manner satisfactory to the Engineer. Excavated material shall not be wasted without permission.

203.03.02 GRADE TOLERANCE

A. Immediately prior to placing subsequent layers of material thereon, the grading layer shall conform to one of the following:

1. The subgrade shall not vary more than 0.10 foot above or below the grade established by the Engineer or Contractor.

2. The final subgrade layer prior to application of the structural base shall not vary more than zero foot above or 0.10 foot below the grade.

203.03.03 UNSUITABLE MATERIAL

A. Unsuitable material as defined in Section 101 “Definitions”, and that is unsuitable for planned use, including material below the natural ground surface in embankment areas, shall be excavated and disposed of in a manner approved by the Engineer or as specified in the contract documents.

B. When unsuitable material is removed and disposed of, the resulting space shall be filled with material suitable for the planned use. Such suitable material shall be placed and compacted in layers as specified below under embankment.

C. Disposal of material outside the right-of-way shall be in accordance with ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

203.03.04 BLASTING

A. Any material outside the authorized cross section on the backslopes which may be shattered or loosened because of blasting shall be removed by the Contractor at no additional cost to the Contracting Agency. Shattered or loosened material below the bottom limits of required excavation shall be uniformly distributed and compacted or otherwise disposed of in a manner satisfactory to the Engineer. The Contractor shall discontinue any method of blasting which leads to overshooting or is dangerous to the public or destructive to property or to natural features.

B. The use of coyote holes in blasting is prohibited. Attention is directed to ***Subsection 107.10, "Explosives."***

203.03.05 ROCK CUTS

A. In excavating side hill rock cuts and rock cliffs, the Contractor shall exercise care and use precautionary methods so as not to break down, loosen, or otherwise damage supporting rock below the bottom limits of required excavation. In general, such cuts shall be worked from the top of lifts of such height that will not damage the bench of rock below the bottom limits of required excavation. The Contractor shall be responsible for the methods used and for any damage to the roadbed resulting from Contractor's operations.

B. The slope of all rock cuts shall be scaled and dressed to a safe, stable condition by removing all loose spalls and rock not firmly keyed to the rock slope. Overhanging rock shall be removed when, in the opinion of the Engineer, it may be a hazard to public use of the roadway.

C. In solid rock excavation, slopes shall be constructed to the approximate neat lines staked by the Engineer. No rock shall project or overhang more than 12 inches from the true slope.

203.03.06 OVERBREAK

A. Overbreak is that portion of material excavated, displaced or loosened outside and beyond the slopes or grade as staked or re-established, regardless of whether any such overbreak is due to blasting, the inherent character of any formation encountered, or to any other cause. Slides and slipouts as defined in ***Subsection 203.03.11, "Slides and Slipouts,"*** and that portion of rock subgrade as set forth below shall not be considered overbreak. All side slope overbreak as so defined shall be removed by the Contractor and shall be disposed of in the same manner as provided for the surplus under the heading of "Surplus Material," but at no additional cost to the Contracting Agency and without any allowance for overhaul.

B. Rock removed to a maximum depth of 6 inches below subgrade will be measured for payment as described in ***Subsection 203.04.01.C.2, "Overbreak."***

203.03.07 SLOPES

A. All excavation and embankment slopes, except in solid rock, shall be trimmed to the lines staked by the Engineer. The degree of smoothness shall be that normally obtained by hand shovel operations or blade grader operations.

203.03.08 WIDENING CUTS

A. If the Engineer directs the Contractor to excavate beyond the limits of the typical cross section originally proposed and within the limits of the right-of-way, the Contractor shall do so and compensation therefor will be as set forth in ***Subsection 203.04.01.C.3, "Widening Cuts."***

203.03.09 SURPLUS MATERIAL

A. Unless otherwise specified in the contract documents, surplus excavated material shall be used to widen embankments uniformly, or to flatten slopes, or at other locations, all in a manner satisfactory to the Engineer. No surplus material shall be disposed of above the grade of the adjacent roadbed nor shall the Contractor waste any material unless approved in writing by the Engineer.

B. If the quantity of surplus material is specified in the contract documents, such quantity shall be considered approximate only. The Contractor shall verify that there is sufficient material available for the completion of the embankments within the areas involved before disposing of any indicated surplus material inside or outside the right-of-way. Any shortage of material caused by premature disposal of the indicated surplus material by the Contractor shall be replaced by the Contractor and no compensation will be allowed the Contractor for such replacement.

203.03.10 SELECTED MATERIAL

A. When specified in the contract documents, or when selected by the Engineer, suitable selected material encountered in excavating or widening the roadway prism or any other excavation within the right-of-way, or in the excavation or borrow, shall be used for finishing the top portion of the subgrade. The top portion of the subgrade shall be 2 feet in depth, or as determined by the Engineer.

B. Selected material shall be defined as material that is excavated from one or more of the above sources and is used for selective purposes.

C. When practical, selected material shall be hauled directly from excavation to its final position and compacted in place and such work shall be paid for at the contract unit price for the excavation item involved. Attention is directed to ***Subsection 104.05, "Rights In and Use of Materials Found on the Project."***

D. When the transporting of selected material directly from excavation to its final position is impractical, the selected material shall be left in place until it can be placed in final position and no additional compensation will be made because of the delayed excavation. If, however, the conditions are such that the undisturbed selected material will hamper

ordinary grading operations or cause unnecessary movements of equipment, the Engineer may order, in writing, the removal of sufficient selected materials and the stockpiling thereof to enable practical hauling operations. If the excavation and stockpiling of selected material is specified in the contract documents or is ordered by the Engineer, the excavation and stockpiling locations shall be designated by the Engineer. The selected material shall be removed from the stockpile and placed in final position when approved by the Engineer.

E. Measurement for payment of selected material will be in accordance with ***Subsection 203.04.01.C.4, "Selected Material."***

203.03.11 SLIDES AND SLIPOUTS

A. Material outside the planned roadway or ditch slopes that is unstable and constitutes potential slides in the opinion of the Engineer, material from slides that has come into the roadway or ditch, and material that has slipped out of new or old embankments shall be excavated and removed. The material shall be excavated to designated lines or slopes either by benching or in a manner approved by the Engineer. Such material shall be used in the construction of the embankments or disposed of as approved by the Engineer.

B. The above provisions shall not be so construed as to relieve the Contractor from the duty of maintaining all slopes true and smooth. Erosion, regardless of amount or extent, caused by the action of the elements which results in damage to work or materials, shall in no case be considered a slide or slipout. Measurement for payment will be in accordance with ***Subsection 203.04.01.C.6, "Slides and Slipouts."***

203.03.12 DRAINAGE

A. During construction of the roadway, the roadbed shall be maintained in such condition that it will be well drained at all times.

B. V-type ditches shall be formed to the cross section and dimensions on the plans by means of suitable equipment, which will deposit all loose material on the downhill side. The bottom of the finished ditches shall not be less than 2 feet 6 inches below the crest of the loose material piled on the downhill side.

C. In going from cut-to-fill, the roadway ditches shall be so cut as to avoid damage to embankments by erosion.

D. The flat-bottom ditches indicated on the plans, or staked by the Engineer, shall be excavated to the required cross section and grade. Materials so obtained shall be used to construct roadway embankments or dikes or both, to form a continuous diversion channel as staked by the Engineer.

203.03.13 CHANNELS

A. To avoid destruction of natural growth during construction of ditches, channels, or dikes, travel of equipment shall be confined to the construction limits. Where ditches, channels, and dikes are nearly parallel to the roadway, turn-around shall not be located closer than

200 feet apart. Attention is directed to ***Subsection 107.12, "Protection and Restoration of Property and Landscape."***

B. Fine grading of channel bottoms will not be required unless paving is specified.

203.03.14 BORROW

A. A possible source of borrow material may be indicated in the contract documents. If the Contractor desires to use borrow materials from sources other than those described in the contract documents, the Contractor shall, at no additional cost to the Contracting Agency, acquire the necessary right to take materials and pay all costs involved. All costs of exploring such alternate sources shall be borne by the Contractor. Use of material from these sources will not be permitted until approved in writing by the Engineer.

B. The Contractor shall, at the time of execution of the contract, execute an "Agreement" for all borrow deposits obtained under an "Option and Agreement for Sale of Materials" when said "Option" is contained in the Special Provisions. This agreement shall be executed whether the material is to be used or not.

C. In case designated borrow deposits fail to contain the necessary quantity of acceptable material, the Contractor shall immediately notify the Engineer in writing. The Engineer shall thereupon investigate, and if the Engineer's investigation shows that there is not sufficient quantity of acceptable material, the Engineer shall designate an alternate deposit from which to obtain the deficit.

D. In all borrow pits having undesirable material, including overburden, refuse, organic and deleterious substances, the material shall be removed and wasted or redistributed, in a manner satisfactory to the Engineer. All costs incurred therefor shall be considered as incidental and subsidiary to the borrow material.

E. Borrow shall not be obtained until all other excavation items are complete to the extent necessary to determine the need for borrow.

F. The Contractor shall notify the Engineer 30 days in advance of opening any borrow areas so that cross section elevations and measurements of the ground surface after stripping may be taken, and the borrow materials can be tested before being used. Sufficient time for testing of the borrow material shall be allowed.

G. Borrow deposits shall be excavated to regular lines as staked to permit accurate measurement. The dimensions of the borrow deposit will be designated and the Contractor shall not excavate below the depth or outside limits given, except with prior approval. The depth of excavation throughout the area of the borrow pits shall be as uniform as practicable and the side slopes shall conform to the requirements of ***Section 626, "Final Cleanup."*** Unless otherwise permitted, borrow pits shall be excavated so that the pits will drain to the nearest natural outlet.

H. All materials that are not satisfactory for use for the purposes intended shall be rejected at the pit and disposed of in a manner satisfactory to the Engineer.

I. If the Contractor excavates more material than is required, the excess will not be measured for payment.

J. All work and materials required to build and maintain borrow haul roads and obliteration of haul roads in accordance with ***Section 626, "Final Cleanup"*** shall be considered subsidiary to the "borrow" item and no further compensation will be allowed.

203.03.15 FOUNDATION

A. When embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is to be built one half width at a time, the slopes that are steeper than 5:1, when measured at right angles to the roadway, shall be continuously benched as the work is brought up in layers. Benching shall be of sufficient width to permit operations of placing and compacting equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus cut out shall be recompacted along with the new embankment material at no additional cost to the Contracting Agency.

B. All foundations for embankment shall be cleared and grubbed in accordance with ***Section 201, "Clearing and Grubbing."***

C. In designated areas, unsuitable material shall be removed and disposed of as prescribed in ***Subsection 203.03.03, "Unsuitable Material."***

D. Where 12 inches or less of embankment is placed over existing bituminous surface, such surface shall be removed and incorporated in the embankment or otherwise disposed of as approved by the Engineer. Where more than 12 inches of embankment is placed over existing bituminous surface, such surface shall be left undisturbed. Measurement for removal of existing bituminous material will be measured and paid for as roadway excavation unless the contract documents specifically call for payment under ***Section 202, "Removal of Structures and Obstructions."***

203.03.16 EMBANKMENT MATERIALS

A. Embankments shall be constructed with suitable materials, excavated as prescribed and with any excess materials from other operations which are acceptable and suitable for use.

B. All materials used in embankment shall be free from objectionable material such as leaves, grass, roots, logs, stumps, brush, or other perishable material.

C. When there is a choice of material, the excavation shall be made so the best material will be placed on top of the embankment for at least 1 foot in depth. This paragraph shall not be interpreted as to require the Contractor to stockpile and subsequently rehandle embankment materials except as provided in ***Subsection 203.03.10, "Selected Material."***

D. Material shall not be placed in the embankment when either the material, foundation, or the embankment on which it would be placed is frozen.

E. Where embankments are to be made of material from rock cuts or other material that is unsuitable for finishing the roadbed, the upper 6 inches of the roadbed shall be formed of approved material.

F. Embankment material for the detention basin berm shall be granular backfill in accordance with ***Subsection 207.02.02 "Granular Backfill."***

203.03.17 PLACING EMBANKMENT

A. For embankment or backfill deposited against structures, attention is directed to Subsection 207.03.02, "Placing and Compacting at Abutments, Piers, Wingwalls and Retaining Walls."

B. Where structure abutments are placed on embankment, the embankment shall be constructed to subgrade elevation prior to excavating for the construction of the abutment. Where the abutment is supported on piles, the embankment shall be constructed to the elevation of the bottom of the footing.

C. Where a structure is to be covered by a rockfill, it shall be covered with not less than 2 feet of satisfactory soil or granular materials before the rock embankment is placed over the structure.

D. Embankments shall, except as specified herein, be constructed in layers. The construction of embankments shall begin at the lowest point of the fill below the grade or the bottom of ravines. Individual layers shall be spread evenly to uniform thickness throughout and parallel with the finished grade for the full width of the embankment, unless otherwise permitted. The thickness of the layer shall be as necessary to secure the required compaction with 12 inch maximum thickness after compaction. Excepted provisions for placing in marsh and placement of rock are outlined below. Hauling equipment shall be routed to obtain uniform compaction and channelization of haul routes and rutting of the fill shall be avoided.

E. When embankments are constructed across wet or swampy ground that will not support the weight of heavy hauling and spreading equipment, the Contractor will be expected to choose such methods of embankment construction and to use such hauling and spreading equipment as will least disturb the soft foundation. When soft foundations are encountered, and when approved by the Engineer, the lower part of the fill may be constructed by dumping and spreading successive vehicle loads. This shall be in a uniformly distributed layer of a thickness not greater than that necessary to support the vehicle while placing subsequent layers, after which the remainder of the embankment shall be constructed in layers and compacted as specified.

F. It is not the policy of the Contracting Agency to allow an increase in the planned depth of embankment material over soft, wet, or swampy ground for the sole purpose of providing support for heavy hauling and spreading equipment, unless the Contractor proves to the satisfaction of the Engineer that the planned depth is inadequate to support light hauling vehicles. If it proves necessary for the Contractor to use smaller hauling vehicles or different methods of embankment construction than the Contractor had originally

contemplated in order to comply with the foregoing, such shall not be the basis for a claim for extra compensation against the Contracting Agency. The unit contract price for the various pay items involved shall be full compensation for all labor, materials, and equipment necessary to perform the work as outlined herein.

G. Embankment which, in the opinion of the Engineer, contains enough rock larger than 9 inches to make it impractical to place and compact in 12-inch lifts shall be considered as "Rock Embankment." The materials shall be spread in a uniform horizontal layer over the full width of the embankment. The layer thickness shall not exceed 1-1/3 times the vertical dimension of maximum size material larger than 9 inches. The largest size rock allowed in the embankment will be 3 feet measured in vertical direction and rocks larger than this shall be broken up before being placed in the embankment. Rock to be wasted may exceed 3 feet and be disposed of in an inconspicuous manner approved by the Engineer.

H. In rock fills where end dumping is employed, direct end dumping upon the previously constructed layer of embankment will not be permitted. Rock shall be dumped on the layer of embankment being constructed and dozed ahead into place. Care shall be exercised to work the fines and smaller rock into the spaces between the larger rock. Compaction will be required as provided in Subsection 203.03.19, "Compaction, Rock Embankment."

I. To the extent of project requirements for embankments, all rock from excavation shall be used for embankment. The Contractor shall plan the grading operation to use rock that may be encountered in excavation in accordance with the following provisions:

J. Rock, in general, shall be placed to form the base of embankment for the full width of the cross section under the following condition:

1. on the side slope or slopes of a new embankment being placed; or

2. on the side slope or slopes of an embankment already in place requiring widening; or where excess rock may be wasted; or

3. on the side slopes and top of rolled embankment made of embankment materials other than rock.

K. The Contractor shall not place large rock in embankments where piles will be driven. The Contractor shall be responsible for penetrating the embankment with specified piles.

L. When rock and other embankment materials are excavated at approximately the same time, the rock shall be distributed throughout the fill and not nested in one location.

M. When there is insufficient material other than rock in the excavation to permit properly compacted layers, the rock shall be placed for the full cross section width with the larger rocks well distributed and the void spaces filled with the smaller rocks and fragments.

N. When shown on the plans or considered necessary by the Engineer, embankments shall be built to such elevation above required grade to allow for settlement, or sufficient surcharge shall be placed above the required elevation of earth grade over deposits of

unstable material to secure displacement or settlement. Surcharge shall be removed only after the fill has reached stability or the required settlement time has been reached.

203.03.18 COMPACT, DIRT EMBANKMENT

A. Optimum moisture content and material density of the various soils will be determined by a Geotechnical Engineer and acceptable ranges for optimum moisture and material density shall be approved by the Engineer. At the time of compaction, the moisture content of the various soils shall be within the approved ranges.

B. The compacted subgrade shall be maintained at a minimum of optimum moisture content until placement of an aggregate base course or cement treated base.

C. When necessary, each layer before being compacted shall be processed as required in order to bring its moisture content within the prescribed limits. The material shall be wetted by the application of water or dried as necessary and either process may be carried out either on the embankment or at the source of the material or otherwise as approved by the Engineer. Full compensation of any work involved in wetting or drying embankment material to obtain the required moisture content shall be considered as included in the contract unit price bid for excavating or furnishing the material and no additional compensation will be allowed therefor.

D. Hauling and leveling equipment shall be routed over each layer of the fill in such a manner as to uniformly distribute the compaction afforded by the wheel load. In addition to hauling and leveling equipment, the Contractor shall provide compaction equipment that is specifically designed and manufactured for compacting dirt embankments. The compaction equipment shall work continuously with the grading equipment.

E. The top 8 inches of the base of cuts and natural ground having less than 5 feet of embankment, measured from the subgrade, and all embankment material, shall be compacted to not less than 90 percent relative compaction unless otherwise specified. When natural ground material is encountered that cannot be compacted to the required density, compaction requirements shall be determined by the Engineer.

F. All selected borrow and structure backfill placed within the limits of embankment shown on the plans for approaches to bridges shall be compacted to not less than 95 percent relative compaction unless otherwise specified.

G. It is to be expected that a loss of density in the upper portion of earth subgrade may occur due to the elements, or for lapse of time, or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed.

203.03.19 COMPACTION, ROCK EMBANKMENT

A. Field density tests will not be required on rock embankments. In lieu thereof, the required compaction shall be tested by proof rolling. Unless otherwise specified, compaction shall be attained and tested by using construction methods and equipment as follows:

1. Methods:

    a. The material for the embankment shall be deposited, spread, and leveled the full width of the embankment, and the layer of thickness may be 1-1/3 times the vertical dimension of maximum size material. The maximum size rock shall not exceed 3 feet.

    b. Hauling and leveling equipment shall be routed and distributed over each layer of the fill in such a manner as to make use of the compaction afforded thereby. Rollers, vibrators, or compactors shall compact the embankment full width with a minimum of 3 complete passes for each layer of embankment. The compacting equipment shall not exceed a speed of 5 miles per hour and shall work continuously with the grading equipment.

    c. Rolling shall be done in a longitudinal direction along the embankment and shall begin at the outer edges and progress toward the center. The travel paths of traffic and construction equipment shall be kept dispersed over the entire width of the embankment to aid in obtaining uniform compaction. Weights of equipment used in making embankments over soil having an excessive moisture content may be limited, if, in the judgment of the Engineer, such limitations are necessary in order to maintain the fill in a satisfactory condition.

    d. Water shall be applied to the embankment in the amount necessary to obtain the required compaction.

2. Equipment:

    a. Compaction equipment shall be adequately designed to obtain compaction requirements without adverse shoving, rutting, displacement, or loosening and shall meet the requirements specified herein. Rollers shall have displayed thereon in permanent legible characters, the manufacturer's guaranteed net operating weights as distributed on each axle.

    b. The proof roller shall be a pneumatic-tired roller or pneumatic-tired compactor weighing not less than 50 tons, and capable of applying to the ground loads of not less than 25,000 pounds per wheel. All tires shall be of equal size and diameter and shall be capable of operating at an air pressure of at least 90 psi. The tires shall be kept uniformly inflated so that the difference in pressure in any 2 tires shall never exceed 5 psi and means shall be provided by the Contractor for checking the tire pressure on the job at any time.

3. Tests:

    a. Subsequent layers shall not be placed until the previous layer of the embankment is compacted to the degree that no further appreciable deflection is evidenced under the action of proof rolling equipment, as determined by the Contractor with approval of the Engineer.

b. Rolling and proof rolling may be deleted on any layer or portion thereof when, in the judgment of the Engineer, accomplishment is physically impractical.

c. Payment for rolling and proof rolling or for the correction of any subgrade weakness or deficiencies disclosed by the proof rolling operation shall be considered subsidiary to the price bid for the "Excavation" item.

4. The Contractor shall submit an inspection report to the Engineer that has been reviewed and stamped by a Nevada professional engineer.

203.03.20 MAINTENANCE

A. Embankment material that may be lost or displaced as a result of natural settlement of the ground or foundation upon which the embankment is constructed shall be replaced by the Contractor with acceptable material from excavation or borrow, etc. The quantity of material required will be paid for at the regular contract price for the type of material used.

B. The Contractor shall, at no additional cost to the Contracting Agency, remove and replace with acceptable material any embankment or portion thereof which has been constructed with unapproved material as well as remove and replace portions of the embankment which may become unstable or displaced as the result of carelessness or negligence on the Contractor's part.

203.03.21 SUBGRADE TOLERANCE

A. Subgrade shall comply with ***Subsection 203.03.02, "Grade Tolerance."***

203.03.70 OVEREXCAVATION AND BACKFILL

A. Where overexcavation below the depths as shown on the plans or required by the specifications is necessary to remove unsuitable material, the Engineer may require the Contractor to remove the unsuitable materials and backfill to the finished graded section with Type I aggregate base, conforming to 3-inch size per subsection 704.03.03, compacted to a minimum of 90% of ASTM D1557 Modified Proctor and in accordance with the methods in the USS.

B. Unless otherwise provided in the Special Provisions, overexcavation and backfill below the limits shown on the plans will be paid for as "Extra Work".

203.03.71 HAZARDOUS MATERIAL

A. Hazardous material shall be defined as material or water contaminated with volatile organic compounds, inorganic non-metals, petroleum hydrocarbons or other contaminates as specified by the Nevada Division of Environmental Protection Agency (NDEP).

B. The Contractor shall retain a Certified Environmental Manager (CEM) for making periodic inspection of the project for potential hazardous materials. In addition, the CEM will be available for inspection of the project as directed by the Engineer and/or NDEP should material be uncovered that may be potential hazardous material.

C. When potential hazardous material is encountered with the project, the Contractor shall:

1. Immediately contact the CEM, Engineer and City of Las Vegas Environmental Officer.

2. Have the CEM perform the inspection of the potential hazardous material and if required perform the inspection for the removal and disposal of the hazardous material.

3. Retain a certified geotechnical firm to perform the required tests for hazardous materials and/or contaminants.

4. If required, perform the removal and disposal of the hazardous materials as directed by the CEM, Engineer and/or City of Las Vegas Environmental Officer in coordination with NDEP.

203.03.72 EXCAVATION

A. It is expected excavation for storm drain and detention basin items will require removal of various types of material, including cemented soils and rock (i.e. caliche).

B. Prior to construction, baseline distress evaluation by a qualified professional shall be conducted by the Contractor. The evaluations shall document existing distress to the structures and other improvements in the area of work.

C. Vibration monitoring by a qualified professional shall be conducted by the Contractor during excavation of cemented soils. The Contractor shall be required to conduct impact assessment tests of the equipment excavating cemented soils prior to construction. The Contractor shall submit an Impact Assessment Test Plan and Impact Assessment Test Results. The frequency and amplitude of the vibratory equipment shall be calibrated and used to measure ground velocity for conformance to the current regulatory limit of 0.3 inch per second peak ground velocity at the nearest affected structure. The measurements shall comply with the recommendations of the “Office of Surface Mining, Blasting Guidance Manual, 1987.”

D. The Contractor shall submit to the Owner a plan detailing his proposed excavation techniques. This excavation plan shall include the results of a seismic survey performed by a certified seismic survey firm. The plan must show all proposed locations of excavation operations utilizing methods involving headache balling, hoe ram, or other techniques. The excavation plan shall include recommendations from certified seismic survey firm for limiting ball weights, height of drop, etc. for all areas headache balls and/or hoe rams techniques are proposed. In addition, the plan must include the results of a pre-excavation survey and a seismic monitoring plan. The excavation plan shall also include as a minimum; detailed examination of adjacent structures, including videotaping and

installation of crack monitoring tape along existing structural cracks. The excavation plan must be approved by the Owner prior to construction.

E. If damage to structures becomes evident, the Contractor shall immediately cease his excavation operations and submit a new excavation plan detailing new or modified methods to end the adverse effects. The Contractor shall make no claims for any delay caused by the re-submittal nor any additional expense resulting from changing his proposed excavation methods.

F. The excavation plan shall be updated and resubmitted to the Owner any time the Contractor proposes altering his methods. The plan(s) will be considered shop drawings and will be handled as such. The Contractor shall make no claim for any losses resulting from delays during the review of these submittals in accordance with the limitations detailed for shop drawings in these specifications.

G. The Contractor's methods for excavation are solely his responsibility. Approval of the excavation plan by the Owner will in no way limit the Contractor's liability regarding property damaged and subsurface damage beyond the excavation limits by his operations, nor will it alter the Contractor's sole responsibility for the safety of his operations. The Contractor shall be responsible for all damage caused by his excavation operations and be responsible for answering all complaints. Provide the Owner with advance warning of the use of excavation techniques which may lead to property damage, to review the proposed techniques, to confirm general compliance with these specifications, and to allow monitoring of the excavation methods.

H. Excavations near mapped alluvial faults shall be inspected by a qualified professional prior to RCP/RCB installation. If a fault is encountered, appropriate remedial action shall be taken by the Contractor per geotechnical recommendations.

203.03.73 COMPACTED FILL

A. Compacted fill will consist of native material excavated, hauled, screened, placed, and compacted within the neat lines shown on the Drawings and as specified in Subsection 203.03.16.

B. All fill materials shall be placed in continuous horizontal layers in maximum 12-inch lifts. Each layer shall be moisture conditioned to at least minus 2 percent of optimum moisture content and compacted by rolling with compaction equipment methods to at least 95 percent of the maximum dry density as determined by ASTM D1557.

C. The existing soil in areas to receive fill along the dam embankment shall be scarified to a minimum of 8 inches, reworked, moisture conditioned, and recompacted to at least 95 percent of the maximum density as determined by ASTM D1557. Moisture content at time of compaction should be at least optimum. The depth of excavation, replacement, and compaction may be reduced or increased by the Owner's representative depending on the representative's visual inspection of uncovered soils. Hard cemented soils may result in a decrease in required excavation depth while partially cemented soils or soft spongy or deleterious soils may result in an increase in required excavation depth. Any increase in depth shall comply with Subsection 203.03.70, Over-Excavation and Backfill.

203.03.74 EMBANKMENT PROTECTION

A. Completed excavation and embankment grading planes and other disturbed areas within the limits of construction shall be protected by soil stabilizer placed on all exposed soil surfaces. Soil stabilizer shall be applied to all disturbed soil areas not specified to be covered with riprap, decomposed granite, aggregate base, asphalt pavement or other surfacing. Unless otherwise specified in these Special Provisions, herbicide shall not be placed on any surfaces within the detention basin.

B. Apply soil stabilizer within 14 days of when no further disturbance of the surface will be made. Protect all structures, walls, landscaping, etc. from overspray. Store and handle soil stabilizer in accordance with the manufacturer's recommendations. Do not spray when weather conditions are windy. Windy conditions are defined as a sustained wind of 8 mph or more, or any condition that may cause dispersal of material to be difficult or inaccurate. Soil stabilizer shall form a crust like barrier within 4 to 8 hours. The use of accelerators is recommended.

C. Soil stabilizer shall be PLAS-TEX, Enviro-Shield Bonded Fiber Matrix, or approved equal and shall be applied at the manufacturer's recommended application and dilution rates.

D. Add a color pigment to the soil stabilizer at the time of application. Apply a suitable pigmentation to the soil stabilizer slurry such that is used for pigmenting concrete at an application rate of 50 pounds per acre. The color of the pigmentation shall be approved by the Engineer.

203.03.75 QUALITY CONTROL TESTING

A. Quality control testing will be performed for Dam Safety Permit compliance in accordance with the State Engineers Office. The testing will be performed by an independent testing laboratory.

B. The Contractor shall schedule his operations so as to allow and facilitate quality control testing by the independent laboratory.

C. The following standard tests will be used as a basis for classifying soil materials and for control testing:

Test Designation	Test
ASTM C136 AASHTO T27	Test for Sieve or Screen Analysis of Fine and Course Aggregates
ASTM D1556	Density of Soils In-Place by the Sand-Cone Method
ASTM D1557 AASHTO T180	Moisture-Density Relations of Soils and Soil Aggregate Mixing Using 10 Pound Rammer and 18-Inch Drop
AASHTO T310	In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

ASTM D4318 AASHTO T89/T90	Plasticity Index of Soils
AWWA 4500E	Maximum Sulfate Content
AWWA 4500CL	Maximum Chloride Content
Southern Nevada Amendments to the Building Code	Maximum Expansive Potential 60 psf
ASTM C117	Test for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
ASTM D422	Particle-Size Analysis of Soils
ASTM D6938	Nuclear Methods
ASTM D5084	Permeability
ASTM D3080	Direct Shear Testing

D. Two representative soil samples of imported fill will be performed at the beginning of construction. Additional tests will be conducted to classify and establish the moisture density relationship for each type of soil encountered in areas that may yield excavated materials suitable for placement in embankment. Whenever the material encountered is different from previously tested material, a new set of classification and moisture-density tests will be performed.

E. The number of locations of in-place density tests for embankment and compacted fill construction shall be sufficient to determine that each layer of material placed in embankment has been compacted adequately to obtain the density specified therefore. The minimum number of in-place density tests by ASTM D1556 and AASHTO T310 procedures will be one for each 5,000 square feet per 8-inch lift of fill.

F. The following standard tests will be used for concrete material quality control testing:

Test Designation	Test
ASTM C1064	Temperature of Freshly Mixed Portland Cement Concrete
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C173/C231	Air Content of Freshly Mixed Concrete
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens

G. The concrete will be tested a minimum of once per day and per every 100 cubic yards placed.

H. The above frequency of tests is approximate and is provided for the Contractor's information in planning Contractor's work and interruptions during testing. The actual number of tests will depend on the variability of materials being placed and uniformity of the Contractor's placement operations.

I. Quality control test data will be reviewed and submitted monthly. All quality control test data will be compiled in a final report and submitted at the completion of work for Dam Safety Permit compliance. All reports submitted to the City shall be stamped by a Nevada Registered Professional Engineer.

203.03.76 CALICHE EXCAVATION

A. Caliche is anticipated to be encountered on this project and is defined as a rock-like material that occurs in soil deposits erratically in thickness, hardness, and lateral extent and it is therefore difficult to predict in terms of interference with below-grade construction. Contractor shall take adequate precautions to reduce the potential for vibrational damage to adjacent or nearby structures when using heavy impact equipment during removal of caliche. In the event structures are damaged, Contractor shall be responsible for all repairs.

B. Generation of oversized material (rocks or hard chunks greater than 6 inches nominal diameter) shall be anticipated by Contractor when excavating caliche. Oversize material shall be crushed prior to being used as structural fill, backfill, and compacted fill, or disposed of in a suitable manner.

TESTING

203.05.02 TESTING

SECTION	DESCRIPTION	TEST	REFERENCE SPECIFICATION AND/OR TEST PROCEDURE	RECOMMENDED FREQUENCY
203.02.01	Roadway Excavation (Subgrade)	Field Density	AASHTO T 310	1/5000 SF
203.02.02	Drainage Excavation (Subgrade)	Field Density	AASHTO T 310	1/5000 SF
203.02.03	Channel Excavation (Subgrade)	Field Density	AASHTO T 310	1/5000 SF
203.02.04	Borrow	Sieve Analysis	AASHTO T 11 & T 27	1/Type
		Plasticity Index	AASHTO T 89 & T 90	1/Type[1]
203.02.05	Selected Borrow	R-Value	AASHTO T 190	1/Type
		Proctor	AASHTO T 180	1/Project or Change
203.03.01	Roadway At Grade or Fill (Subgrade)	Field Density	AASHTO T 310	Residential = 1/5000 SF/Lift/Day
				Arterial and Collector = 1/5000 SF/Lift/Day
203.03.10	Selected Material	Sieve Analysis	AASHTO T 11 & T 27	1/1000 LF
		Plasticity Index	AASHTO T 89 & T 90	1/1000 LF
		R-Value	AASHTO T 190	1/Type
		Field Density	AASHTO T 310	1/5000 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change
203.03.15	Foundation[2] (Subgrade)	Field Density	AASHTO T 310	1/500 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change
203.03.18	Embankment	Field Density Fill	AASHTO T 310	1/5000 SF/Lift/Day
		Field Density Native Below Embankment Fill Operations	AASHTO T 310	1/5000 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change
203.03.19	Rock Embankment	Visual	Issue Inspection Report	Full Time

END OF SECTION 203

[1] A maximum testable lift is defined as a 12-inch layer of compacted material.
[2] This is in reference to benched slope construction of embankment only.

SECTION 206 – STRUCTURE EXCAVATION

DESCRIPTION

206.01.01 GENERAL

A. This work shall consist of the removal of all material of whatever nature encountered in the construction of foundations for bridges, retaining walls, headwalls for culverts and other structures; the excavation of trenches for pipe culverts, box culverts, cut-off walls for slope paving and concrete aprons, footings for riprap and other excavation specifically designated on the plans, in these specifications or in the Special Provisions as structure excavation, which shall include the work of disposing of surplus material and cleaning up the sites. Structure excavation shall include dewatering and the furnishing of all equipment and the construction or installation of all cofferdams, cribs, and other facilities, which may be necessary to perform the excavations and the subsequent removal of such facilities except where they are required or permitted by the plans or specifications to remain in place. It shall also include all the necessary clearing and grubbing within the proposed structure area and removing old structures or parts thereof as required if the proposal does not include separate bid items for such work.

B. For separate requirements pertaining to the excavation involved in the installation of pipe culverts and underground piping, attention is directed to those sections of these specifications governing such work.

C. Where structure over-excavation below the depths as shown on the plans or required by the specifications is necessary to remove unsuitable material, the Engineer may require the Contractor to remove the unsuitable materials and backfill to the required grade with material conforming to ***Subsection 704.03.02, "Drain Backfill,"*** compacted to a minimum of 90% of ASTM D1557 Modified Proctor and in accordance with the methods in the USS.

D. If groundwater is encountered within the excavated area, dewatering shall be performed as specified in ***Section 270, "Dewatering."***

CONSTRUCTION

206.03.01 GENERAL

A. The Contractor shall notify the Engineer in sufficient time in advance of the beginning of excavation for structures so that elevations and measurements may be taken of the existing ground before it is disturbed and of existing substructure units within the limits of excavation for structures before they are removed. Any material excavated or removed before these measurements have been taken will not be paid for.

B. The excavated area shall conform to the outlines of the footings, as shown on the plans, and shall be of sufficient size to permit placing of the full width and length of the footings shown. The elevation of the bottoms of footings as shown on the plans shall be considered as approximate only, and the Engineer may order, in writing, such changes in dimensions or elevation of footings as may be necessary to secure a satisfactory foundation.

C. Unless otherwise permitted by the Engineer, foundations shall be compacted to not less than 95 percent relative compaction for culvert pipe and structures. For fine-grained soils, which are classified by having 50 percent or more passing the No. 200 sieve, the relative compaction may not be less than 90 percent if approved by the Engineer.

D. All rock or other hard foundation material shall be freed from all loose material, cleaned and cut to a firm surface, either level, stepped or serrated, as may be permitted by the Engineer. All seams and crevices shall be cleaned out and filled with concrete mortar or grout.

E. Where masonry is to rest on material other than rock or boulders, special care shall be given not to destroy its bearing value.

F. Should the Contractor remove structure excavation below grade, the Contractor shall backfill to the required elevation at no additional cost to the Contracting Agency with backfill in a manner satisfactory to the Engineer.

G. Wet pits shall be dewatered for inspection and for construction of foundations unless otherwise provided.

H. Excavated material, which is suitable for backfilling, shall be so utilized or used in embankments, in a manner satisfactory to the Engineer. Surplus or unsuitable material shall be disposed of to cause no obstruction to flow of streams or otherwise impair the efficiency or appearance of the structure. It shall be disposed of in such a manner as to prevent damage to property or the creation of unsightly conditions, and shall not be placed where it will interfere with the operation of drains or impair the roadway ditches, etc.

I. After each excavation is completed, the Contractor shall notify the Engineer, and no masonry shall be placed until the Engineer has approved the depth of excavation and the character of the foundation material.

206.03.02 SAFETY REQUIREMENTS AND REGULATIONS

A. The Contractor shall follow OSHA safety regulations (29 CFR, Part 1926, Subpart P, Excavations) for sloping the sides of excavations, using shoring and bracing, and for using other safety features. When the sides of excavations are sloped for safety considerations, the Contractor shall provide, for informational purposes, one copy of the design that demonstrates conformity with OSHA regulations to the Engineer. Where support systems, shield systems, or other protective systems are to be used, the Contractor shall be responsible for their design and shall submit design calculations along with detailed drawings that demonstrate conformity with OSHA regulations to the Engineer. These calculations and detailed drawings shall be stamped and signed by a professional engineer licensed to practice in the state of Nevada. The design calculations and detailed drawings are considered working drawings and shall be submitted in accordance with ***Subsection 105.02, "Plans and Working Drawings."***

END OF SECTION 206

SECTION 207 – STRUCTURE BACKFILL

DESCRIPTION

207.01.01 GENERAL

A. This work shall consist of placing and compacting, to the lines designated on the plans or as established by the Engineer, backfill material in excavations for bridges, retaining walls, headwalls for culverts, and other structures; placing and compacting backfill material for box culverts and other non-pipe culverts; and other backfill specifically designated in the contract documents as structure backfill. This item does not include backfilling pipes within a trench or minor miscellaneous structure excavations outside the limits of the roadway.

MATERIALS

207.02.01 SELECTED BACKFILL

A. Selected backfill shall be of a quality acceptable to the Engineer and shall consist of suitable material from the excavation complying to Table 1 and Table 2. It shall be free from sod, frozen earth, organic materials, rubbish, or debris. If the material does not comply with Table 1, it may be used only if approved by the Engineer.

Table 1 – Select Backfill Gradation

Sieve Sizes	Percentage of Weight Passing
6-inch	100
3-inch	80-100
No. 4	35-100

Table 2 – Select Backfill Maximum Plastic Index Requirement

Percentage by Weight Passing No. 200 Sieve	Plasticity Index Maximum
10-10.0	15
10.1-20.0	12
20.1-50.0	10
50.1-80.0	8
80.1-100.0	6

B. When the completed select backfill test results from the sample indicate a Plasticity Index of 12 or greater, a swell potential test may be required. Contact the Contracting Agency for further procedure requirements or comply with the contract Special Provisions.

C. The liquid limit of the material shall not exceed 50 percent maximum.

D. Stones or lumps exceeding 3 inches shall not be used within the zones 12 inches or less from the structure, 12 inches or less from the finish subgrade in unpaved areas, or 16 inches or less below the finish subgrade in paved areas.

E. Acceptable material from excavation "Selected Backfill" may be used for structure backfilling unless "Granular Backfill" is specified.

207.02.02 GRANULAR BACKFILL

A. Granular backfill shall consist of natural sand or a mixture of sand with gravel. Broken Portland cement concrete and bituminous type pavement will be permitted, subject to the gradation limits specified herein. The granular backfill material shall have a sufficient amount of fine material to fill the voids between the coarser aggregate.

B. In addition, the material shall conform to the following requirements:

Table 3 – Granular Gradation

Sieve Sizes	Percentage of Weight Passing
3-inch	100
No. 4	35-100
No. 16	25-100
No. 200	5-15

C. The plasticity index of the material shall be as specified in ***Subsection 704.03.01, "Plastic Limits."***

D. The total available water soluble sulfate content of the material shall not exceed 0.3 percent by dry soil weight.

CONSTRUCTION

207.03.01 GENERAL

A. Compaction of backfill or embankment around all structures shall be in accordance with the requirements of AASHTO LFRD Bridge Construction Specifications with exceptions as described in this section. The compaction shall be performed with mechanical tamping units and the material shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used subject to approval by the Engineer.

B. Unless otherwise specified or approved by the Engineer, the compaction requirement shall be a minimum of 95 percent.

C. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used. Backfill material shall be placed in uniform horizontal layers with a maximum compacted depth of 12 inches and shall be brought up uniformly on all sides of the structure or improvement.

D. Backfill material to be used around buried structures where water is present or anticipated to be present shall be carefully selected so that it will protect the surrounding soil from infiltrating into the backfill as determined by the Engineer. This select material shall serve as a filter material. If the drain material is to remove an appreciable quantity of water, graded filter drains using separate fine-grained layers for filters and coarse-grained layers

to conduct the water may be required. As an alternate to using a filter material, a filter fabric may be placed between the backfill material and surrounding soil.

E. Material resulting from structure excavation and not used, shall be deposited in roadway embankments in accordance with the requirements specified elsewhere or otherwise disposed of in a manner approved by the Engineer and no additional compensation will be allowed for such work.

F. Structure backfill shall not be placed until the structure or facilities have been inspected by the Engineer and approved for backfilling. Backfill material shall not be deposited against the back of concrete abutments, concrete retaining walls, or the outside walls of concrete box culverts until the concrete has reached 80 percent of the required compressive strength and approved by the Engineer.

G. Backfill operations placed against concrete walls that will support any deck shall not be performed until after the deck has been placed.

H. Where backfill is placed against waterproofed surfaces, care shall be taken that no damage is done to the waterproofing material.

207.03.02 PLACING AND COMPACTING AT ABUTMENTS, PIERS, WINGWALLS AND RETAINING WALLS

A. With the approval of the Engineer, all spaces excavated and not occupied by abutments, piers, or other permanent work shall be refilled with earth up to the surface of the surrounding ground or to the limits designated on the plans or as described herein. All backfill shall be thoroughly compacted in accordance with the provisions set forth in ***Subsection 207.03.01, "General."***

B. Where backfill is to be placed on one side of an abutment, wingwall, pier, or headwall, care shall be exercised to prevent displacement of line, or batter, or both.

C. Existing slopes that are shaped to cause wedge action in the backfill shall be step-cut or benched before backfilling.

207.03.03 PLACING AND COMPACTING AT CULVERTS

A. After the bedding has been prepared and the culverts installed or constructed as required by the pertinent specifications, "Selected Backfill" or "Granular Backfill" shall be placed along both sides of the culvert equally in uniform layers such that the elevation of the top of the backfill on either side of the culvert does not exceed the elevation of the top of the backfill on the other side of the culvert by more than 6 inches. The thickness of each layer shall be compatible with the characteristics of the backfill and the type of equipment being used, but shall not exceed 12 inches in depth after compaction nor a loose lift of 16 inches. Each layer shall be wetted as required and thoroughly compacted to the density requirements as set forth in ***Subsection 207.03.01, "General."***

B. Special care shall be taken in placing and thoroughly compacting the material under the haunches of all pipe culverts.

C. Unless otherwise directed, the backfilling shall continue as directed to the level of the ground or to an elevation 6 inches above the structure in the case of a pipe culvert in projection, or even with the top of the structure in the case of reinforced concrete box culvert in projection.

D. No construction equipment or other traffic shall be permitted to cross any culvert until a safe minimum depth of fill above the culvert has been placed and compacted in accordance with these specifications. The Contractor shall be solely responsible for protecting the structure from superimposed loading by construction equipment and shall repair any damage to the structure or replace the structure as ordered without extra compensation.

E. Special care shall be taken in backfilling arches, particularly half-circle arches. The arch shall be covered in layers, each layer conforming to the shape of the arch and tamped thoroughly.

207.03.04 PLACING AND COMPACTING OF BIN-TYPE RETAINING WALLS

A. Placing and compacting backfill material for bin-type retaining walls shall progress concurrently with the assembly of the bins, and backfilling around the outer sides thereof shall be kept approximately level with the inside fills. The materials shall be thoroughly tamped and meet the density requirements as set forth in ***Subsection 207.03.01, "General."*** Care shall be exercised to completely fill the depressions of stringers and spacers without displacing them from established line and batter.

TESTING

207.06.01 TESTING

Table 4 - Testing

Spec. Section	Description	Test	Reference Specification and/or Test Procedure	Recommended Frequency[1]
207.02.01	Selected Backfill	Sieve Analysis	AASHTO T11 & T27 ***USS 301*** & Special Provisions	1/1000 CY
		Plasticity Index	AASHTO T89 & T90 ***USS 301*** & Special Provisions	1/1000 CY
207.02.02	Granular Backfill	Sieve Analysis	AASHTO T11 & T27 ***USS 301*** & Special Provisions	1/1000 CY
		Soluble Sulfates	AWWA 4500E	1/Type
207.03.01	General	Field Density	AASHTO T310	If Riding Equipment Used: 1/5000 SF/Lift
				If Walk Behind Equipment Used: 1/1000 SF/Lift Per Structure Per Day

END OF SECTION 207

[1] A maximum testable lift is defined as a 12-inch layer of compacted material.

SECTION 208 – TRENCH EXCAVATION AND BACKFILL

DESCRIPTION

208.01.01 GENERAL

A. This work shall consist of the excavation and backfill of trenches for the accommodation of substructures including, but not limited to electrical conduits, telephone conduits, television cable, traffic signal conduits, gas lines, sewer lines, water lines, and storm drains except where governed by utility agency specifications. These other agencies are responsible for the trench to the top of subgrade (bottom of the pavement section).

B. When the terms "Backfill" or "Trench Backfill" are used herein, they shall be construed to mean one or more of the types of backfill specified below under "Materials."

C. The designing engineer shall comply with the intent of the pipe material as defined as either rigid or flexible in conformance with the AASHTO LRFD Bridge Design and Construction Specifications and this Section. Special attention shall be given to the sidewall material properties as this section assumes a minimum AASHTO A1 or A3 material. Other sidewall material type shall be given special consideration for minimum trench widths, the use of Controlled Low Strength Materials (CLSM), or other critical processes that would affect the pipe ability to withstand the load and shall also be noted on the plans and specifications for the project.

D. The type of pipe and applicable installation requirement (trench and embankment) to be used as demonstrated by the design and approved by the Agency Engineer shall be clearly noted on the drawings and specifications along with installation procedures that may differ from this section.

E. Quality control field inspection and testing requirements including frequency shall be in accordance with Contracting Agency requirements. Frequency of quality control field inspection and testing shall be in accordance with ***Subsection 203.05.02, "Testing."***

F. Ponding and jetting will not be allowed on City of Las Vegas projects.

208.01.02 DEFINITIONS

A. **Foundation:** Over-excavation and backfill of the foundation is required only when the native trench bottom does not provide a firm-working platform for placement of the pipe bedding material.

B. **Bedding:** In addition to bringing the trench bottom to required grade, the bedding levels out any irregularities and ensures uniform support along the length of the pipe.

C. **Haunch Zone:** The backfill under the lower half of the pipe (haunches) distributes the superimposed loadings.

D. **Initial Zone:** The backfill from the springline to the top of the pipe zone provides the primary support against lateral pipe deformation for flexible pipe.

E. **Final Zone:** Backfill above the pipe zone to the top of subgrade.

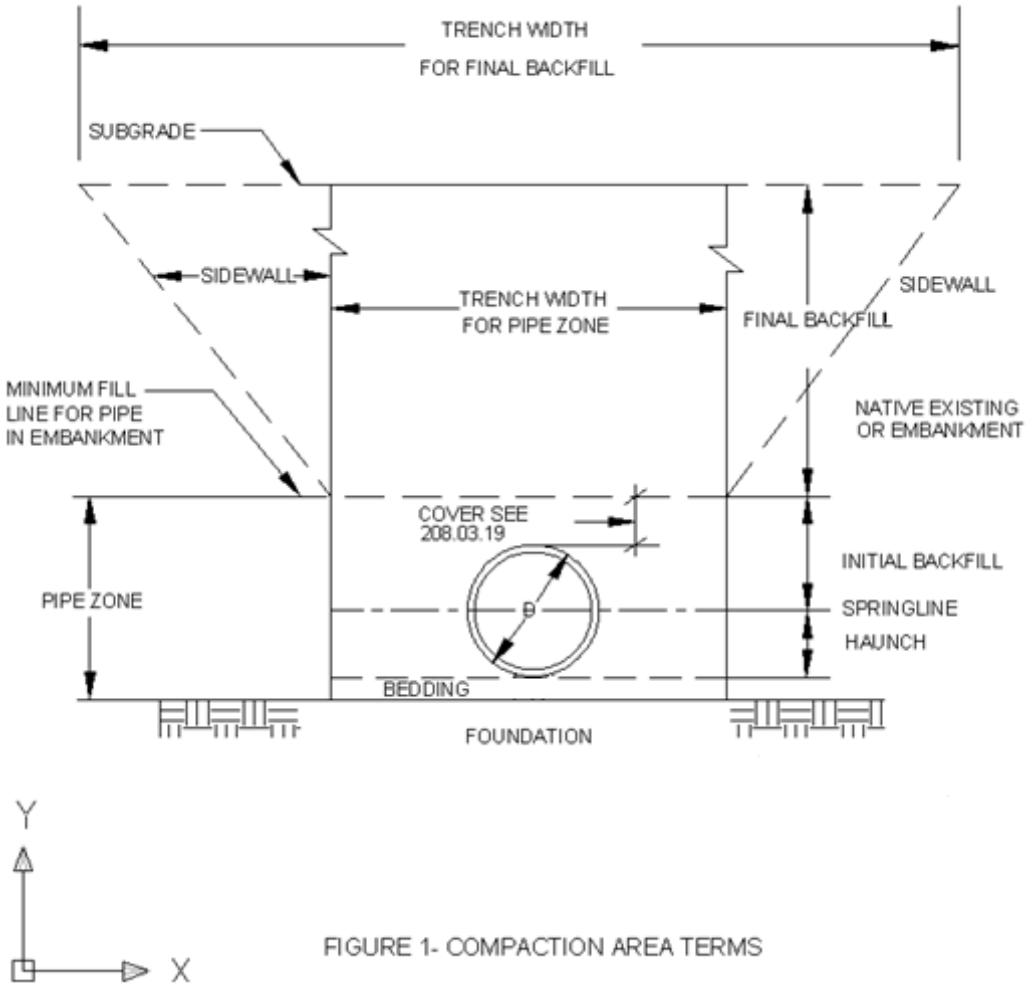


FIGURE 1- COMPACTION AREA TERMS

MATERIAL

208.02.01 GENERAL

A. The material placement in the pipe zone area shall first comply with Table 1, when applicable. Note that CLSM backfill is required for storm drain pipes within the detention basin embankment, see plans for specific limits.

Table 1 - Pipe Zone Maximum Particle Size for Backfill

Nominal Pipe Size (inches)	Maximum Particle Size (inches)
2 to 4	1/2
6 to 8	3/4
10 to 16	1
18 and larger	1-1/2

B. One of two methods of compaction of the trench pipe zone shall be used and shall be specified in the Construction Documents and approved by the Engineer prior to construction:

1. **Method A:** The use of CLSM as defined in this section. This method is required for storm drain pipe within the detention basin embankment, see plans for specific limits.

2. **Method B:** The use of aggregate materials as described in this section as associated with either Rigid or Flexible designed pipe shall be as specified in this subsection below.

C. Prior to construction, the materials and method type shall be submitted and approved by the Engineer.

208.02.02 SELECTED BACKFILL

A. This material shall be similar to that removed from the trench excavation or may be imported material as specified in ***Subsection 207.02.01, "Selected Backfill,"*** or as otherwise shown on the Drawings.

208.02.03 GRANULAR BACKFILL

A. Granular backfill shall be as specified in ***Subsection 207.02.02, "Granular Backfill."***

208.02.04 SAND BACKFILL

A. Sand backfill shall consist of natural sand or a mixture of sand with gravel or stone. In addition thereto, the material shall conform to the following gradation requirements:

Table 2 - Sand Backfill Gradation

Sieve Sizes	Percentage of Weight Passing
3/8 inch	100
No. 4	80-100
No. 200	5-20

B. The plasticity index of the material shall be as specified in ***Subsection 704.03.01, "Plastic Limits."*** The soluble sulfate content shall not exceed 0.3 percent by dry weight of soil.

208.02.05 TYPE II AGGREGATE BASE BACKFILL

A. Type II aggregate base backfill shall be as specified in ***Subsection 704.03.04, "Type II Aggregate Base."*** The total available water soluble sulfate content shall not exceed 0.3 percent by dry weight of soil.

208.02.06 DRAIN BACKFILL

A. Drain backfill shall be as specified in ***Subsection 704.03.02, "Drain Backfill."*** The type shall be as shown on the plans or approved by the Engineer.

208.02.07 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. Backfill shall be as specified in ***Subsection 704.03.07, "Controlled Low Strength Material."***

208.02.08 CRUSHED ROCK

A. The materials properties shall conform to ***Subsection 704.03.06, "Crushed Rock."***

208.02.09 TYPE III AGGREGATE

A. Aggregate properties and gradation shall conform to Type III as specified in ***Subsection 704.03.05, "Type III Aggregate,"*** or as approved by the Engineer.

208.02.70 STRUCTURAL BACKFILL

A. Structural backfill shall consist of material conforming to subsection 207.02.02 “Granular Backfill” or subsection 207.02.01 “Selected Backfill”. Additionally, the backfill material shall be non-gypsiferous (solubility less than 4%), have an expansion potential less than 4%, shall be free of vegetation and debris and contain no rocks larger than four inches nominal diameter.

CONSTRUCTION

208.03.01 TRENCH EXCAVATION, GENERAL

A. Excavation including the manner of supporting excavation and provisions for access to trenches, shall comply with the current regulations as determined by NOSHA. Excavation shall include, without classifications, the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grade shown. Excavation for pipe, wire, or conduits shall be by open trench unless otherwise specified or shown on the plans. However, should the Contractor elect to tunnel or jack any portion not so specified, he shall first submit a design by a Nevada Professional Engineer to and obtain an approval from the Engineer. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavation, and all pumping, ditching, or other approved measures for the removal or exclusion of water, including storm water and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. The Contractor shall be responsible for any damage to persons or property due to interruption or diversion of storm or wastewater because of his operations. If due to delays in delivery of materials or for other reasons, and the Contractor is not expected to fully complete the work within any excavated area in a reasonable length of time as determined by the Engineer, the Engineer may require the Contractor to backfill the excavation and

re-excavate when the work can be completed expeditiously, with no additional payment therefor.

B. Except as otherwise shown or provided herein, excavation shall be open cut trenches with vertical sides up to the top of the pipe zone.

C. Trenching and shoring operations shall be conducted in accordance with 29 CFR (Code of Federal Regulations) Part 1926, Occupational Safety and Health Standards (OSHA) – Subpart P – Excavations (July 1, 1990).

208.03.02 MINIMUM TRENCH WIDTH

A. Excavation of pipe trench for flexible and rigid pipe is as required in Table 3 and this width is only applicable for trenches that have trench sidewall of native material"" which meets the classification class A1 or A3 installation as defined in AASHTO M145 table. In all cases, the trench width shall be wide enough to allow for the compaction equipment.

Table 3 - Minimum Trench Widths

Flexible Pipe	Minimum shall be not less than 1.5 times the pipe outside diameter plus 12 inches
Rigid Pipe	Minimum shall be not less than the outside diameter plus the outside diameter times 0.33

B. For pipe backfill using CLSM, the minimum trench width may be reduced to the pipe diameter plus 12 inches and enough room needed to allow for the proper placement of the CLSM using tools to "spade" the material under the pipe haunches. This condition applies only for trench sidewalls meeting the minimum AASHTO material class A1 or A3.

C. If the sidewall trench soil is classified other than AASHTO Class A1 or A3, a recommendation by a Nevada Professional Engineer shall be submitted and approved by the Engineer prior to construction. However, minimum trench width shall not be less than the minimum stated in this section.

208.03.03 MAXIMUM TRENCH WIDTH

A. The maximum width of the trench shall be determined by the Contractor based on the method and means for the installation. However, trench width shall not exceed the width of a ride-along compactor plus 2 feet when working alongside the pipe or culvert. If for any reason this maximum trench width is exceeded, a higher strength of pipe may be required as determined by the Engineer with no additional cost to the Contracting Agency.

B. Except when otherwise specified or ordered by the Engineer, the bottom of the trench shall be excavated uniformly to the grade or depth indicated on the drawings. The maximum amount of open trench permitted in any one location shall be per Section 624 of these Special Provisions. Trench shall be considered open until backfilled to the top of subgrade. Trenches crossing streets shall be completely backfilled immediately after pipe, wire, or conduit installation.

C. Substantial bridging, properly anchored, capable of carrying the design loading, in addition to adequate trench bracing, shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular working hours. Safe and convenient passage for pedestrians and access to all properties shall be provided.

208.03.04 TRENCH OVER-EXCAVATION

A. Wherever the excavation is made below the grade shown on the drawings, or below the grade ordered by the Engineer, it shall be refilled to the required grade with suitable backfill and bedding material ""at no additional cost to the Contracting Agency.

B. Trench over-excavation below the specified level of bedding material, and additional backfill material, ordered by the Engineer where unsuitable materials are encountered, shall be paid by the appropriate contract item.

C. Trench over-excavation and backfill to control groundwater shall be at the option and expense of the Contractor; however, the backfill material shall comply with this specification and the approved design of the pipe.

208.03.05 DISPOSAL OF UNSTABLE AND EXCESS EXCAVATED MATERIALS

A. Excess material and excavated material unsuitable for backfill shall be removed from the site of the work by the end of each working day unless otherwise approved by the Engineer and disposed of by the Contractor as specified in ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

208.03.06 CHANGES IN ALIGNMENT OR GRADE

A. In the event that changes in elevation of the trench of less than 6 inches are ordered by the Engineer, no changes in the contract amount will be allowed.

208.03.07 PORTABLE TRENCH SHEILD

A. Portable trench shields or boxes that provide a moveable safe working area for installing pipe may be used for the installation of pipe. After placing the pipe in the trench, backfill material shall be placed in lifts and the shield shall be lifted to allow for the backfill material to be placed for each lift, trench wall to trench wall.

208.03.08 MINIMUM PIPE SPACING

A. If the pipe space between parallel pipes in a single trench is not conducive to mechanical backfill, then CLSM shall be used.

208.03.09 TRENCH BACKFILL

A. The backfilling of the trench differs in each zone due to the complexity of providing a secure support for the pipe as well as ensuring that all voids are filled to prevent nuisance

water flow under the pipe. The zones are foundation, bedding, haunch, initial, and final as illustrated in Figure 1.

208.03.10 USE OF CLSM

A. CLSM Class II is required for storm drain pipe within the detention basin embankment, see plans for specific limits. CLSM Class I and Class II may be placed in other installations. However, for flexible pipe, in the pipe zone region, either full CLSM or full aggregate backfill is required. There can not be applied a mixing of CLSM and aggregate fill layers due to the different stresses that can occur on the pipe at the interface of both types of products.

B. CLSM shall be placed directly into the space to be filled. The placement of CLSM shall include "spading" under the pipe haunches and into the corrugations or other difficult areas around a structure. Care shall be taken to prevent flotation or misalignment of the pipe by means of straps, soil anchors or other designed and approved means of restraint as per the manufacturer's recommendation. Material may be placed in stages equally on both sides of the pipe to prevent movement or flotation of pipe.

C. If CLSM Class III - Bonded Aggregate Fill (BAF) is to be used, it shall be as specified in ***Subsection 704.03.07, "Controlled Low Strength Material (CLSM)."*** When used as backfill, CLSM Class III shall comply with ***Subsection 704.03.02, "Drain Backfill."***

208.03.11 FOUNDATION

A. Trench foundation shall be stable prior to placing bedding material. If the Engineer determines that unsuitable materials exist at the trench foundation, the Contractor shall remove and replace the material as directed by the Engineer and as specified in ***Subsection 208.03.04, "Trench Over-Excavation."***

208.03.12 PIPE BEDDING

A. **Dry Utilities:** Dry utilities shall be defined as facilities for fiber optics, electrical, telephone, television cable, traffic signals, and natural gas lines. Pipe bedding for dry utilities only may consist of sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a bedding material, the sand shall be moisture conditioned and mechanically compacted.

B. **Wet Utilities:** Wet utilities shall be defined as facilities for sewer lines, water lines, and storm drains. Except as otherwise provided herein, or in the Special Provisions, or as otherwise shown on the plans, the trench shall be excavated to a depth of at least 4 inches to 6 inches below the bottom of the pipe barrel and to a depth that will be sufficient to provide at least 2 inches of clearance under the pipe bell (where applicable).

C. Uniform and stable bedding shall be provided for the pipe and any protruding features of its joints and/or fittings with the exception that the middle of the bedding equal to 1/3 the pipe outside diameter shall be loosely placed (see Figure 1). The compaction shall be:

1. Compaction density minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

D. The material for use as bedding shall be Type II Aggregate Base or CLSM complying with this section.

E. Bedding shall be backfilled to the required grade of the bottom of the pipe. When Crushed Rock is used for foundation stabilization, the Contractor shall follow the same procedures described below in ***Subsection 208.03.16, "Drain Backfill."***

F. All pipes shall be placed directly on the bedding material unless otherwise required or approved by the Engineer. If groundwater is present or anticipated to be present, the need for a filter material as specified in ***Subsection 207.03.01, "General,"*** shall be reviewed and approval may be required by the Engineer.

208.03.13 HAUNCH ZONE BACKFILL

A. **Dry Utilities:** After pipe or conduit is laid, the haunch areas shall be backfilled with sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a backfill material, the sand shall be moisture conditioned and mechanically compacted.

B. **Wet Utilities:** After the pipe or conduit is laid, the haunch areas shall be backfilled with Type II, Type III, Aggregate Base Backfill, or CLSM. Crushed Rock or drain backfill may be used for the haunch zone only if material use has been specifically approved by the governing agency. If crushed rock or drain backfill is used, comply with ***Subsection 208.03.16, "Drain Backfill."***

C. Compaction of the haunching material can best be accomplished by hand with tampers or suitable power compactors for maximum compacted lift thickness of 6 inches. The Contractor shall take care to not disturb the pipe from its line and grade and shall compact to:

1. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

D. While compacting the embedment near the pipe with impact-type tampers, caution shall be taken to not allow direct contact of the equipment with the pipe.

208.03.14 INITIAL ZONE BACKFILL

A. **Dry Utilities:** Initial zone backfill for dry utilities may consist of sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a backfill material, the sand shall be moisture conditioned and mechanically compacted.

B. **Wet Utilities:** After the pipe or conduit is laid, the initial backfill areas shall use Type II, Type III, Aggregate Base, or CLSM. Avoid usage of impact tampers directly above the pipe until the full loose layer backfill depth above the pipe is obtained. Crushed Rock or drain backfill may be used for the initial zone only if material use has been specifically

approved by the governing agency. If crushed rock or drain backfill is used, comply with ***Subsection 208.03.16, "Drain Backfill."*** The depth of initial backfill above the pipe shall comply with Table 4:

Table 4 - Initial Zone Material Depths

Pipe or Conduit	Initial Zone
2-inch or less diameter	6 inches above the top of pipe
Greater than 2-inch diameter	12 inches above top of the pipe

208.03.15 FINAL ZONE BACKFILL

A. The remaining backfill shall consist of one of the following types as determined by the Engineer.

B. Selected Backfill or CLSM Backfill. Backfill material from the initial backfill zone to finished grade, shall be "Selected Backfill," or CLSM.

1. The material shall be compacted to:

   a. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

   b. If "Selected Backfill" is used in trenches 2 feet or less in width, no stones or lumps greater than 3 inches will be permitted.

2. **CLSM:** When used, CLSM backfill shall be placed from the top of the initial backfill zone to the finished grade.

208.03.16 DRAIN BACKFILL

A. In the event that Drain Backfill is used to control groundwater, the Contractor shall, at no additional cost to the Contracting Agency, construct dams conforming to the requirements of ***Section 501, "Portland Cement Concrete,"*** Class II CLSM, or compacted Type II Aggregate Base. Construct the dams within the drain rock bedding material at each manhole or at intervals of 600 feet, whichever is less. Dams shall extend the width of the trench, a minimum of 18 inches in length, for the height of the drain backfill, and where Type II is used, the compaction shall be:

1. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

B. The Contractor shall install nonwoven geotextile filter fabric between the bedding and backfill material in such a manner to prevent migration of the backfill material into the bedding whenever Drain Rock or Crushed Rock is used as bedding.

C. Geotextile filter fabric shall conform to the requirements specified in AASHTO M288, "Subsurface Drainage Geotextile."

208.03.17 COMPACTION

A. Compaction shall be performed by mechanical means. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used and shall have a maximum lift thickness as indicated in Table 5 - Compaction Lift Thickness. The lifts shall be placed on both sides of the pipe at the same time to reduce pipe movement.

Table 5 - Compaction Lift Thickness

Location	Maximum Compacted Lift Thickness (inches)	Maximum Loose Lift Thickness (inches)
Bedding, Haunch, and Initial Zones	6	8
Final Zone Backfill	12	16

B. Each layer shall be evenly spread, moistened, and tamped or rolled until the specified relative compaction has been attained.

C. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

208.03.18 TRANSITION INSTALLATIONS

A. When differential conditions of pipe support might occur, such as in transitions from manholes to trench, a transition support region shall be provided to ensure uniform pipe support and preclude the development of shear, or other concentrated loading on the pipe.

208.03.19 MINIMUM DEPTH OF COVER

A. The minimum cover shall be as stated on the plans and/or contract Special Provisions. For flexible pipe, the minimum cover for compaction process using wheel or hydro hammer loads is 24 inches. Equipment used for the initial zone shall allow compaction to the lift requirements of this specification without damage to the pipe.

208.03.20 TESTING

A. Where tests reveal non-compliance with the requirements of the Contract, the Contractor shall bear the costs of subsequent rework and retesting until the required specification compliance is obtained to the satisfaction of the Engineer.

208.03.21 CUTTING AND RESTORING STREET SURFACING

A. Prior to beginning work within any public right-of-way, or cutting any street surfacing therein, an encroachment permit and barricade plan approval shall be obtained from the governmental entity or agency having jurisdiction over that right-of-way.

B. Permit fees and construction restrictions shall be in accordance with the rules, regulations, and ordinances of the entity or agency having jurisdiction.

C. While undergoing improvements, all streets upon or within which any work is being done shall be kept open to all traffic by the Contractor, as specified in ***Subsection 104.04, "Maintenance of Traffic,"*** unless otherwise approved by the Engineer, or as provided in the Special Provisions.

D. Prior to beginning the work, barricading and traffic control devices conforming to the latest editions of the Traffic Control Plans for Highway Work Zones for the Clark County Area and the Manual on Uniform Traffic Control Devices shall be in place, and shall be in compliance with the governmental agency approved traffic control and barricade plan.

E. Pavement in the area of the trench excavation may be wheel cut or spade cut.

F. Temporary Steel Plate Bridging: When approved by the Engineer or Contracting Agency, the Contractor may use steel plates to bridge excavated trenches in areas where the roadway surface is to be opened to traffic. Steel plates shall extend at least 12 inches beyond the edges of the trench. Trenches shall be adequately reinforced to support the bridging and traffic loads. Trench plate thickness shall be at least 3/4 inches for a 1 foot wide trench and shall increase 1/8 inch for every foot of trench width up to a thickness of 1-1/4 inch for a 5 foot wide trench. Steel plates for trench widths greater than 5 feet shall require a special structural design. Trench plates shall be coated with an Antiskid type surface meeting current Caltrans standards of a nominal Coefficient of friction of 0.35 in accordance with California test method 342 (Appendix H). Trench plates shall not be overlapped or stacked on top of another plate. At no time shall the length of any configuration of steel plates exceed three hundred feet or be left in place for longer than 14 days without prior written approval from the Engineer. The Contractor shall ensure that anchoring, strength and side supports are adequate to prevent collapse or movement of the plates. The placement and installation method for temporary steel plate bridging shall be as follows:

1. **Method 1: Roadways with posted speeds of 45 mph and greater, or when required by the Engineer** – The pavement shall be cold-planed to a depth equal to the thickness of the plate and to a width and length equal to the dimensions of the plate(s). Any voids shall be filled with cold mix and compacted to ensure that the roadway has a smooth drivable surface and the plate is flush with the top of the roadway surface (recessed into the asphalt.) The Contractor shall ensure that the approach and ending plates are securely attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement, subsequent plates shall be butted to each other. Steel Plate Ahead (W8-24) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes.

2. **Method 2: Roadways with posted speeds less than 45 mph** – Approach and ending plates shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement. Subsequent plates shall be butted to each other. Fine graded asphalt concrete shall be compacted to form ramps with a maximum slope of 8.5% and a minimum 18 inch

taper to cover all edges of the steel plates. Steel Plate Ahead (W8-24) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry, or equivalent slurry approved by the Engineer.

G. Whenever permanent pavement patches are not constructed immediately following trench backfilling operations, temporary pavement patches consisting of a minimum of 2 inches of hot or cold plantmix or plates shall be utilized to provide the required number of paved travel lanes. Bump Ahead (W8-1) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes. Temporary pavement patches may be left in place for a maximum of 30 working days following completion of backfilling operations unless otherwise approved by the Engineer.

H. The following surface tolerance for temporary patches shall be observed. When a 12-foot straight edge is laid across the temporary patch parallel to the centerline of the street and in a direction transverse to the centerline, a rut, hump, or depression of more than 1/2 inch shall not be evident. Deteriorated temporary patches exhibiting ruts, humps, or depressions shall be repaired or replaced immediately upon notification of the Engineer. If the existing street exceeds the above tolerances, then the temporary patch shall be equal to or better than the condition of the surrounding pavements.

I. Unless otherwise specified and approved, prior to placing the permanent patch, the existing pavement shall be saw cut to a neat line and to a minimum width as shown on the Standard Drawings for Pavement Restoration.

J. Existing aggregate base, shall be scarified and recompacted to meet the requirements of ***Section 302, "Aggregate Base Courses."*** Compaction by rolling with vehicle tires will not be permitted. Aggregate base courses that were constructed with geosynthetics shall be repaired in conformance with the manufacturer's recommendations.

K. BLANK

L. Completion of the permanent patch in areas where an open graded surface course exists, which is less than 10 years in age, shall include placement of a surface course to match the existing surface texture and material mix design, including original bituminous cement type.

M. In areas where lime treated sub-base, cement modified sub-base, soil cement, or similar materials have been used, the Contractor may substitute a lean concrete mix or asphalt concrete equivalent, subject to approval of the Engineer.

N. Upon completion of the permanent patch, including the surface treatment, the surface shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities. The Contractor shall inspect with a straightedge 12 feet long that is laid across the permanent patch parallel to the centerline of the street and in a direction transverse to the centerline. The surface shall not vary more than 1/4 inch from the lower edge of the straightedge. Patches exhibiting deviations greater than 1/4) inch shall be replaced or use mechanical grinding prior to acceptance of the patch. If the existing street

exceeds the above tolerances, then the patch shall be equal to or better than the condition of the surrounding pavement. The Contractor shall submit a report of the tolerance testing to the Engineer for approval prior to the acceptance of the patch.

O. Any concrete improvements disturbed or damaged during construction shall be replaced prior to placement of the permanent pavement patch.

P. All traffic control devices removed or disturbed during construction shall be replaced upon completion of the permanent patch including but not limited to delineation, paint, thermoplastic pavement markings, and traffic signal detector loops. Temporary lane lines and other markings used during construction shall be permanently removed, to the satisfaction of the Engineer, prior to placing the new traffic stripes or markings.

Q. Pavement in the area of the trench excavation shall be sawcut.

R. Cold mix patches will not be allowed.

END OF SECTION 208

SECTION 209 – DRAIN BACKFILL

DESCRIPTION

209.01.01 GENERAL

A. This work shall consist of furnishing, hauling, placing, and compacting drain backfill material around structures, pipes or perforated underdrains to the lines designated on the plans or established by the Engineer.

MATERIALS

209.02.01 GENERAL

B. Material shall conform to the requirements of ***Subsection 704.03.02, "Drain Backfill."***

CONSTRUCTION

209.03.01 GENERAL

C. The trench shall be excavated and drain backfill placed in accordance with provisions of ***Section 607, "Underdrains."***

D. Where drain backfill is part of the structural section, it shall be compacted to not less than 90 percent maximum density. Test method to be determined by the Engineer.

E. Compacting by ponding or jetting will not be permitted.

SECTION 210 – WATERING

DESCRIPTION

210.01.01 GENERAL

A. This work shall consist of, but is not limited to furnishing, hauling, and applying all water required for compaction of embankment foundation areas, embankments, subgrade, mineral aggregate base and surfacing materials, structure backfill, processing lime treated base or subgrade material, or cement treated base, and for controlling dust caused by grading operations, traffic, and natural conditions.

MATERIALS

210.02.01 GENERAL

A. All materials shall conform to the requirements set forth in ***Section 722, "Water."***

CONSTRUCTION

210.03.01 EQUIPMENT

A. Equipment used for applying water required for compacting embankment materials, subgrade, base and surfacing materials, and for controlling dust shall be pressure type distributors equipped with a spray system that will ensure uniform application of water. All the watering equipment used for the application of water shall be equipped with a positive means of shutoff and the use of equipment not so equipped will not be permitted. An approved pump, pipe, hose, and nozzle equipment may be used in embankment construction. Where the head is sufficient to provide enough pressure, the pump requirement may be eliminated.

B. The Contracting Agency does not require that watering equipment be provided with measuring or metering devices.

210.03.02 GENERAL

A. Water for dust control shall be applied in the amounts and on the areas designated by the Engineer.

B. The Contractor shall apply water in the amount necessary to attain the compaction in those materials requiring a specified density. In certain areas of the base courses, water may be introduced into the aggregate at the plant and when necessary to attain the specified compaction, shall be supplemented by additional wetting as specified above.

C. Excavation areas and borrow pits may be watered prior to excavating the material.

D. When water is applied directly to the roadbed, the material shall be processed by suitable equipment until the layer is uniformly wet. Care shall be taken to avoid disturbing layers which have been previously placed and compacted.

E. The Contractor shall make all arrangements for providing an adequate water supply. The Contractor shall negotiate with owners of supply and sign an agreement with each owner prior to removing the water. A copy of said agreement shall be furnished to the Engineer.

The Contractor shall pay all royalties occurring under such agreements and shall also obtain any necessary right-of-way.

END OF SECTION 210

SECTION 211 – EROSION CONTROL

DESCRIPTION

211.01.01 GENERAL

A. This work shall consist of preparing slopes, placing and compacting top soil, seeding, fertilizing, jute matting, and mulching graded and disturbed areas in accordance with these specifications and the details shown in the contract documents.

MATERIALS

211.02.01 GENERAL

A. The materials used shall be those prescribed for the several items which constitute the finished work and shall conform to the applicable requirements of ***Section 726, "Roadside Materials."***

211.02.02 PLANTING SOIL

A. Unless designated in the contract documents, the Contractor shall make the Contractor's own arrangements for obtaining soil at no additional cost to the Contracting Agency. Soil shall be transported directly from the source to final position unless otherwise permitted. Soil shall not be obtained from an area known to have noxious weeds growing in it.

B. Prior to removal of planting soil from the source, the Contractor shall contact the County Weed Control Agency or the State Quarantine Officer for the inspection and destruction of injurious and noxious weeds. Soil that has been treated with herbicides or sterilizers shall be tested by the Nevada State Department of Agriculture to determine the residual in the soil.

211.02.03 SEED

A. All seeds shall conform with all laws and regulations pertaining to the sale and shipment of seed required by the Nevada State Department of Agriculture and the Federal Seed Act. All shipments of seed shall be reported to the Nevada State Department of Agriculture for inspection. Seed shall be of the varieties and proportions specified in the contract documents.

211.02.04 FERTILIZER AND AGRICULTURAL MINERALS

A. All fertilizer and agricultural minerals shall conform with all "Rules and regulations governing the registration, and collection of license tonnage fees for commercial fertilizer in the State of Nevada" as required by the Nevada State Department of Agriculture. Commercial fertilizer formulation and rate of application shall be as specified in the contract documents and subject to sampling for verification of analysis.

211.02.05 MULCH

A. **Hay or Straw:** Hay or straw shall be acceptable to the Engineer. All shipments of hay or straw shall be free of noxious weeds as defined by Nevada State Department of Agriculture. Rate of application shall be as specified in the contract documents.

B. **Wood Cellulose Fiber:** Wood cellulose fiber shall be manufactured in such a manner that after addition and agitation in slurry tanks with fertilizers, seeds, water, and other approved

additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry. When hydraulically sprayed on the ground, the material shall be uniformly impregnated with seed. Rate of application shall be as specified in the contract documents.

C. **Wood Chips:** Wood chips shall be as specified in ***Subsection 726.03.04.D, "Wood Chips and Shavings."***

D. **Bark:** Bark shall be as specified in ***Subsection 726.03.04.E, "Bark."***

211.02.06 ASPHALT EMULSION

A. Asphalt emulsion used as a tie-down for mulch shall be as described in the contract documents.

CONSTRUCTION

211.03.01 PREPARATION

A. Excavation slopes shall be thoroughly cultivated to the depth shown in the contract documents, after which planting soil, if required by the contract, shall be uniformly spread to an approximate thickness of 4 inches, the exact thickness will be determined by the Engineer.

B. Cultivation of embankment slopes shall be required before placing planting soil unless otherwise specified in the contract documents or ordered by the Engineer. Such cultivation shall be considered subsidiary to other portions of the work and no direct payment will be made for such work.

C. Cultivation shall not be performed until all equipment is through working in the area, except equipment required to cultivate the area and spread planting soil.

D. After cultivation and prior to seeding, all rocks 1 inch in smallest dimension and larger shall be removed from all slopes to be seeded and shall be disposed of as approved by the Engineer.

211.03.02 PLACEMENT OF PLANTING SOIL

A. Planting soil shall be evenly spread over the specified areas to the depth shown on the plans unless otherwise approved by the Engineer. After the planting soil has been spread, all large clods, hard lumps, rocks, and litter shall be raked up, removed, and disposed of by the Contractor.

B. Planting soil shall not be placed when the ground is frozen, excessively wet, or, in the opinion of the Engineer, in a condition detrimental to the work.

C. All damage occurring to existing roadbeds, shoulders, walks, curbs, or other existing adjacent structures or areas due to the Contractor's operation in hauling and placing the planting soil shall be repaired by the Contractor at no additional cost to the Contracting Agency.

211.03.03 FIRMING OF PLANTING SOIL

A. Planting soil shall be made firm by use of a heavy or weighted disk set at an acute angle. The entire planting area shall be firmed by a minimum of three passes of the disk. The planting soil surface shall be brought to finished grade by one pass of a toothed harrow with teeth set at a 45-degree angle or by one pass of a steel-wire mat. Soil firming

operations shall be performed by traveling at right angle to the slope, except slopes greater than 30 percent shall be firmed by equipment conveyed up and down the slope by means devised by the Contractor. After firming operations, the planting soil shall be 2 inches below the top of all structures.

211.03.04 SEEDING AND FERTILIZING

A. The Contractor shall notify the Engineer not less than 24 hours in advance of any seeding operation and the Contractor shall not begin the work until areas prepared or designated for seeding have been approved. Following the Engineer's approval, seeding and fertilizing of the approved slopes shall begin immediately.

B. Seeding shall not be done during windy weather or when the ground is frozen. Seed and fertilizer shall be uniformly spread over the area at the rate and mix specified in the contract documents. Seed and fertilizer may be sown by one of the following methods:

1. An approved type hydro-seeder which utilizes water as the carrying agent and maintains a continuous agitator action that will keep seed and fertilizer mixed in uniform distribution until pumped from the tank. Pump pressure shall be such as to maintain a continuous, nonfluctuating stream of solution.

2. Approved blower equipment with an adjustable disseminating device capable of maintaining a constant, measured rate of material discharge that will ensure an even distribution of seed and fertilizer at the rate herein specified.

3. Helicopters properly equipped for aerial seeding and fertilizing. Helicopters so equipped shall have the following:

   a. Two hoppers or seed compartments each capable of containing a minimum of 100 pounds of grass seed or granular fertilizer.

   b. Power driven, readily adjustable disseminating mechanisms capable of maintaining a constant, measured rate of distribution of grass seed or granular fertilizer.

   c. Where liquid fertilizer is furnished in lieu of dry granular fertilizer, the helicopter shall be equipped with two barrels or containers capable of containing a minimum of 15 gallons each. Distribution shall be a spray boom of sufficient size and length, fitted with proper nozzles to distribute uniformly, liquid fertilizer as herein specified.

4. Approved power-drawn drills, with double-disc front delivery openers, and depth bands for positive depth control. Depth control shall be set at a depth of 3/4 inch for consistent furrow bottom placement.

   a. An approved deep furrow drill may be used where it is determined the seedbed is firm and there is little danger of soil blowing. An approved spreader may be used for fertilizer placement. Drills and spreaders shall be calibrated before use on the project.

   b. Areas inaccessible to above methods of application shall be seeded and fertilized by approved hand methods. Distribution of the material shall be uniform and at the rates specified.

c. The Contractor shall provide qualified personnel experienced in all phases of the seeding and fertilizing operation, equipment, and methods as herein specified.

211.03.05 SPREADING MULCH:

A. **Hay or Straw:** Hay or straw mulch shall be furnished, hauled, and evenly applied at the rates indicated, and shall be spread by means of an approved type mulch spreader. The spreader shall produce a uniform distribution of the hay, without cutting or breaking it into short stalks. Areas beyond the range of the mulch spreader shall be mulched by approved hand methods. Distribution of the material shall be uniform and at the rate specified in the contract documents.

1. Unless otherwise specified, straw or hay shall be anchored into the soil by use of a heavy disc with flat serrated discs approximately 1/4 inch thick, having dull edges and spaced no more than 9 inches apart.

2. Anchoring shall be to a depth of 2 inches across the slope, and with no more than one pass of the equipment on the same surface.

B. **Wood Cellulose Fiber:** Wood cellulose fiber utilized as a mulch may be applied with seed and fertilizer in one operation by approved hydraulic equipment. The equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed, and water. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic discharge spray nozzles which will provide a uniform distribution of the slurry.

C. **Wood Chips:** Wood chips utilized as a mulch may be applied by available mechanical chip spreaders or by approved hand methods. The wood chips shall be spread to an average depth of 3 inches.

D. **Bark:** Bark utilized as a mulch may be applied by available mechanical spreaders or by approved hand methods. The bark shall be spread on open slope areas to an average depth of 3 inches. Bark applied as a mulch for tree and shrub rings shall be spread to an average depth of 4 inches.

211.03.06 APPLYING ASPHALT EMULSION

A. When called for in the contract documents, mulch material shall be anchored in place with asphalt emulsion as herein specified. Asphalt emulsion shall be sprayed into the mulch as it leaves the blower pipe and shall be uniformly mixed with the mulch. Asphalt emulsion as specified shall be applied at the rate of 250 gallons per acre. Any mulch disturbed or displaced following application shall be removed, reseeded, and remulched as specified.

211.03.07 PLACING JUTE MATTING

A. Jute matting shall be unrolled and placed parallel to the flow of water immediately following the bringing to finished grade the area specified in the plans or the placing of seed and fertilizer. Where more than one strip is required to cover the given areas, the strips shall overlap a minimum of 4 inches. Ends shall overlap at least 6 inches with the up-grade section on top. The up-slope end of each strip of matting shall be buried in

6-inch slots with the soil firmly tamped against it. The Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be buried in a similar manner. Check slots shall be placed between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as up-slope ends. Check slots shall be spaced so that one check slot or one end occurs within each 50 feet of slope.

B. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting shall be spread evenly and smoothly and in contact with the soil at all points.

C. Jute matting shall be held in place by approved wire staples, pins, spikes, or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in 3 rows for each strip of matting, with 1 row along each edge and 1 row alternately spaced in the middle. All ends of the matting and checks slots shall be fastened at 6-inch intervals across their width. Fastening devices shall anchor the matting against the soil and be driven flush with the finished grade.

END OF SECTION 211

SECTION 270 – DEWATERING

DESCRIPTION

270.01.01 GENERAL

A. This work shall consist of furnishing all materials, labor, equipment and supervision to design, install, operate, remove dewatering systems and to lower the water table sufficient to prevent ground water from entering excavations.

B. The work shall also consist of, but is not necessarily limited to, the proper disposal of groundwater removed by a dewatering system **in accordance with local, state, and federal regulations**. Prior to discharging groundwater into the storm drain system, the Contractor shall be responsible for obtaining the groundwater discharge permit from the Nevada Division of Environmental Protection, comply with the conditions of the permit and pay all costs associated with the permit requirements such as permit fees, laboratory analysis and treatment of the discharge water, if required. The permit application can be downloaded at: ndep.nv.gov/BWPC. Sampling and laboratory analysis shall be completed by Nevada Certified Environmental Manager and Certified Laboratory.

C. Dewatering shall conform to the requirements of ***Section 208, "Trench Excavation and Backfill"*** and ***Section 502, "Concrete Structures"*** unless otherwise specified herein.

MATERIALS

270.02.01 GENERAL

A. At or prior to the preconstruction conference, the Contractor shall submit the dewatering plan showing method of dewatering, piping locations, discharge points, sewer and storm drainage facilities utilized and estimated discharge quantities.

CONSTRUCTION

270.03.01 GENERAL

A. Dewatering for structures and pipelines shall commence when groundwater is first encountered and shall be continuous until such times as water can be allowed to rise in accordance with the following provisions. Dewatering shall be conducted such that no concrete footings or floors or pipelines are placed in water nor shall water be allowed to rise over them until the concrete or mortar has set at least eight (8) hours. Water will not be allowed to rise in pipeline trenches or drained excavations until pipelines or facilities are backfilled or restrained to prevent flotation.

B. The Contractor shall remove all dewatering equipment and materials at the completion of the work or as otherwise directed by the Engineer.

C. The dewatering system shall be kept in operation until all work in the excavation is backfilled and properly compacted to a point three (3) feet above the existing water table elevation.

D. The Contractor shall arrange for and provide all necessary utilities to operate the dewatering system.

270.03.02 POINT OF DISCHARGE

A. The Contractor shall dispose of groundwater removed by the dewatering system into the storm drain system in accordance with local, state and federal regulations.

END OF SECTION 270

SECTION 301 – SELECTED MATERIAL SUBBASE

DESCRIPTION

301.01.01 GENERAL

A. This work shall consist of excavating and placing selected granular materials in one or more courses for subbase in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer. This material is designated to be placed below the Type II aggregate structural layer for pavements and is a part of the pavement structure.

301.01.02 REFERENCE CODES AND STANDARDS

A. Related Interagency Quality Assurance Committee (IQAC) procedures at:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

MATERIALS

301.02.01 GENERAL

A. Material shall be as set forth in the Special Provisions.

B. When Type I Aggregate Base is specified, the gradation acceptance limits and testing methods shall be as set forth in ***Subsection 704.03.03, "Type I Aggregate Base."***

CONSTRUCTION

301.03.01 SUBGRADE PREPARATION

A. The surface of the subgrade upon which the selected material is to be placed shall conform to the established lines and grade, shall be smooth and uniform, and shall be compacted to the required density. The tolerance to the plan elevation grade shall be +0 inches and -1/2 inch.

301.03.02 PLACING

A. In producing, handling, and placing selected materials, care shall be taken to prevent segregation of the fine particles from the coarse. When the required compacted thickness is more than 6 inches, the material shall be placed in layers, none of which shall exceed 6 inches in depth after compaction, except as provided in ***Subsection 301.03.04, "Compaction."***

B. After the material has been uniformly deposited, it shall be thoroughly blade-mixed to the full depth of the layer by alternately blading the entire layer to the center and back to the edges of the roadbed.

1. The material shall then be spread and finished to the required cross section.

2. At the option of the Contractor, selected material may be spread with equipment meeting the requirements of ***Subsection 303.03.03, "Surface Tolerances."***

C. Binder material, if required, shall be incorporated either in the surfacing aggregate at the plant where the aggregate is produced or uniformly on the roadbed in amounts designated by the Engineer.

301.03.03 WATERING

A. Water shall be applied prior to and during all blading operations to moisten the material sufficiently to prevent segregation of the fine and coarse particles.

B. Water shall also be applied during the compaction and maintenance stages in sufficient amounts to attain compaction and prevent raveling.

301.03.04 COMPACTION

A. Compaction shall immediately follow the spreading operation.

1. Where the required thickness is 6 inches or less, the base course may be spread and compacted in one layer.

2. However, if vibratory compaction equipment approved by the Engineer is used, and the requirement for density is complied with, the compacted thickness of any one layer may be increased to 8 inches.

B. Aggregate bases placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations that are inaccessible to the spreading equipment may be spread in one or more layers by any means to obtain the specified results.

C. Each layer of material shall be compacted to not less than 95 percent relative compaction, except under sidewalk areas. Under sidewalk areas, the material shall be compacted to not less than 90 percent compaction.

D. A loss of density in the upper portions of the material may occur due to the elements or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed for such recompaction.

END OF SECTION 301

SECTION 302 – AGGREGATE BASE COURSES

DESCRIPTION

302.01.01 GENERAL

A. This work shall consist of furnishing, placing, and compacting aggregate base courses constructed as specified below and in conformity with the lines, grades, thicknesses, and cross sections shown on the plans or established by the Engineer.

302.01.02 REFERENCE CODES AND STANDARDS

A. Related Interagency Quality Assurance Committee (IQAC) procedures at:
http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

MATERIALS

302.02.01 GENERAL

A. Materials shall meet the requirements of the following subsections:

Materials	Subsection
Type I Aggregate Base	***704.03.03***
Type II Aggregate Base	***704.03.04***

CONSTRUCTION

302.03.01 SUBGRADE PREPARATION

A. Any ruts, holes, defects, or soft yielding places which occur in the subgrade or subbase for any cause whatsoever shall be corrected and compacted to required density and stability before an aggregate base course is placed thereon.

1. The above mentioned repairs shall be made at no additional cost to Contracting Agency, except as provided for in ***Subsection 203.03.03, "Unsuitable Material."***

2. The tolerance to the plan elevation grade shall be +0 foot and -0.1 foot.

B. Unless otherwise specified, the top 6 inches of subgrade shall be compacted to not less than 90 percent compaction.

302.03.02 SPREADING AGGREGATES

A. The aggregate shall be uniformly deposited on the approved subgrade by means of the hauling vehicle with or without spreading devices. Aggregate shall be distributed over the surface to the depth specified on the plans or established by the Engineer.

B. After base course material has been deposited, it shall be thoroughly blade-mixed to full depth of the layer by alternately blading the entire layer to the center and back to the edges of the road. The material shall then be spread and finished to the required cross section by means of a self-propelled pneumatic-tired motor grader.

C. At the option of the Contractor, the aggregate may be spread with an approved self-propelled spreader with the aggregate ready for compaction without further shaping. If

this option is exercised, however, the operation shall become subject to the requirements of ***Subsection 302.03.03, "Watering and Mixing Aggregates."***

D. Reference points will be established on one side of the roadway at intervals approved by the Engineer.

E. Furnish, place, maintain, remove, and dispose of all materials required to provide continuous line and grade control to the placing machine.

302.03.03 WATERING AND MIXING AGGREGATES

A. The base course material and water may be mixed at the plant in a mixer approved by the Engineer.

B. Water shall be added during the mixing operation by means of spray bars in the amount necessary to provide the optimum moisture content for compacting.

C. After mixing to the extent that the product has a uniform homogeneous appearance, the material shall be transported to the job while it contains the proper moisture content and may be placed on the roadbed by means of an approved self-propelled aggregate spreader.

D. If the material has dried appreciably prior to final compacting, additional water shall be added by means of a pressurized water truck to assist in compaction and to prevent raveling.

302.03.04 WATERING

A. Water may be applied prior to and during all blading and processing operations to moisten the material sufficiently to prevent segregation of the fine and coarse particles.

B. Water shall be applied during the compaction and maintenance stages in sufficient amounts to assist in compaction and prevent raveling.

C. Comply with ***Section 210, "Watering."***

302.03.05 COMPACTION

A. Compaction shall immediately follow the spreading operation.

1. Where the required thickness is 6 inches or less, the base course may be spread and compacted in 1 layer.

2. However, if vibratory compaction equipment of a type approved by the Engineer is used, and the requirement for density is complied with, the compacted thickness of any 1 layer may be increased to 8 inches.

B. Aggregate bases placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations that are inaccessible to the spreading equipment may be spread in one or more layers by any means to obtain the specified results.

C. Each layer of material shall be compacted to not less than 95 percent compaction, except for under sidewalk areas, where the material shall be compacted to not less than 90 percent compaction.

D. A loss of density in the upper portions of the material may occur due to the elements or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed for such recompaction.

302.03.06 TOLERANCE FOR FINISHED SURFACE

A. When a 10-foot straightedge is laid in any direction, the finished surface shall not deviate at any point more than 1/2 inch from the bottom thereof.

B. The tolerance to the plan elevation grade shall be +0 foot and -0.05 foot.

END OF SECTION 302

SECTION 310 – SOIL CEMENT SLOPE TREATMENT

DESCRIPTION

310.01.01 GENERAL

A. This section covers high compressive strength and low compressive strength soil cement concrete in addition to bedding mix, and also includes requirements for producing, transporting, placing, compacting, curing, and other work appurtenant to constructing soil cement concrete. In these Specifications, high strength and low strength soil cement concrete differ in aggregate, cement, water, and performance requirements. All other requirements contained herein including producing, transporting, placing, compacting, curing, performing quality control, etc. apply to all soil cement regardless of its strength classification.

B. Soil cement concrete shall be placed and compacted to the line, grades, and sections indicated on the drawings. Bedding mix to be used for special treatment of cold joints in soil cement structures shall consist of fine aggregate, cement, and water.

C. The Contractor shall have full responsibility for administration of a Quality Control Plan for soil cement concrete, which shall meet the same quality control requirements of ***Section 106, "Control of Materials."***

310.01.02 GOVERNING STANDARDS

A. Except as modified or supplemented herein, all materials and construction methods for soil cement work shall comply with the applicable provisions of the ACI and ASTM standards specified.

B. Mix design proportions will be determined by the Contractor and meet the specification requirements contained herein.

MATERIALS

310.02.01 MATERIALS

A. Materials used for soil cement concrete shall conform to the following requirements and no substitutions or alternate material sources shall be permitted without the advance approval of the Engineer:

(a) Portland Cement	ASTM C150, Type V, having a maximum tricalcium aluminate content of 5 percent.
(b) Pozzolan	ASTM C618, Class F.
(c) Water	ASTM C94.
(d) Admixtures (optional)	Retarder ASTM C494, Type D.

(e) Fine Aggregate	Natural onsite soil, or crushed rock, clean and free of organic contaminants (solid or chemical). Clay lumps or balls larger than 2-inch shall be pulverized to pass a No. 4 sieve prior to mixing.
(f) Coarse Aggregate	Natural onsite soil, or crushed rock. Sound crushed rock, in accordance with ASTM C33, free of potential alkali reactivity. Gradation shall be as required to achieve the blended aggregate requirements as specified herein.
(g) Bedding Mortar Aggregate	Neat cement slurry. Mixture of cement, fly ash if desired, and water without any aggregate. Artificial or manufactured sand will not be acceptable.

310.02.02 BLENDED AGGREGATE REQUIREMENTS

A. Contractor shall screen, blend, and otherwise process aggregates from onsite sources to produce a blended soil cement aggregate with a plasticity index of zero that meets the following requirements in accordance with ASTM C136:

LOW STRENGTH SOIL CEMENT BLENDED AGGREGATE REQUIREMENTS	
U.S. Standard Sieve	Percent Passing By Weight
1”	100
No. 4	30 - 80
No. 200	0 - 25

HIGH STRENGTH SOIL CEMENT BLENDED AGGREGATE REQUIREMENTS	
U.S. Standard Sieve	Percent Passing By Weight
1"	100
3/4"	80 - 100
No. 4	30 - 50
No. 30	10 - 25
No. 200	3 - 12

310.02.03 ONSITE AGGREGATE

A. Geotechnical analysis indicates that processed onsite aggregate is acceptable for the soil cement mix. Onsite material should be screened of material larger than 1 inch in diameter. Crushing of oversize material for use in soil cement mix is acceptable and is encouraged to increased fractured faces in the mix. Screening (e.g. at the number 4 sieve) of onsite aggregates and recombining stockpiles (e.g. 50-50 mix) may be required in order to meet

specified gradation. Processing methods for aggregate production, including any washing, shall be at the Contractor's discretion.

B. Contractor shall provide necessary aggregate to allow for overbuild, stockpile bases, trial placement, testing, waste, and materials used for Contractor's convenience.

C. Unless otherwise approved, Contractor shall maintain sufficient quantities of aggregate on-site for a minimum of three days of soil cement placement at the maximum anticipated production rate.

310.02.04 ADMIXTURES

A. If used, the admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations for minimum shrinkage and for compliance with these specifications. Retarding admixture may be used in all soil cement.

310.02.05 BEDDING MIX

A. Use bedding mix as shown in the drawings between the foundation and soil cement and wherever required between layers of soil cement. Retard bedding mix so that its initial set time exceeds 3 hours at 95° F. It may be re-tempered within this time period before it is spread on the foundation or lift surface. Spread bedding so that the maximum thickness over rock foundations does not exceed 2-Inches or 3/4-Inch on soil cement surfaces. Spread bedding mix to a minimum thickness of 1 inch on rock foundations and 3/8-Inch on soil cement lift surfaces. Spread soil cement over the bedding and begin compacting within 45 minutes from the time the bedding mix was discharged. Use mix proportions of fine aggregate, cement, and water developed by the Contractor, based on trial mix testing approved by the Engineer. Use materials of the same type and from the same source as those used for the trial-mix testing. Proportion the bedding mix within the following general guidelines:

Slump (placed on soil cement)	7 to 9 Inches
Maximum aggregate size	3/8-Inch
Minus 200 material (aggregate)	2% maximum
Water reducing admixture	may be required
Design strength (28 day)	2500 psi minimum
Retarder	as required to achieve the required delayed set time

B. Admixtures may be introduced into the mix to maintain its workability. Proportion the mix to be broomable and to minimize segregation. Batch bedding mix either on-site or offsite and transport to the lift surface by crane and bucket, transit truck mixer, pump, or other methods approved by the Engineer. Do not use conveyor delivery unless it can be demonstrated that the mix can be transported on the conveyor without any segregation. The mix design shall have 15% to 30% Pozzolan substituted for cement, by volume, provided that all other specification requirements are met.

310.02.06 SOIL CEMENT MIX DESIGNS

A. At least 90 days prior to construction of the soil cement test sections, Contractor, using the services of an independent testing laboratory acceptable to Owner, shall prepare soil cement mix designs and trial batches for the high strength and low strength mixes. The mix designs and testing shall be conducted under supervision of a Professional Engineer registered in the State of Nevada. Certified reports covering the materials, mix designs, and test results shall be submitted to the Engineer for review.

B. The mix designs will be determined by the Contractor's independent testing laboratory based on the following performance specifications:

Performance Specifications for Low Strength Soil Cement	
Minimum 28 day Compressive Strength of Test Cylinders	750 psi
Minimum 28 day Compressive Strength of Core Samples	750 psi

Performance Specifications for High Strength Soil Cement	
Minimum 28 day Compressive Strength of Test Cylinders	2,000 psi
Minimum 28 day Compressive Strength of Core Samples	2,000 psi

The Contractor is solely responsible for conforming to the performance specifications and may adjust proportions as needed to conform to them. Written approval of the Engineer is required for each mix design change, which must include new mix proportions and test results verifying it conforms to the performance specifications.

The mix design shall include the following information as a minimum:

1. Batch weights or proportions and specific gravities for each proposed aggregate size, water, cement, pozzolan and if required, filler.

2. AASHTO T-180 and ASTM D558 maximum density and optimum moisture.

3. Moisture content and dry density of compressive strength specimen.

4. Water/cement ratio of compressive strength specimen.

5. Compressive strength of soil cement at ages 7, 14, and 28 days and 2 specimens based on an average of at least 3 specimens at an age of 28 days and 2 specimens for other ages.
6. Recommended factor of safety used to determine the cement content that will reasonably assure compliance with the strength requirements.

CONSTRUCTION

310.03.01 SUBMITTALS

A. Placement Plan Submittal

Thirty (30) days prior to beginning soil cement placement, Contractor shall prepare and submit a Soil Cement Placement Plan. The plan shall include sketches and a written narrative containing the following information:

(1)	Working Hours	Tentative hours of work
(2)	Material Storage	Size and capacity of aggregate, cement, fly ash, Pozzolan, and water storage facilities.
(3)	Plant	Type, model and description of mixing plant proposed for use. Maximum hourly capacity and anticipated average hourly production rates. Calibration report.
(4)	Control of Mix Proportions	Location and type of measuring equipment used to control proportions of all mix ingredients.
(5)	Layout Diagram	Diagram showing location of plant, storage facilities, and stockpiles.
(6)	Equipment	General description of type and size of equipment to be used for transporting, conveying, placing, spreading, and compacting soil cement.
(7)	Form Systems	Description and sketches of forming systems.
(8)	Curing	General description of curing plan.

B. Material Submittals

(1)	Cement and Pozzolan:	Submit source(s) of cement and Pozzolan.
(2)	Aggregates:	Submit source(s) of all aggregates.
(3)	Delivery Schedule:	Submit delivery and production schedule for all materials.

C. Testing Laboratory Material Submittals

Contractor shall submit representative production samples of cement, Pozzolan, aggregates, and admixtures to the independent testing firm laboratory selected by the Contractor and approved by the Owner 90 days prior to soil cement placement. Contractor shall submit samples that are representative of those proposed for the project and include manufacturer's test reports indicating compliance with applicable specification requirements and showing all chemical and physical properties. Contractor shall identify all materials with labels and/or tags as appropriate, and provide minimum quantities of materials as shown in table below:

TESTING LABORATORY MATERIAL SUBMITTALS	
MATERIAL	**QUANTITY**
Fine Aggregate	2 tons
Coarse Aggregate	2 tons
Cement (in barrels or sealed bags)	0.3 ton
Pozzolan (in barrels or sealed bags)	0.15 ton
Water	Furnished by laboratory
Admixtures (if proposed by Contractor)	1 gallon each

D. Mix Design Submittals

(1) Bedding Mix Design: Submit mix design and test results for bedding mix showing that the selected mix meets the requirement of ***Subsection 310.03.05, "Batching and Mixing."*** Submit 28-day compressive strength test results no later than 90 days following Notice-to-Proceed.

(2) Soil Cement Mix Design: Submit mix design and test results for soil cement mix showing that the selected mix meets the requirement of ***Subsection 310.02.06, "Soil Cement Mix Designs."*** Submit 28-day compressive strength results no later than 90 days prior to the planned start of soil cement activities.

E. Soil Cement Aggregate Production, Delivery Plan, and Schedule Submittal

Prepare and submit to the Engineer for approval, a production and delivery schedule and a plan for stockpiling aggregate onsite. If onsite aggregate is not used for soil cement, submit a plan for transporting the soil cement aggregates from the aggregate plant(s) to the soil cement plant site. Include a map showing the proposed haul route(s); traffic control measures; the number, type, and weights (fully loaded) of haul vehicles to be employed; and height and weight restrictions for all bridges located along the proposed route(s).

F. Delivery Ticket Submittals

Submit delivery tickets for each delivery of cement, Pozzolan, and bedding mix. Include the source, date manufactured or produced, type or class, Contractor's name, project name, and a

certification that the material meets the specification requirements. Include the following information on each delivery ticket for each load or batch of bedding mix:

(1) Name and location of batch plant
(2) Ticket number
(3) Load and truck number
(4) Date
(5) Destination
(6) Concrete class
(7) Batch weights for all materials
(8) Amount of concrete
(9) Time mixer charged with concrete
(10) Recording of revolution counter (transit-mixed concrete)
(11) Space for initials of receiving party

G. Hot and Cold Weather Concreting Submittals

Submit proposed plan for placing soil cement during hot and cold weather conditions. Include planned procedures for heating and/or cooling materials, use admixtures, and protection of completed work.

H. Quality Assurance Plan Submittal

At least 30 days prior to soil cement placement, Contractor shall submit a Quality Assurance Plan to the Engineer. The Quality Assurance Plan shall include the names and qualifications of personnel involved in the Contractor's quality assurance program, a description of the procedures and frequency of testing, and a tentative format for the daily plant reports as specified in ***Subsection 310.03.10, "Curing and Protection."***

310.03.02 ENGINEER REVIEW

A. Owner will review the Soil Cement Placement Plan and Quality Assurance Plan for general conformance with the project requirements and for the purpose of planning its own quality control testing and inspection activities. Contractor must obtain Engineer's approval of all submittals in this section prior to placing soil cement.

310.03.03 SOIL CEMENT TEST SECTION

A. Prior to beginning placement of the permanent soil cement, the Contractor shall place low strength and high strength soil cement test sections using the mix designs prepared by the independent laboratory. The Contractor shall demonstrate the quality, efficiency, and workability of all the materials and equipment necessary for uninterrupted production and placement of the soil cement, expect that conveyor placement will not be required. Tasks are to include lift surface cleaning, compaction, density testing, cold joints, bedding mix placement, and forming and/or shaping of steps and training walls. Trial placement shall not be initiated until the plant and all equipment required for delivery and placement of the soil cement are operational and fully calibrated. Contractor shall demonstrate various spreading and compaction procedures including, but not limited to, various equipment types and number of passes. The Contractor shall use personnel on the test sections who will be working

directly on the low strength and high strength sections of the project in order to familiarize them with the process and products.

B. The test section for high strength soil cement and low strength soil cement will be constructed at a location determined by the Engineer and agreeable to Contractor. The test section shall consist of three twelve inch thick lifts of soil cement approximately 100 feet long at the base. The lift width shall be 8 feet. The total volume of high strength soil cement test section will be approximately 30 cubic yards.

C. The Contractor shall construct the first two lifts, and discontinue work for 24 hours. At that time, the Contractor shall prepare the surface for a cold joint in accordance with ***Subsection 310.03.07, "Joints Lift and Construction Joints,"*** and proceed with placing the remaining lift.

D. The trial section is to be placed 28 days prior to production of the remaining soil cement work. Acceptance of the trial section is predicated upon achieving the required strengths.

Subgrade Preparation

The foundation soil for the test section shall be cleared, graded, and compacted in accordance with ***Section 203, "Excavation and Embankment."*** The soil cement and bedding mortar shall be placed with the methods and in the sequence that will occur during the actual construction.

Mixing

Soil cement for test sections constructed shall be batched and mixed in accordance with the same requirements specified in ***Subsection 310.03.06, "Soil Cement Transporting, Placing, Spreading, and Compacting."***

Placement

Soil cement placement for test section construction shall be placed, spread, and compacted in accordance with the requirements specified in ***Subsection 310.03.06, "Soil Cement Transporting, Placing, Spreading, and Compacting."*** Equipment used for hauling and placing soil cement shall be clean and free of deleterious substances.

Testing and Quality Control

Prior to initiating the trial placement, Contractor shall perform testing of the aggregates in accordance with the requirements of ***Subsection 310.03.11, "Quality Control and Testing"*** to demonstrate that specification requirements are met. Contractor shall also perform all other tests and quality control measures Identified in ***Subsection 310.03.11, "Quality Control and Testing"*** during the trial placement. In addition, the Engineer will perform his own tests and inspections and the Contractor should anticipate interruptions. Contractor shall allow 3 days from the completion of his work to accommodate such tests and inspections of the trial section until production can begin so the Engineer can perform his evaluation of the test section.

Review Meeting

After completing construction of the test sections but prior to beginning soil cement construction, Contractor, Engineer, and Owner will assemble at a time and location determined by Owner to discuss the results of test section construction and the suitability of the soil cement mixtures. Soil cement mix proportions may be adjusted based on results obtained from test section construction.

310.03.04 JOB CONDITIONS

A. Cement and Pozzolan Delivery, Storage, and Handling

Cement and pozzolan for soil cement shall be stored in separate bins. Storage bins in which built cement and pozzolan are stored shall be weather tight and protected from exposure to moisture. Interior surfaces of storage bins shall be clean and free of deleterious substances to the satisfaction of the Engineer prior to storage. Each shipment of cement and pozzolan shall be stored in chronological order based on delivery date at the job site and shall be used in the same chronological order to prevent undue aging.

B. Temperature of Cement

Deliver cement to the job site at a temperature not exceeding 160° F. The temperature of the air used to transport cement into storage containers or silos must be less than 180°F. The temperature of the air will be determined by measuring the temperature on the outside of the transport pipe with a surface thermometer.

C. Storage

Immediately upon receipt at the soil cement mixing plant, store bulk cement, and pozzolan in a dry, weather-tight silos. All storage facilities are subject to approval and must permit easy access for inspection and identification. Store sufficient cement, and pozzolan to complete at least 5 hours of placement at the typical production rate being experienced.

D. Admixtures

Deliver admixtures (if proposed by Contractor) to the site in the original manufacturer's containers. Store and handle in accordance with manufacturer's printed instructions.

E. Aggregate Production, Delivery, Storage, and Handling

The Contractor’s responsibility includes producing aggregates onsite or providing and delivering aggregates to the site, monitoring delivered quantities, and stockpiling in a manner preventing segregation, intermixing, and contamination.

(1) General: The requirements of Subsection 310.03.04E (2) through (3) also apply when soil cement is produced off-site and hauled to the project site.

(2) Aggregate Production: Contractor shall operate the aggregate production plant in an efficient manner to achieve and maintain an adequate level of productivity and ensure that the final aggregate product is consistent and free from contamination by organic material, overburden, or other foreign materials.

(3) Environmental Controls:

a. Stormwater Control: Implement work to conform to Best Management Practices for control of site runoff and stormwater pollution for the work area that encompasses the aggregate production plant, stockpiles, and related construction site areas.

b. Pollutant Control: Contractor shall maintain aggregate plant areas in a clean orderly condition, free from spilled fuel, lubricant, coolant, or other potential pollutants. Contractor shall maintain material handling areas to reduce potential for pollutants to enter stormwater runoff and institute special precautions to prevent and to clean up spills of any material that might contaminate stormwater runoff.

(4) Delivery:

a. Compliance with Regulations: The Contractor's responsibility includes ascertaining and compliance with all state laws and regulations regarding haul vehicle weight limits and other restrictions as they relate to haul vehicles on public roads. Where the point of ingress or egress is connected to a paved public road, provide a stabilized construction entrance adjacent to the paved area to minimize the amount of mud transported onto the paved area. Contractor shall maintain the entrance pad and top dress with aggregate as required.

b. Delivery Route: Contractor shall deliver aggregates using route(s) identified in the approved delivery plan.

c. Maintenance of Roads: Contractor shall promptly remove, to the satisfaction of the Engineer and the haul route's jurisdictional authorities, any soil, aggregate, or other debris deposited on roads or adjacent areas as a result of the Contractor's activities associated with the work to be performed under this contract. If the Contractor fails to clean a road surface and adjacent areas in a timely manner, or fails to clean the road surface and adjacent areas to the satisfaction of the Owner of the road, the Owner of the road or the Owner has the right to perform the defective work and charge the Contractor for the cost incurred.

Contractor shall notify the Engineer as soon as any damage or deterioration to the road(s) occur that is likely to require remedial work.

(5) Stockpiling Procedures: Contractor shall maintain aggregate stockpiles in good condition to prevent segregation and inclusion of foreign materials. Stockpiles shall be located on level ground free of brush, roots, debris, and other deleterious substances. Stockpiles shall be constructed in uniform layers not exceeding 3 feet in thickness. The maximum height of any stockpile shall not exceed 15 feet. Ramps formed for stockpile construction shall be of the same material as that being stockpiled, and shall be considered a part of the stockpile. Prior to steepening or widening stockpile ramps, contaminated surface materials shall be removed. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

(6) Moisture Conditioning: If aggregate evaporative cooling is utilized, or if the aggregate is sufficiently dry to require moisture conditioning, continuously mist aggregates during stockpiling until a saturated surface-dry (SSD) condition is achieved. Use sprinklers or fog

spray type nozzles and do not apply pressurized water directly into stockpile. Exercise caution during aggregate stockpile misting to prevent washing of fine material.

(7) Stockpile Withdrawal: Withdraw aggregates from the stockpiles using conveyors, face loading with front-end loaders, or a combination of conveyors and face loading. Regardless of the method employed, withdraw materials that are representative of the entire stockpile, both in terms of gradation and moisture content. Blend any obviously segregated material with other material in a manner that will result in a gradation that meets the specifications. If the material cannot be suitably blended, separate it from the stockpile and use for other non-critical purposes, or waste the material.

F. Material Certification

With each shipment of cement and Pozzolan delivered to the project site, Contractor shall provide Engineer with one copy of the material supplier's certification as to the source quality, and weight of the material delivered to the project site.

G. Plant Calibration

After mobilizing and erecting plant equipment at the project site and prior to beginning soil cement production, Contractor shall perform, at his expense, all necessary shakedown and trial runs of his proportioning, mixing, hauling, handling, and conveying equipment so that when put into production operation for construction of the Work, the equipment shall consistently and accurately produce a uniform soil cement mixture of the quality specified.

Contractor shall calibrate the plant scales and other mixture proportion control devices and shall submit a calibration report prior to initiating soil cement placement. The accuracy of all scales and control devices shall be certified in accordance with State of Nevada standards for weights and measurement of concrete batching and mixing equipment. Contractor shall recalibrate the plant following each 30 shifts or 5,000 cubic yards of placement, whichever is less, or when quality control testing indicates a potential problem.

H. Flood Protection

The plant and all related equipment shall be built so that if the plant areas are temporarily inundated by flood waters, damage to the equipment or stockpiles shall not result in a delay caused by rebuilding of the plant or replacing stockpiles.

310.03.05 BATCHING AND MIXING

A. General

The Contractor shall select the type of concrete mixing plant to be used and shall determine the plant layout. The plant shall include all necessary mixers, volumetric or weight controls, storage bins, feed systems, and discharge mechanisms. A description of the plant shall be submitted to the Engineer for review and acceptance as described in ***Subsection 310.03.01, "Submittals."*** The plant may be a continuous pugmill or a batch type pugmill. The Contractor shall perform, at his expense, all necessary shakedown and trial runs of his mixing and proportioning equipment so that when put into production operation for construction, the equipment shall consistently and

accurately provide mixtures of the quality specified. The minimum sustainable capacity of the plant(s) must be at least 300 tons per hour using the specified mixes. Material not meeting the specified requirements will be rejected and not allowed in the construction. The Owner will require the Contractor to remove rejected material at the Contractor's expense.

B. Batching or Proportioning Tolerances

Batching or proportioning of soil cement materials shall conform to the mixture proportions directed, within the following tolerances:

BATCHING OR PROPORTIONING TOLERANCES	
MATERIAL	PERCENT*
Cement	± 2.0
Water	± 2.0
Blended Aggregate	± 3.0
Admixtures	± 3.0
Pozzolan	± 3.0

* For continuous mixing plants, the variation is in percent by weight of the total weight of each material for the specified mix in the total sample obtained for a given duration of time. The minimum sample collected shall be one to three cubic feet.

C. Continuous-Mixing Plant Requirements

(1) General

Continuous mix plants shall be capable of producing concrete of the same quality and uniformity as would be produced in a conventional batch-type plant. In general, the plants shall conform to the requirements of ASTM C685, except that proportioning tolerances shall be as specified herein and adaptation to accommodate aggregate size shall be made as needed.

The plant may be a central-type plant and shall have a stationary twin-shaft pugmill mixer and shall be a continuous-mixing type. The plant shall be equipped with positive means for controlling the mixing time maintaining constant mixing time, and maintaining a constant rotation speed of the pugmill shafts.

Mixers shall not be charged in excess of the capacity recommended by the manufacturer and shall be capable of combining the materials into a uniform mixture and shall be capable of discharging the mixture without segregation. The plant's transfer systems must be capable of charging and discharging the constituents and mixed product without bridging or choking.

Mixers shall be maintained on satisfactory operating condition and mixer paddles shall be kept free of hardened concrete. Mixer paddles shall be replaced when their face area has been reduced to less than 80% of their original area. The minimum mixing time for continuous mixing pugmills or batch type pugmills is 15 seconds. The minimum mix retention time for batch type pugmills is 90 seconds.

The intent is to operate continuous pugmills in a continuous manner at one set of feed rates with a minimum number of shutdowns and startups during soil cement production placing. Contractor shall calibrate and operate the plant so that all materials simultaneously begin feeding into the mixer at the specified rates when the mixer is started, and all materials simultaneously stop feeding into the mixer when it is stopped. No lag or lead-time between materials will be allowed at the point where they enter the mixer. After material feeds are shut down, discharge all remaining material in the mixer. The initial soil cement produced after a plant re-start may not conform to the specification requirements. If the plant can be stopped and re-started at the same mix proportions, no material has to be wasted. The need to waste material after a re-start will be evaluated for consistency and uniformity on a case-by-case basis by the Engineer. When the plant is shut down for over 30 minutes, waste the first one-half cubic yard of material.

(2) Aggregate Feed

Separate bins or compartments with steep side slopes, large gate openings, and the capability of handling aggregate in a damp condition shall be used for each aggregate group used in the soil cement mix. Each bin shall be of sufficient capacity to supply the mixer continuously while operating at full capacity. The bins shall be arranged to ensure separate and adequate storage of appropriate fractions of aggregate. Each compartment shall be provided with some means of preventing backing up of material into other bins. Unless the aggregate in the bin is readily visible to operating personnel, each aggregate bin shall be equipped with mechanical or electrical sensors to indicate when aggregate in the bin is below the level to permit accurate proportioning to the mixing unit. Each bin shall be constructed or equipped in such a manner that a representative sample may be taken readily and safely from each bin discharge during plant operations.

Feed cement and aggregates uniformly, continuously, and simultaneously, at the appropriate ratios for the mix design specified, into the mixer by belt or other acceptable method. Feed controls may be by volume or weight. Aggregate feed may be accomplished by a single belt from each stockpile or from feed bins of the various size groups through openings at the bottom of the feed bins. Provide each opening in aggregate feeders with a gate that can be locked at the necessary opening size to provide the correct feed rate. Keep return side of all belts clean. Keep bins sufficiently full to allow a uniform flow of aggregate at an essentially constant rate. Particular attention may be needed to guarantee a continuous flow of the fine aggregate if it is very damp and is graded towards the fine side of the specified gradation band. Feed cement (and Pozzolan) continuously in a manner that can be controlled by adjusting the belt speed or feed rate. Provide special attention to the cement (and Pozzolan) feed equipment so that it consistently and uniformly delivers materials even at low (100 lb./yd^3 or less) dosage rates.

Use feeds capable of gradual adjustment while in operation. Use continuously correcting automated gate openings and/or belt-feed rates by electronic feedback of weight sensor units on the belts if operation without them cannot provide the accuracy, consistency, and quality required by these specifications.
Provide individual silos for bulk cement and Pozzolan with ample size and so constructed that the various materials will remain separate under all working conditions. Separate all compartments containing cement and Pozzolan from each other by a free draining air space. Clearly mark cement and Pozzolan silos with signs to indicate the material contained in each silo.

(3) Cement and Pozzolan Feed

Feed cement and Pozzolan continuously in a manner that can be controlled by adjusting the belt speed or feed rate. Provide special attention to the cement (and Pozzolan) feed equipment so that it consistently and uniformly delivers materials even at low (100 lb./yd^3 or less) dosage rates. Metering and feed shall be designed and controlled so that cement is uniformly fed into the mixer or into the stream of aggregate on the feeder belt, all with necessary controls to prevent loss of cement as dust or in any other form. Control of the quantity of cement shall be linked either electronically or mechanically to the other feed systems. An electronic belt-weighing device shall be provided to meter and monitor the individual amount of cement delivered into the mixture.

(4) Water Control Units

Contractor shall provide a water dispenser that is capable of dispensing the mix water within the specified requirements. Contractor shall also provide piping, valves, and other components that are free from leakage for delivering water to the mixer. Water may be weighed or metered by an in-line volumetrically activated flow meter. The metering valve must be capable of gradual adjustment during the mixing process to compensate for varying moisture contents in the aggregates. Contractor shall use valves that are automatically controlled and will close if the cement, Pozzolan, or aggregate stops entering the mixer at the required rate. This control may be bypassed for cleaning operation. When the quantity of water is controlled by metering, provisions shall be made where the quantity of water delivered through the meter can be checked readily by weight. A water storage tank shall be provided to prevent surge drawdown effects.

(5) Mixer

The mixer unit shall be a stationary mixer of the twin-shaft pugmill type capable of producing a uniform homogenous mixture of the required soil cement materials within tolerances specified. Blades shall be adjustable for angular position on shafts and reversible to retard flow of mix. The mixer shall bear a manufacturer's plate indicating net volumetric contents of mixer at several heights inscribed on a permanent gate and the rate of feed of aggregate per minute at plant-operating speed.

(6) Discharge Hopper

A discharge hopper with a minimum capacity of five cubic yards shall be provided wherever the mixed soil cement temporarily accumulated before loading into trucks or conveyors for transport. The hopper shall be equipped with vibrators and dump gates that will permit rapid and complete discharge of soil cement without segregation. Hopper shall be constructed with side slopes, baffles, and gates as necessary to prevent segregation of the soil cement mixture. When discharging soil cement from conveyors into the hopper, the drop height shall not exceed 5 feet. When loading soil cement into trucks, scrapers, or other transport equipment, the maximum drop from the bottom of the discharge hopper to the bed of the transport equipment shall not exceed 5 feet. Telephone or radio communication between the discharge hoppers, the mixing plant, and the placement site shall be provided.

(7) Chutes and Drop Tubes

Unless specifically authorized in writing, chutes or uncontrolled drops exceeding 5 feet will not be permitted.

(8) Conveyors

Contractor shall design and/or provide conveyors and transfer components for low maintenance, continuous operation with clean return belt surfaces and without segregation or excessive loss of material. Fit all belts with covers or shields to prevent drying by the wind and sun, and over-wetting from rain. The maximum free fall drop from conveyors is 5 feet.

(9) Sampling Facilities

Suitable facilities and labor shall be provided for obtaining representative samples of materials as they enter the mixer, are discharged from the mixer, are discharged from the discharge hopper and from the placement after spreading. Contractor shall furnish all necessary platforms and equipment for obtaining samples, which will be used for quality control and quality assurance testing.

(10) Equipment Substitutions

After equipment is demonstrated as suitable for production and placement, as indicated by Contractor submittals, calibration report(s), and the trial placement, no substitution of equipment will be permitted without prior written approval by the Engineer.

310.03.06 SOIL CEMENT TRANSPORTING, PLACING, SPREADING, AND COMPACTING

A. General

The soil cement mass shall be constructed in as nearly a continuous operation as is practical. The spillway face, cut-off wall, and open channel cross section shall rise at essentially the same level across the entire area. As placement of a lift progresses, the exposed edges shall be kept "live" by progressively placing out from them. Whenever a cold joint at any edge of any lift does occur, it shall be prepared as required in the ***Subsection 310.03.07, "Joints Lift and Construction Joints."*** The rate and schedule of placement shall minimize the occurrence of cold joints. All surfaces of the concrete outlet conduit against which soil cement is to be placed shall be clean, free of dirt, oil, and grease, and properly prepared prior to placement of soil cement. All dirt, mud, water, and debris shall be removed from the space to be occupied by soil cement; all surfaces encrusted with dried soil cement from previous placement operations shall be cleaned; and the entire installation shall be acceptable to the Engineer.

B. Time Requirements

The time from mixing the soil cement to depositing it shall not exceed 20 minutes and the time from depositing the soil cement to spreading it shall not exceed 10 minutes. The compaction operation shall be started within 45 minutes after the addition of water to the soil cement moisture at the plant, and within 20 minutes after completion of spreading. Final compaction of any volume of soil cement shall be completed within one hour of the time at which water was introduced into that volume of soil cement mixture at the mixing plant.

C. Subgrade Preparation

Before placing soil cement, the subgrade shall be prepared as described in ***Section 203, "Excavation and Embankment."*** Immediately prior to the placement of the bedding mix, the receiving surfaces shall be in a moist condition. Contractor shall not cover exposed slopes with bedding mix until the area has been approved by the Engineer.

D. Slope Preparation

Before placing soil cement, the embankment slope face shall be uniform, dense and free of loose ravels or otherwise unsuitable materials. Density of the slope face shall be equal to the density specified for embankment construction. Immediately prior to the placement of soil cement, the receiving surfaces shall be in a moist condition.

E. Embedments

All embedments such as weep hole drain conduits shall be accurately positioned and securely anchored in place. Embedment surfaces shall be clean when installed.

F. Transporting

Soil Cement shall be transported from mixer to placement area as rapidly as practicable by methods which minimize segregation, contamination and drying. Trucks, conveyors, or other equipment acceptable to the Engineer may be used to transport soil cement to the placement area.

Soil cement may be hauled using trucks, large front-end loaders, or scrapers to various locations on the placement area. Tracked haul vehicles will not be permitted. Contractor shall use bottom-dump haul vehicles, end dump trucks with special tail gates or drop control methods that demonstrate an ability to handle dumping without excessive segregation, and/or front-end loaders. The haul vehicles must be free of deleterious materials including, but not limited to, oil, grease, loose, deteriorated, or dry soil cement and soil. The maximum free fall drop height from hauling vehicles is 5 feet.

Equipment will not be allowed to track mud or other contamination onto previously placed soil cement. This may require using clean crushed rock on haul roads, washing tires of vehicles prior to driving onto the soil cement prior to placing the next lift, or other special measures. Any segregated soil cement that results from using haul vehicles shall be removed by hand or re-blended. Haul vehicles shall be operated in a manner that precludes tight turns, sudden stops, or other procedures by vehicle operations (oil spills, etc.), it shall be cleaned or the damaged material shall be removed.

G. Conveying

Conveyor belt systems or mobile crane conveyors may be used for final deposition of the soil cement into place for spreading and compaction. The conveyor system and soil cement shall be designed and manufactured by personnel fully experienced with conveyor belt delivery of low slump mass concrete and shall be designed specifically for continuous operation at speeds that meet production requirements and do not segregate materials.

Conveyors shall be equipped with protection devices as necessary to prevent leakage of lubricants or other foreign materials onto the belts or onto the soil cement surfaces below. Conveying equipment shall be outfitted with suitable hoppers at all transfer points if soil cement is transported to the conveyor by truck or other vehicular equipment. If necessary Contractor shall provide baffles at the end of conveyors and within hoppers to limit free fall heights to 5-feet and at other locations that otherwise cause excessive segregation.

H. Placing and Spreading

(1) General

The Contractor is cautioned to understand and apply applicable fall protection requirements to all work on the site. The Contractor is responsible for all health and safety requirements at the site.

(2) Layout of the Placement Area

It is the intent of this specification to raise the soil cement at essentially the same level across its entire area. As nearly as is practical, expose no more than two lift surfaces at one time. One additional layer may be exposed under special circumstances such as crossing conduits or other features. Maintain lift grade control by using grade stakes and/or laser-guided equipment, or other surveying methods. Whenever a cold joint at any edge of any lift occurs, locate it at least 10 feet horizontally from the location of other cold joints that may have occurred previously. Prepare the joint as required by ***Subsection 310.03.07, "Joints Lift and Construction Joints"*** of these specifications for "cold joints" prior to resumption of soil cement placement.

(3) Depositing

Deposit soil cement at the location at which it is to be spread. Where haul vehicle delivery is used, depositing will generally be accomplished with a dump-spread action while the vehicle is moving. When stationary end dumping is necessary, deposit the material on top of the fresh soil cement layer being advanced, not on the previously compacted layer. Do not place material in piles higher than 3 feet. For belt delivery, limit pile heights to 3 feet and discharge from the belts in a manner that does not cause segregation. If trucks are used to deliver soil cement, do not discharge material directly against any formwork. At isolated or confined placement locations, the Engineer may permit pushing the soil cement up to 50 feet with spreading equipment, provided that segregation does not occur. Modify operations if the Engineer determines that excessive segregation is occurring.

(4) Spreading

Within 10 minutes after depositing, the mix shall be spread into an even layer that will, after compaction, be 12-inches thick, unless another lift thickness is satisfactorily demonstrated and approved during the trial placement. (Do not place soil cement in compacted lifts unless they are 4-inches thick.) Where soil cement is spread onto or into a bedding mortar, spreading shall be accomplished before the bedding has begun to set, but no more than 90 minutes from the time the bedding mix was batched and within 45 minutes of when the bedding mix was first deposited.

Spreading shall be accomplished with low contact pressure equipment, such as a track-type dozer and must be capable of placing the soil cement in uniform lifts and without segregation. The suitability and acceptance of any spreading equipment will be based on the results of the test section. Do not operate tracked spreading equipment on compacted soil cement unless tracks with flat rubber pads are used or rubber mats are placed between the compacted surface and the dozer tracks. Remove any loose material resulting from operation of equipment on compacted surfaces prior to placing the next lift. Have a front-end loader with operator available to assist with depositing and spreading of material in confined areas, at irregular foundation conditions, and at other locations as needed. Accomplish spreading in a manner that does not cause segregation. If large aggregate rolls or segregates to the outside edge of a spread layer of soil cement, reblend it into the soil cement or remove it. Maintain all equipment in good operating condition so that it does not leak or drip oil, grease, or other obvious visible contamination onto the soil cement. Do not place concrete on a previous layer which is suspect and is being considered for testing, retesting, or rejection, or has not been completely compacted.

Soil cement may be placed with an approved tamping paver. Adjust the paver and regulate the speed to prevent segregation. Do not exceed a paver speed of 10 feet per minute unless it can be demonstrated to the satisfaction of the Engineer that higher speeds do not cause problems. Operate the paver with a constant supply of soil cement in the hopper.

I. Compaction

(1) Compaction Procedures

At the start of compaction, the mixture shall be in a uniform, loose condition throughout the full depth, and at the specified optimum moisture content. The specified moisture content shall be maintained uniformly throughout the layer of material being compacted. Concrete lifts shall not be left undisturbed for longer than 30 minutes during compaction operations.

If necessary, moisture shall be added during the compaction operation to maintain the uncompacted mixture at its optimum moisture content.

(2) Compaction

Compact each 12-inch layer of soil cement with a minimum of 4 passes of a self-propelled double drum or 8 passes of a self-propelled, single-drum vibratory compactor. (A round trip is 2 passes). Use the largest size equipment specified below that is capable of physical and practical operation in the area to be compacted. Use small walk-behind vibratory rollers and/or hand-guided power tampers for compaction in any areas that cannot be reached with the drum of a large vibratory roller. Do not operate rollers in the vibratory mode until they are moving. Maintain all compaction equipment in good operating condition at all times and do not allow it to drip or spill oil or other obvious visible contamination onto the soil cement. Break down, trim, and compact the edge of all compacted layers against which adjacent soil cement is not placed within 30 minutes so that the edge is thoroughly compacted and does not contain loose segregated aggregate. Spread and roll so that a flat surface results with minimum roller marks from the edge of the drum, and so that the drum does not bridge over any of the surface beneath the roller drum after the last pass. Operate rollers at speeds not exceeding 160 feet per minute.

(3) Acceptance

Compacted soil cement shall be within 2 percent of optimum moisture content. No individual compaction density test shall be less than 95% of the optimum compaction density value. Determine the average wet density from the average of two readings taken with the gauge probe at a depth 2 inches from the bottom of the lift. If the two readings vary by more than 2%, repeat the density test. If it is demonstrated early in production that the two readings are consistently within 2%, the two readings can be reduced to one. Also measure densities with the gauge probe at 6 inches; however, this reading will not be used to compute the average density.

(4) Additional Compaction

If, after testing, the soil cement does not meet the required density, it may be compacted with additional roller passes, provided that the time limit in Subsection 310.03.06B has not been exceeded.

(5) Removal of Material

If the time limit specified in Subsection 310.03.06B has been exceeded and the soil cement has not achieved the required density, or if the mixture is wetted by rain so that the average moisture content exceeds the specified moisture requirements before achieving compaction, remove the soil cement full depth and replace it at no cost to the Owner. Clean the underlying surface and treat as a lift surface cold joint prior to replacing the removed soil cement with new material.

(6) Compaction Requirements

The Contractor will determine the optimum compaction density value during the trial placement. The optimum compaction density value is the highest density attainable using the specified soil cement mix proportions and the equipment approved for soil cement construction. Nuclear density readings are taken after two roller passes in the trial placement until there is no increase in density or the increase is less than 0.1 lb./pass. Final evaluation of density results for the determination of the optimum compaction density value will be made only after all major field adjustments have been made and the mix design is considered to represent soil cement that has suitable placement, spreading, and compaction characteristics, and provides the required strength and porosity values. Small field adjustments to the optimum compaction density value may be made throughout construction based upon the running average density value. Such changes may be made based on slight changes or long-term drift of density values resulting from field mix design adjustments.

(7) Compaction Equipment

Large-width, self-propelled vibratory rollers shall be used in open areas; small vibratory rollers shall be used within 3 feet of the cast-in-place concrete and at irregular areas; and hand-guided power tampers shall be used for compaction in any areas that cannot be reached with the drum of a vibratory roller. Rollers shall not be operated in the vibratory mode until they are moving. All compacting equipment shall be kept in good operating condition at all times and will not be allowed to drip or spill oil or other visible contamination onto the soil cement.

Self-Propelled Rollers: Contractor shall provide single or double drum, self-propelled vibratory rollers that transmit a dynamic impact to the surface through a smooth steel drum by means of

revolving weights, eccentric shafts, or other equivalent methods. Use compactors with gross weights of not less than 21,000 lb., minimum dynamic force of at least 475 lb. per inch of drum width at the operating frequency used during construction, vibrating frequency of at least 1500 cpm (cycles per minute), drum diameter between 4 and 6 feet, drum width of 5 to 8 feet, and engine horsepower of at least 125. The roller shall be operated at speeds not exceeding 1.5 miles per hour. Within the range of the operational capability of the equipment, the Engineer may direct or allow variations to the frequency and speed of operation which result in maximum density at the fastest production rate. Any other compaction equipment proposed must demonstrate that it is capable of compacting the soil cement full depth to the specified density prior to soil cement production. Provide at least one fully operable, self-propelled vibratory roller on the placement area at all times during production placement. Standby replacement equipment shall be available within an hour, if needed.

Power Tampers and Small Vibratory Rollers: Contractor shall use small vibratory rollers that can operate within a few inches of a vertical face to compact the soil cement adjacent to formwork, precast panels conventional concrete structures, abutment slopes, and at other areas where the large vibratory rollers specified above cannot maneuver. Contractor shall provide rollers with a dynamic force of at least 150 lb./in of drum width for each drum of a double drum unit and at least 300 lb./in of drum width for a single drum unit. Provide at least one fully operable, small roller at the site during soil cement placement.

Contractor shall provide tampers, plates, and rammers that develop a force per blow of at least 3500 lb. per square foot. Contractor shall maintain at least two tampers, plates, or rammers in good operating condition at the site during soil cement placement.

The amount of rolling and tamping required shall be whatever is necessary for the particular equipment to provide the specified degree of compaction. Contractor shall reduce the lift thickness as required to achieve the specified compaction in locations where power tampers and small vibratory rollers are used. Contractor shall conduct field tests with proposed equipment of rolling and tamping as required to comply with specifications. Standby replacement equipment shall be available as needed.

310.03.07 JOINTS LIFT AND CONSTRUCTION JOINTS

A. General

It is the intent of this specification to place the entire soil cement mass with sufficient continuity so that it hardens and acts as a monolithic block without discontinuous joints or potential planes of separation. The length of time between placement of successive layers of soil cement that can be tolerated is dependent upon temperature. Joint quality is also dependent upon cleanliness, surface moisture and whether a bedding mix is applied. When the limits between successive lifts of soil cement layers exceed those specified herein, a cold joint will be considered to have occurred, and the procedures described for cold joints in this section.

Routine Lift Surface Treatment: Keep joint surfaces in a clean, uncontaminated, and continuously moist condition until placement of the succeeding soil cement. At a minimum, the Contractor should anticipate blowing every lift surface with compressed air if loose material and contamination are present. Employ a system to continuously maintain lift surfaces in a moist, but not wet, condition. The system may consist of, or be supplemented as necessary by, mists and

light sprays from hand-held hoses to reach all areas of each lift. Heavy sprays from water trucks provide too much water and are not acceptable. Water trucks may be used if they can provide a fine spray or mist. Do not apply the mist or spray in a channeled or pressurized manner that may erode the fresh soil cement surface or at a rate that causes ponding on the surface. Have one person on duty during the soil cement placement operation with the sole responsibility of operating the water system to keep the entire surface moist but not over-watered. He may be allowed to perform routine maintenance of nozzles and move hoses only if these activities do not prevent him from keeping the entire exposed surface in a continuously damp condition. During non-placement hours the soil cement shall be maintained in a moist condition either by on-site personnel or by covering the lift with tarps or plastic.

B. Lift Surface Cold Joints

A cold joint on a lift surface will be considered to have occurred when a period of more than 4 hours has elapsed (from May to September), and a period of more than 8 hours has elapsed (from October to April) before placement of the successive lift. Prepare cold joints for the subsequent lift by removing all laitance, loose debris, and contaminants from the entire surface. Expose, but do not undercut the aggregate with the cleaning procedure. At this stage of maturity, use water jetting if air alone does not satisfactorily prepare the surface. After preparation, maintain the surface in a damp condition and place a layer of bedding mix with an average thickness as specified in ***Subsection 310.02.05, "Bedding Mix."***

C. Lift Edge Cold Joints

A cold joint on a lift edge will be considered to have occurred when more than 30 minutes has elapsed since placement of the material at the lift edge. Treat the cold joint prior to resuming soil cement placement by cutting back into the compacted cement providing a vertical full depth joint. The cold joint shall be transverse to the layer direction and located a minimum 6" inside the lift edge. Joints shall be staggered to inhibit cracking. Prior to subsequent lift, clean joint of laitance, loose debris and contaminates from the joint edge.

D. Lining Joints at Structures

The joints between the soil cement lining and concrete structures shall be 1-inch premolded elastomeric joint filler.

310.03.08 FINISH TREATMENTS AND TOLERANCES

The finish treatment and tolerances for soil cement shall be as specified herein.

A. Facing Finish Treatment

(1) Forming: Construct the exposed face of the soil cement as shown on the drawings and as specified herein. Select a forming system and demonstrate at the soil cement test section that it will provide soil cement surfaces within the specified tolerances and acceptable texture.

(2) Forms: Form the steps and any other exposed soil cement face to provide the finished surfaces shown on the drawings. Construct all formwork as specified. The Contractor is

responsible for the design of the formwork, as well as its construction in ***Section 502, "Concrete Structures."*** Provide and construct forms with sufficient strength to withstand the pressure resulting from placement and compaction of the soil cement and with sufficient rigidity to maintain specified tolerances. Forms need not be mortar tight if bedding mix is not used.

(3) Repairs: It is the intent of these specifications to require forms and soil cement workmanship be such that soil cement surfaces will require no repairs after form removal. The workability of the soil cement may need to be adjusted such that the concrete can be fully consolidated against the forms. It is anticipated that form work will have to be strengthened to resist lateral forces exerted by compaction equipment. As soon as the forms have been stripped and the formed surfaces exposed, the Engineer will inspect the formed surface to determine if there is adequate consolidation, excessive honeycomb, or other defects. The soil cement test section shall be used as a "Paint Chip" as to what texture and degree of honeycombing is acceptable and what is not. If the defects are excessive, clean the defective areas of loose or unconsolidated material and repair with conventional concrete at no cost to the Owner.

(4) Compaction: Compact the soil cement as specified in ***Subsection 310.03.06, "*Soil Cement Transporting, Placing, Spreading, and Compacting*."***

(5) Tolerances: See Subsection 310.03.08B.

B. Structural Tolerances

(1) General: Construct within the tolerances specified in ***Section 502, "Concrete Structures"*** except as supplemented or modified below.

(2) Specific Requirements:

a. Limit overbuild of the downstream face of the soil cement to 1 inches. Underbuild will not be allowed.

b. Do not vary the downstream edge of any soil cement lift by more than 1 inches in 100 feet.

c. Construct the thickness of individual compacted layers of soil cement within plus or minus 2 inches of that stipulated.

d. Keep the elevation of the surfaces of roller-compacted concrete layers upon which subsequent concrete is placed within 5 inches from the design elevation. Additionally, keep the elevation of the top three lifts within 2 inches of that shown on the drawings.

e. Do not vary the upstream and downstream edges of the finished top of structure by more than 2 inches in 10 feet. Do not exceed the plan width by more than 2 inches. Place the top lift such that the final elevation of the top soil cement layer is within 2 inches of that shown on the drawings and does not vary more than 1 inch in 10 feet. Underbuild will not be allowed.

f. Surface irregularities are solely the responsibility of the contractor.

310.03.09 REQUIREMENT AND LIMITATIONS

Contractor may be required to alter soil cement placement operations, or halt placement operations, to minimize the detrimental effects of adverse weather on the soil cement.

A. Hot Weather Soil Cement Placement

The Contractor shall protect the soil cement from moisture loss during hot weather. Soil cement placement shall be suspended if high ambient temperatures and/or wind dry the uncompacted soil cement mixture so that adequate compaction is not possible. The surface of soil cement upon which subsequent soil cement will be placed shall be kept continuously damp. During daylight hours the maximum temperature of the soil cement mixture immediately prior to compaction shall not exceed 85°F. If the Contractor places soil cement during the night between 8:00 p.m. to 8:00 a.m., the maximum temperature of the soil cement mixture immediately prior to compaction shall not exceed 90°F. The temperature will be measured at the point where the soil cement is delivered to the lift surface. Contractor shall take all precautions necessary to control the placement temperature of soil cement including, but not limited to, sprinkling stockpiles, use of chilled water or liquid nitrogen, use of sun screens, or nighttime placement.

B. Cold Weather Soil Cement Placement

Soil cement shall not be placed when ambient air temperatures drop below 32°F. In the event ambient temperatures drop below 32°F and the temperature of the soil cement mixture stays above 35°F, the Engineer may permit placing of soil cement for temporary periods provided the ambient temperature remains above 25°F. If the ambient temperature drops below 32°F or the surface of any soil cement less than 7 days old drops to 35°F, cover the surface with heavy tarps, blankets, straw, or other acceptable temporary protection until the ambient temperature rises above 35°F. Remove all soil cement that is less than 7 days old and is exposed to temperatures less than 32°F.

C. Rainfall

Soil Cement shall not be placed during heavy rain which is more than 0.20 inches per hour, or 0.03 inches in 6 minutes, as defined by the Weather Bureau Glossary of Meteorology. Contractor shall suspend production when free surface water begins to accumulate on the compacted soil cement when excessive pumping, tracking, or other unacceptable damage begins to develop, or when, in the opinion of the Engineer, rain is adversely affecting any aspect of quality. Contractor shall remove any uncompacted soil cement exposed to precipitation that, in the opinion of the Engineer, makes it unsuitable.

310.03.10 CURING AND PROTECTION

A. Cold Weather Protection

Keep the surface of all soil cement lift layers continuously damp and at a temperature above 35° F until it is covered with the next layer of soil cement. Comply with the temperature restrictions in ***Subsection 310.03.09B, "Cold Weather Soil Cement Placement."*** Measure the soil cement temperature with a digital thermometer equipped with a surface probe. Protect from erosion by

heavy rain and damage by water trucks all surfaces of soil cement layers upon which subsequent layers will be placed. Clean any surface damaged by erosion that undercuts coarse aggregates, and cover with bedding mix prior to placing next soil cement layer.

B. Moist Curing Requirements

Moist Curing Requirements: Keep the surface of all soil cement lift layers continuously damp until each is covered by the next layer or for a period of 14 days.

C. Use of Curing Compounds

Curing compounds will not be permitted on the soil cement.

310.03.11 QUALITY CONTROL AND TESTING

A. General

(1) Contractor shall establish and maintain an effective, on-site, quality control program in cooperation with the Owner and the Engineer for the soil cement concrete. The soil cement quality control program will be the means for ensuring compliance with contract requirements and for maintaining records of control, including all tests and inspections, their findings, and remedial actions taken when necessary. All testing and inspections described herein will be the responsibility of the Contractor. Density test results shall be made immediately available to the Owner and the Engineer. All lab test results will be provided to the Owner and the Engineer no more than 24 hours after test completion.

(2) Contractor shall establish and execute the quality control program under the supervision of a Soil Cement Quality Control Manager who will review and approve all activities concerning the production of materials, planning and scheduling of construction activities for placing soil cement, and the execution and evaluation of soil cement tests. Work closely with the Engineer and keep the Engineer advised of planned construction procedures, the placing schedule, the testing schedule, and results obtained from tests. Designate a Soil Cement Quality Control Manager for each shift. Several personnel may be required in the various areas of monitoring, testing, and reporting during the placement period. Make all information and test results available to the Engineer. Permit the Engineer full access to all construction and Contractor quality control activities.

(3) At a minimum, include the following processes in the soil cement Quality Control Program: Aggregate stockpiling and handling, aggregate testing, mixing requirements and mix proportions at the soil cement mixing plant, mix delivery, compaction, lift joints, material quality control, and all other tests and inspections required by these specifications. Establish the program as described in the following paragraphs.

B. Aggregate Gradation:

(1) Testing: At least once during each shift that soil cement is placed, and once during each shift that aggregates are delivered, test gradations and for the combined gradation of all aggregates mixed at the designated proportions. A retest sample is required for any gradation test out of specifications. The location where samples are taken will be selected

by the Engineer. Make provisions for accurate sampling of aggregates on feed belts to the soil cement mixing plant.

(2) Action Required: When a test result is outside of the specification limits, take a retest sample. If the retest sample is outside of the specification limits, suspend soil cement production until the problem is corrected. The Contractor will be responsible for all costs incurred as a result of soil cement placement suspension resulting from out-of specification materials.

C. Aggregate Moisture Determination

(1) Testing: At least once during each shift of soil cement placement for each aggregate size used, test the moisture in accordance with ASTM C566. The location where the sample is selected may be determined by the Contractor provided that it is typical of materials entering the mixer. The frequency of testing may be increased or decreased depending on moisture uniformity or variability as a project record is developed.

(2) Action Required: When moisture content determinations indicate a change in water entering the mix with the aggregates, contact the placement foreman to see if a corresponding adjustment in water added at the mixer is necessary to obtain adequate compaction and meet consistency requirements at the placement site.

D. Material Finer than the No. 200 Sieve

(1) Testing: During the first two weeks of aggregate stockpiling, perform tests every other day in accordance with ASTM C 117 to determine the amount of material passing the No. 200 sieve for the aggregate. After it has been established that a problem does not exist, and if production remains constant, continued testing will be required only once per week.

(2) Action: When test results for material finer that the No. 200 sieve are outside of the specification limits, take action to correct the deficiency. Suspend soil cement production until the problem is corrected. Materials produced "out of spec" may be blended with materials "in spec" so that the composite as used in soil cement meets specification requirements.

E. Aggregate Quantities

Accurately monitor and record the quantity of each aggregate produced, delivered, stockpiled, and used during each shift. Maintain a cumulative record of the amount of each aggregate produced or delivered, used in the permanent work, and wasted. Base quantities on saturated surface-dry (SSD) moisture conditions. Also record the moisture content.

F. Cement and Pozzolan Quantities

Accurately monitor and record the quantity of each material delivered and used during each shift and the quantities of materials stored onsite. Maintain a cumulative record of the amount of each material delivered, used in the permanent work, and wasted.

G. Soil Cement Mixing Plant Control

When the soil cement mixing plant is operating, continuously control the amount of all constituent materials including cement, Pozzolan, each size of aggregate, water and admixtures. Adjust the mixture proportions to compensate for free moisture in the aggregates as necessary. Prepare a daily report and submit to the Engineer before the start of the next shift indicating the type and source of cement used during that day, aggregate size groups and percentage used, required mix proportions per cubic yard for each mix design used, the amount of water as free moisture (above SSD) in each size of aggregate, and the aggregate weights per cubic yard of soil cement produced during plant operation. Also include in the report the total amount of each material used per shift. Include in the daily report the proportions for each batch, for batch plants, and for each one hour interval for a continuous plant.

H. Scales for Weight Batching

(1) Tests and Checking: Check the accuracy of scales with test weights prior to the startup of concreting operations. Retest the scales at least every month of operation thereafter. In addition, retest whenever there are variations in properties of the soil cement that could be the result of proportioning errors. When weight-batching procedures are used, frequently check the accuracy of each batching device during the startup of operations by noting and recording the required weight and the weight actually batched.

(2) Action Required: When either the weighing accuracy or batching accuracy is found not to comply with specification requirements, do not operate the plant until necessary adjustments or repairs have been made.

I. Volumetric Feed Calibrations

Check the accuracy of volumetric feeds by collecting all material delivered to the mixer during a unit of time. Provide suitable methods and equipment for obtaining and handling samples at the soil cement mixing plant. Determine the weight of material delivered to the mixer during a time interval between 5 to 15 minutes as determined by the Engineer, and calculate the resulting proportions of materials per cubic yard. Determine the accuracy of volumetric feeds at least three times during checkout of the soil cement mixing plant prior to production operations and soil cement placement. Recalibrate plant at least every 30 shifts or 5,000 cubic yards thereafter and whenever there are variations in the properties or control of the soil cement that could be the result of volumetric feed errors. Use samples of sufficient size to give accurate determinations. This may require sample weights in excess of 500 pounds per item checked.

J. Testing Soil Cement Mixers

(1) General: Sample and test fresh concrete for compliance with the specifications at the placing location. Provide a method of readily obtaining representative soil cement samples from the placement, the plant and gob hopper locations. Approximately 400 pounds of material will be required for each sample.

(2) Mixer Performance: A mixer performance test is required on a continuous pugmill plant only if the plant has not produced soil cement of similar proportions in the past. The tests may be required if the soil cement shows signs of nonuniformity or inconsistency in test results. In the event the test results show nonconformance with specifications, the Contractor shall

adjust mixer to meet specification, or replace with mixer that complies at Contractor's sole cost.

K. Temperature

(1) Testing: Measure and record the soil cement temperature on an hourly basis at the placement location. Perform additional tests when rapid set time or workability loss is reported by the placing foreman or Engineer, or during periods of hot weather. Record the temperature of the air and the soil cement during the period of cure and cold weather protection when those restrictions are applicable.

(2) Action Required: When soil cement temperature is outside the specification limits, suspend soil cement placement until the problem is corrected. Include temperatures as standard data in the quality control reports.

L. Moisture Content

(1) Tests and Checking: Determine the moisture content of the soil cement mix each time a density reading is taken with the nuclear gauge. Determine moisture content at the placement using a nuclear gauge in the backscatter mode immediately after compaction. Drive the probe to a depth of 2 inches above bottom of the lift for each reading. Calibrate the gauge against oven-dry samples of the mix design used. Verify the calibration to oven dry materials at least once per five shifts. Perform at least three tests in different areas of each layer of soil cement placed. Continuously monitor the apparent effectiveness of compaction equipment from a visual standpoint, and notify the mixing plant whenever the soil cement mix becomes too dry or too wet.

(2) Action Required: When moisture content tests indicate a significant change from what has been established as the optimum mixing and placing moisture, notify the placing foreman who will check the behavior of the mix under conditions at that time. When the placing foreman observes a condition of moisture that begins to consistently allow the vibratory rollers to sink excessively in the mix, cause excessive paste to develop at the surface, or leave an open, unconsolidated appearing surface, make an adjustment to the mix water added at the plant and record the adjustment.

M. Cement and Pozzolan

Visually monitor the cement and Pozzolan feed to the soil cement mix on a continuous basis throughout the operation of the soil cement mixing plant. In addition, directly measure and record the cement and Pozzolan contents of the soil cement, at 30-minute intervals and each time the silos are filled. Use a belt scale to measure the soil cement produced between mixing and loading. A load cell placed under the silos or volumetric measurement of the cement and Pozzolan used since the last silo filling will be acceptable methods of measuring the cement and Pozzolan usage. Report the cement and Pozzolan contents to the Engineer each time measurements are taken.

N. Soil Cement Specimens for Compression Tests

Forms for cylinders will be rigid reusable type with disposable liners. The Contractor shall prepare eight cylinders for testing per ASTM C39 for high strength soil cement and ASTM C42 for low

strength soil cement when requested by the Engineer (twice per shift). The Contractor will make, transport, cure, and test all samples (per ASTM C1435 and ASTM D558).

O. Density

(1) Nuclear gauge must be recently calibrated or during the trial placement, construct a soil cement block for nuclear gauge calibration. Make the block with a newly fabricated 30-inch diameter steel mold. Weigh the mold before, and after, filling with soil cement. Compute the density of the soil cement block and use this computed density to calibrate/check the nuclear density gauges.

(2) Tests and Checking: At least once every hour during placement, determine the density of the soil cement after compaction with a calibrated nuclear density gauge. Have at least one gauge on the placement area at all times. Test each layer of soil cement with the nuclear gauge every hour or 250 cubic yards, whichever is less, in at least 3 separate locations for wet density. Use the direct transmission mode. The Engineer may perform supplemental density testing with his own gauges.

(3) Action Required: When the nuclear gauge indicates a wet density less than required, perform a retest. If the retest indicates incomplete compaction, immediately provide additional rolling provided the time limits in ***Subsection 310.03.06B, "Time Requirements"*** are met, and determine whether the lower density resulted from insufficient passes of the roller, a change in the mix properties, or segregation at the bottom of the lift. If the mix properties have changed, suspend placement until the problem is corrected. If the problem persists and if the lower density is the result of inadequate rolling, notify the soil cement foreman. The Engineer may require full depth removal of the inadequately compacted material.

P. Compaction Equipment

(1) Tests and Checking: Before any compactor is used in soil cement construction, check it for correct dimensions, weight, vibratory frequency and amplitude; and cleanliness. At least once per 12 shifts of use, retest the frequency.

(2) Action Required: Remove compaction equipment not meeting the physical dimensions and weights required from the project. Correct any roller having improper frequency for soil cement compaction. Immediately notify roller operators running at speeds in excess of specification requirements or using improper compaction practices. Correct the problem or, if necessary, replace the operator.

Q. Dumping and Spreading

(1) Tests and Checking: Continually observe and monitor dumping and spreading operations to ensure that they are done in a manner that minimizes segregation. Routinely check each layer of soil cement in its spread condition for evenness and thickness, so that level, well-compacted layers within the specified thickness tolerance result after compaction. Determine the levelness, thickness, and elevation of each layer.

(2) Action Required: When thickness checks on uncompacted soil cement indicate an excess or shortage of material, immediately blade off or supplement the layer as needed. Whenever the thickness or elevation exceeds the allowable tolerances, notify the Engineer and he will determine what corrective action, if any, is necessary.

R. Preparation for Soil Cement Placement

Where applicable, inspect foundations, construction joints, forms, and embedded items in sufficient time prior to soil cement placement to assure that the area is ready to receive concrete. Check forms and facing panels for condition, support, alignment, and dimensions. The placing foreman will be the first level of supervision for all placing operations. The soil cement Quality Control Supervisor will determine if the specified mix is placed in the proper location, measure and record concrete temperatures, ambient temperatures, weather conditions, time of placement, yardage placed, and method of placement. Do not permit soil cement placement to begin until an adequate number of vibratory rollers and spreading equipment of the appropriate size, in working order, and with competent operators are available.

S. Curing and Surface Protection

(1) Continuous Moist Curing: At least every 2 hours, 7 days per week, inspect all areas subject to moist curing and lift surface protection. Record the surface moisture condition at that time. If any area has been allowed to dry, it will be considered as improperly cured.

(2) Action Required: Clean any area that has been allowed to dry more than 4 hours with a high-pressure water jet (3000 psi). Allow the surface to dry to a saturated surface dry condition and spread bedding mix prior to placing soil cement. If any area was allowed to dry less than 4 hours, clean it using a low-pressure water jet (500 psi) and prepare the surface as described above. The Engineer may require the Contractor to remove improperly cured soil cement.

(3) Protection: At least every 8 hours around the clock, 7 days per week, inspect all areas subject to cold-weather protection or protection against damage. Record any deficiencies. During removal of cold weather protection, measure concrete and ambient temperature at least every 2 hours. Record and provide temperature measurements to the Engineer on a daily basis.

T. Soil Cement Coring

The Contractor shall obtain 4-inch diameter cores at the locations directed by the Engineer. Obtain cores for the full depth of the soil cement placement and a minimum of 1-foot into the foundation rock (if placed on a rock foundation). Exercise special care to obtain cores in good condition from all holes. Place each core run in core boxes in the correct sequence. Separate the core runs with wooden blocks marked according to the measured depth at the end of each core run. If core loss occurs, place blocks with a similar diameter and a length equal to the core loss in the core box at the location of the core loss. Label the blocks with the amount of the core loss. If the loss area is not known, show the amount of loss on a wooden block with the letters D.O.R., "Distributed Over Run," marked on it and place the block just ahead of the "End of Run" block. Do not place cores from more than one hole in any box. Using a waterproof marker, label the inside of the lid and all four sides of the outside of the box with the hole number, box number, and depth

interval. Fasten the covers securely to the core box and deliver the box to the on-site core storage area. All testing of cores will be at the expense of the Contractor.

U. Thickness Testing

The engineer may request a thickness test text at any time to verity the placed thickness of soil cement. If a section of placed soil cement fails to meet the required thickness, additional tests will be done to determine the area that fails to meet these specifications. Areas that do not meet the required thickness as determined by the Engineer shall be subject to replacement:

V. Acceptance of Soil Cement – Acceptance and penalties for placed concrete shall be determined by the results of the 28 day compressive strength. Soil cement represented by the compressive strength tests which do not meet the minimum strength specified, will be subject to replacement. All soil cement represented by compressive strength test which do not provide at least 75 percent of the specified strength shall be removed and replaced unless allowed to remain in place by the Engineer.

The Contractor, at his own expense, can submit evidence that will indicate to the Engineer that the strength and quality of the soil cement is such that the concrete should be considered acceptable. The owner can perform its own individual testing to verify contractor testing.

If such evidence consists of concrete cores, the Contractor shall obtain three cores from the concrete represented by the failing strength test and deliver them to the Engineer in time to allow complete testing of such cores within 42 days after the placement of the concrete. All cores shall be obtained and tested in accordance with the requirements of AASHTO T-24. The concrete represented by the cores will be considered acceptable if the numerical average of three tests is 75 percent of the required 28-day compressive strength. If the average compressive strength does not meet this requirement, all concrete so represented shall be removed and replaced unless permitted to remain in place by the Engineer.

END OF SECTION 310

SECTION 409 – PORTLAND CEMENT CONCRETE PAVEMENT

DESCRIPTION

409.01.01 GENERAL

A. This work shall consist of a pavement composed of Portland cement concrete, with or without reinforcement as specified, constructed on a prepared subgrade or base course in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer.

B. At the option of the Contractor, concrete pavement may be constructed with equipment utilizing stationary side forms or by the use of slip-form paving equipment.

MATERIALS

409.02.01 MATERIALS

A. Materials shall conform to the requirements of the following sections and subsections:

Materials	Section/Subsection
Fine Aggregate	***706.03.03***
Coarse Aggregate	***706.03.01***
Hydraulic Cement	***701***
Water	***722***
Air-Entraining Admixtures	***702.03.02***
Joint Filler	***707.03.04***
Curing Materials	***702.03.01***
Reinforcement	***713***

B. An inadequate water supply shall be considered sufficient cause for delaying or stopping mixing operations. In case of a deficiency of water, the requirements for subgrade and curing concrete previously placed shall have priority over mixing.

409.02.02 GRADATION REQUIREMENTS

A. Gradation shall comply with ***Subsection 501.02.02, "Gradation Requirements."***

409.02.03 CONCRETE PROPERTIES AND TESTS

A. Portland cement concrete pavement shall be subject to the following requirements and test methods:

Test	Test Designation	Requirements
Flexural Strength of Concrete	ASTM C293	Minimum Modulus of Rupture: 450 psi

CONSTRUCTION

409.03.01 CLASSIFICATION AND PROPORTIONS

A. The Contractor shall notify the Engineer not less than 32 calendar days in advance of use of the proposed sources of materials and shall make arrangements for the Engineer to obtain samples as required for testing purposes.

1. When requested by the Contractor and allowed in writing by the Engineer, samples will not be required from aggregate sources previously tested within the past year.
2. Samples shall not exceed 500 pounds for each separate grading.
3. The Contractor shall furnish a written statement giving the cement factor in sacks per cubic yard; the proportions of cement, water, and each size of aggregate in saturated surface dry (SSD) condition; and the percentage of air in the concrete proposed for use in the work.
4. If the Contractor proposes to use an admixture other than an air-entraining agent, the Contractor shall state admixture's complete brand name and the quantity proposed to be used per sack of cement.
5. The Engineer, after making such tests as the Engineer deems advisable, will either accept the proposed materials and proportions or suggest modifications needed for acceptance.
6. After acceptance by the Engineer of batch proportions and materials, batch proportions and materials shall not be altered during the course of the work except as found necessary to maintain yield, cement factor, and unit weight within specification requirements.

B. Portland cement concrete shall be proportioned using the aggregates tested such that the requirements in Table 1 of this subsection will be satisfied without falling below the minimum or exceeding the maximum values given.

1. The cement factor of any individual batch placed in the work shall not be more than 0.15 sack per cubic yard less, nor more than 0.25 sack per cubic yard greater than the designated factor (sacks of cement per cubic yard).
2. Aggregates shall be batched and reported to the Engineer.
3. The weights used may be varied as necessary to comply with the above tolerances in cement factor and unit weight.
4. Coarse and fine aggregate in each batch of concrete shall be combined in proportions that will produce a mixture within the grading limits for combined aggregates specified as follows:

GRADING LIMITS OF COMBINED AGGREGATES

Sieve Sizes	Percentage Passing
2-inch	100
1-1/2-inch	90-100
1-inch	50-86
3/4-inch	45-75
3/8-inch	38-55
No. 4	30-45
No. 8	23-38
No. 16	15-33
No. 30	8-22
No. 50	4-13
No. 100	1-5
No. 200	0-3

TABLE 1 - CONCRETE PROPORTIONS

Class of Concrete	Sacks of Cement Per Cubic Yard		Coarse Aggregate Size No.	Maximum Water Gallons Per Sack Cement*	Slump Range Inches	Air Range %	Unit Weight Variation Pounds
	Min.	Max.					
P.C.A.	5.5	7	467	5.5	0-3**	4±1	±3
P.C.A.A.	6	7.5	467	5.5	0-3**	5±1	±3

*Based on aggregate in a saturated surface dry condition (SSD).

**The nominal slump in inches shall be 3 inches, the maximum slump shall be 3-1/2 inches. When the slump of concrete is found to exceed the nominal slump, the mixture shall be adjusted as directed by the Engineer to reduce slump to a value within the specified range. Four slump tests will be considered sufficient to determine nominal slump. The difference in slump, determined by comparing slump tests on 2 samples of mixed concrete for each individual batch tested, shall not exceed 1 inch. When the difference in slump does exceed 1 inch, procedure and equipment used in producing the concrete shall be adjusted to reduce the difference in slump to not more than 1 inch.

409.03.02 EQUIPMENT

A. **General:**

1. Equipment and tools necessary for handling materials and performing all parts of the work shall meet the approval of the Engineer as to design, capacity, and mechanical condition.
    a. This equipment shall be on the site and available for inspection, testing, and approval before paving operations are started.
    b. All equipment, tools, and machinery shall be maintained in a satisfactory working condition.
2. The Contractor shall provide equipment of such capacity that the paver will operate continuously or at a constant rate of production insofar as feasible. In the event that any piece of equipment does not have sufficient capacity to keep pace with the other operations, the Engineer may limit the size of the batch or otherwise limit the rate of production to prevent poor workmanship, overloading of equipment, or frequent delays.
3. Any equipment operating entirely or partially on the pavement, regardless of the age of the pavement, shall be equipped so that only rubber-tired wheels will come in contact with the pavement.
4. Aggregates and cement shall be proportioned by weight, except that when the amount of concrete required for any 1 contract is 10 cubic yards or less, the materials may be measured by volume. Materials that are proportioned by volume shall be measured in containers of known capacity.
5. Proportioning shall consist of combining the aggregates, each stored in a separate bin in the various gradations prescribed in ***Subsection 706.03.01, "Coarse Aggregate,"*** with cement and water.
    a. Weigh hoppers shall be charged from bins located directly over the hoppers or from conveyor belts.
    b. When conveyor belts are used, there shall be a separate belt for each size aggregate.
    c. There shall be an approved moisture meter installed to indicate the moisture in the sand.
6. Bulk cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge. The cement hopper shall be attached to a separate scale for individual weighing.
7. The amount of water to be added to the mixture shall be measured and discharged rapidly into the mixing drum through a valve with a positive cut-off. When water is measured by weight, the water shall be weighed on a separate scale.
8. All weighing or metering devices, except moisture meters used for proportioning materials, shall be accurate to within 1 percent.
    a. The devices shall be sealed and certified by the Nevada State Department of Weights and Measures.

b. These certifications shall be dated within the past 12 months and shall be renewed whenever required by the Engineer.

c. The moisture meter shall be accurate to within 1/2 of 1 percent.

d. Whenever portable bunkers are set up at a new location, the scale assemblies shall be inspected and certified regardless of the date the scales were last tested.

9. Scales used in proportioning shall be either springless dial or multiple beam type.

   a. Scale gradations shall be no greater than the following:

      1) Aggregate Scales: 25 pounds

      2) Cement Scales: 5 pounds

      3) Water Scales: 5 pounds

   b. All scales shall be of such size and so arranged that the scales may be read easily from the operator's platform.

   c. If a multiple beam type scale is used, the scale shall be provided with an indicator operated by the main beam that will give positive visible evidence of over or under weight.

   d. The indicator shall be designed to operate during the addition of the last 400 pounds of any weighing.

   e. The over travel of the indicator hand shall be at least 1/3 of the loading travel.

   f. Indicators shall be enclosed against moisture and dust.

10. Weighing equipment shall be insulated against vibration and movement of other operating equipment in the plant. When the entire plant is running, the scale reading at cut-off shall not vary from the weight designated by the Engineer by more than 1 percent for cement, 1 percent for water, 1-1/2 percent for any size of aggregate, or 1 percent for the total aggregate in any batch.

11. Machine mixing will be required in all cases other than those in which the mixing would obviously prove to be impractical, in which event hand mixing will be permitted. Mixing shall be commenced as soon as possible after the cement is placed in contact with the aggregates, but in no event shall the intervening period exceed 30 minutes.

12. All concrete mixers shall be of such design and construction and so operated as to provide a thoroughly and properly mixed concrete in which the ingredients are uniformly distributed.

    a. Mixers shall be maintained in proper and serviceable working condition and any part or portion thereof that is out of order, or becomes worn to such extent as to detrimentally affect the quality of mixing, shall be promptly repaired or replaced.

    b. Mixers shall not have any aluminum parts which will have direct contact with concrete.

B. **Concrete Consistency:**

1. The amount of water added at the mixer shall be regulated to take into account the free water in the aggregates. Free water is defined as the total water minus the water absorbed by the aggregate in a saturated surface dry condition.

2. The amount of water used in the mixture shall not exceed the minimum amount necessary to permit practical placement and consolidation of the concrete, and unless otherwise authorized by the Engineer, shall be that required to produce concrete with a slump within the range shown as nominal in the following table:

Type of Work	Nominal Slump Inches	Maximum Slump Inches
Concrete Pavement	0-3	3.5

3. The concrete used in the work shall not have a slump greater than that shown as maximum above, nor a free water content greater than 312 pounds per cubic yard of concrete.

4. The consistency of concrete shall be determined in accordance with ASTM C143.

5. If slump tests of individual samples taken at approximately the 1/4 and 3/4 points of the discharge differ by more than 2 inches, the mixer will not be acceptable for further use until the condition is corrected.

C. **Paving and Stationary Mixers:**

1. Paving and stationary mixers shall be equipped with an accurate automatic timing device so designed and constructed as to lock the discharge lever before aggregate and cement enter the drum, and release the lever only after the specified mixing time has elapsed. The regulation of the setting of the device shall be under the supervision of the Engineer. Water control equipment shall also be provided with each concrete mixer.

2. The proper proportions of aggregate, cement, and water for each batch of concrete shall be placed in the mixer, and shall be mixed for a period of not less than 1 minute after all materials are in the drum. The minimum mixing time, however, shall not be less than 1-1/2 minutes.

3. The rotating speed at which the mixer shall be operated shall conform to that recommended by the manufacturer.

4. The total volume of materials mixed in any 1 batch shall exceed neither the water level capacity of the mixer nor the manufacturer's guaranteed capacity of the mixer.

D. **Transit Mixers:**

1. The type, capacity, and manner of operation of the mixing and transporting equipment for ready-mix concrete shall conform to the current "Standards for Operation of Truck Mixers and Agitators of the National Ready-Mixed Concrete Association" and the "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau."

   a. Transit mix concrete trucks shall be equipped with an automatic device for recording the number of revolutions of the drum during the mixing period.

b. Each mixer and agitator shall have attached thereto, in a prominent place, a metal plate or plates installed by the manufacturer on which is plainly marked the capacity of the drum in terms of the volume of mixed concrete and the speed of rotation for the agitating and mixing speeds of the mixing drum or blades.

2. Each mixer shall have an identification number painted in a location on the truck that can be easily read from the batching platform.

3. The total volume of materials introduced into the mixer shall not exceed the manufacturer's guaranteed mixing capacity.

   a. If the concrete so mixed does not meet the uniformity requirements of this subsection, the amount of materials charged into the mixer shall be reduced.

   b. The drum of the mixer shall be completely emptied of previously mixed load.

   c. The proper proportions of aggregate, cement, and water for each load of concrete shall be placed in the mixer and shall be mixed therein for not less than 70 nor more than 100 revolutions of the drum or blades at the speed designated by the manufacturer of the equipment as mixing speed.

   d. Additional revolutions of the drum shall be at the speed designated by the manufacturer of the equipment as agitating speed.

   e. The revolving of the drum shall be continuous until the concrete is completely emptied from the drum.

4. When concrete is being placed for pavement structures, all wash water shall be emptied from the mixer before any portion of the succeeding load is placed therein. For all other work, the mixer shall be empty or may carry 10 gallons of water in the drum.

   a. Adequate control of ready-mixed concrete will normally require that additional water be added and mixed into the batch at the point of discharge.

   b. Water so added shall be mixed into the load for a minimum mixing time of 3 minutes.

   c. Water shall not be added to the load during transit.

   d. The total elapsed time between the addition of water at the batch plant and discharging the completed mix shall not exceed 60 minutes. Under conditions contributing to quick setting, the total elapsed time permitted may be reduced by the Engineer.

5. The Engineer shall be provided with a legible certified weighmaster's certificate at the job site for each load which shall contain the following information:

   a. Name of Vendor

   b. Name of Contractor

   c. Number of Cubic Yards in the Load

   d. Actual Weights of Cement and of Each Size of Aggregate

   e. Amount of Water Added at the Plant

   f. Amount of Water in the Aggregate

   g. Brand and Type of Cement

h. Brand and Amount of Admixture

i. Time and Date of Batching

6. When mix proportions have been designated for a project and are identified by number, the Engineer may waive the foregoing and accept a legible certified weighmaster's certificate which shall contain the following information:

a. Name of Vendor

b. Name of Contractor

c. Number of Cubic Yards in the Load

d. Mix Designation Number

e. Amount of Water Added at the Plant (including Water in Aggregate)

f. Time and Date of Batching

7. Space shall be provided on the certificate so that amount of water added on the job may be indicated.

E. **Forms and Headers:**

1. Forms and headers shall be either wood or metal, and shall be:

a. Set plumb and true to line and grade, with the upper edge thereof set to the grade of the pavement to be constructed.

b. Rigidly installed on a true alignment and so maintained for a distance in advance of placing the pavement to provide for at least a 1-day run of concrete.

2. Headers shall rest firmly on the subgrade or base. They shall be oiled immediately prior to the placing of the concrete and shall remain in place at least 12 hours after concrete has been placed.

3. Forms and headers shall be removed before the work will be accepted.

F. **Wooden Forms:**

1. Wooden forms shall be constructed of 3-inch nominal lumber in pieces not less than 16 feet long except where changes in alignment or grade necessitate the use of material of smaller dimensions. The lumber used shall:

a. Be free from warp and other imperfections that would impair the strength for the use intended.

b. Have square edges (which may be slightly beveled) and square ends.

c. Be surfaced on the upper edge.

d. Not be more than 1/2 inch less in depth than the specified thickness of the edge of the pavement.

2. Wooden forms shall be secured by nailing to side stakes spaced not more than 4 feet apart, driven into the subgrade vertically to a depth not less than 12 inches, and so that the tops will be below the upper edge of the header. The stakes shall be sufficient length and cross-sectional area to adequately resist lateral displacement of the headers during the paving operations.

3. Wooden headers shall be spliced by nailing a board to the outside of the headers. The board shall be at least 4 feet long, 1 inch thick, and at least 6 inches wide (or the depth of the header, whichever is less), and shall be centered on the joint.

G. **Metal Forms:**

1. Metal forms shall be free from warp, have sufficient rigidity to resist springing during the paving operations, and shall be not less in depth than the specified thickness of the edge of the pavement being constructed.

2. The forms shall be secured with metal stakes spaced not more than 5 feet apart and driven below the top of the forms.

3. The stakes shall be designed so as to be driven through openings in the forms to lock the forms in position.

H. **Slip Form Construction:**

1. At the option of the Contractor, and with the approval of the Engineer, concrete pavement may be constructed by the use of slip form paving equipment.

2. Slip form paving equipment shall be provided with traveling side forms of sufficient dimensions, shape, and strength to support the concrete laterally for a sufficient length of time during placement to produce pavement of the required cross section, and the equipment shall spread, consolidate, screed, and float-finish the freshly placed concrete to provide a dense and homogenous pavement.

3. The concrete shall be distributed uniformly into final position by the slip form paver and the horizontal deviation in alignment of the edges shall not exceed 1-1/4 inches from the alignment established by the Engineer.

4. The concrete, for the full paving width, shall be effectively consolidated by internal vibration, with transverse vibrating units, or with a series of longitudinal vibrating units. Internal vibration shall mean vibration by means of vibrating units located within the specified thickness of pavement section and at a minimum distance ahead of the screed equal to the pavement thickness.

5. When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels, offset to run a sufficient distance from the edge of the pavement to avoid breaking or cracking the pavement edge.

6. After the concrete has been given a preliminary finish by finishing devices incorporated in the slip form paving equipment, the surface of the fresh concrete shall be checked by the Contractor with a straightedge to the tolerance and finish required in ***Subsection 409.03.08, "Spreading, Compacting, and Shaping."***

7. The subgrade shall be moist at the time of placing concrete.

   a. The subgrade shall be thoroughly wet the night before or at least 6 hours prior to placing the concrete, and again sprinkled immediately before the concrete is placed on it.

   b. Sprinkling shall be such that mud and pools of water will not be formed.

   c. At the time of placing the concrete, the grade shall not be muddy, soft, or frozen.

409.03.05 REINFORCEMENT

A. Concrete pavement shall be reinforced at structure approaches and other locations as shown on the plans or directed by the Engineer, and as specified in this section.

B. Bar reinforcement shall conform to the provisions in ***Section 505, "Reinforcing Steel."***

C. Bar reinforcement shall be held accurately and firmly in position during the placing and compacting of the concrete without sagging by means of supporting devices which shall be left in place.

D. The supports shall be specially manufactured for the purpose and each support shall be capable of supporting a vertical load of 200 pounds.

409.03.07 PLACING CONCRETE

A. The Contractor shall make adequate advance arrangements for preventing delay in delivery and placing of the concrete.

1. An interval of more than 45 minutes between placing of any 2 consecutive batches or loads shall constitute cause for stopping paving operations.

2. The Contractor shall make a contact joint, at no additional cost to the Contracting Agency, at the location and of the type directed by the Engineer, in the concrete already placed.

B. Unless otherwise specified, concrete pavement shall be placed in 12-foot traffic lane widths separated by contact joints as shown on the plans, or, at the option of the Contractor, the concrete pavement may be placed monolithically 2 or more lanes wide without a contact joint, but with a longitudinal weakened plane joint at each traffic lane line.

C. All concrete shall be used while fresh. The use of water for retempering any concrete will not be permitted.

D. Any concrete showing improper proportions of materials, including water, shall not be used in the pavement and any such unsatisfactory concrete shall be removed and disposed of by the Contractor at no additional cost to the Contracting Agency.

E. The Contractor shall protect freshly placed concrete from damage by any cause and any damage shall be repaired by the Contractor at no additional cost to the Contracting Agency.

F. Expansion joint material shall be protected while depositing fresh concrete adjacent thereto.

G. Concrete work shall be adequately barricaded in all directions to protect the work.

409.03.08 SPREADING, COMPACTING, AND SHAPING

A. The concrete shall be consolidated and the surface finished true to grade and cross section.

1. Upon completion, the surface shall be free of any unevenness greater than 1/8 inch when checked with a 10-foot straightedge placed on the surface of the pavement.

2. The 10-foot straightedge shall be furnished by the Contractor and shall be at the site of the work prior to commencing concrete placement.

B. **Tamping:**

1. The concrete shall be distributed uniformly between the side forms as soon as the concrete is placed, after which the concrete shall be struck off and tamped with a mechanical tamper.

2. The tamper shall be operated at right angles to the centerline of the pavement, and tamping continued until the concrete is thoroughly consolidated to the specified cross section and sufficient mortar for finishing purposes has been brought to the surface.

3. Steel-shod hand tampers or vibrating bars may be substituted in those cases where the use of mechanical spreader and tamper would be obviously impracticable.

4. Approved concrete vibrating equipment shall be used in conjunction with the mechanical tamper to consolidate the concrete adjacent to the forms or existing pavement.

C. **Floating:**

1. After tamping, the surface of the concrete shall be floated by either the finishing machine method or the transverse float method described below.

2. Bridge decks may be floated by the longitudinal float method.

3. **Finishing Machine Method:** The concrete shall be floated smooth and true to grade with an approved finishing machine.

4. **Transverse Float Method:**

   a. The concrete shall be floated at least twice with a long-handled float at least 5 feet wide, after which the surface of the concrete shall be finished smooth and true to grade with a wooden float 16 feet long, 2 inches thick, and 6 inches wide.

   b. The float shall be rigidly ribbed and with adjustable screws between the rib and float board to ensure a true and flat surface on the underside at all times.

   c. The float shall be operated from the side of the pavement, and parallel with the centerline.

   d. The edge of the float shall be used to cut down all high areas, and the material so removed shall be floated into the depressions until a true surface is obtained.

   e. Each successive pass of the float shall halflap the previous pass.

   f. The float shall be operated as far behind the tamping machine as the workability of the concrete will permit before its initial set.

5. **Longitudinal Float Method:**

   a. The concrete shall first be floated with a double-handled longitudinal float not less than 16 feet nor more than 20 feet in length, having a trowelling surface not less than 8 inches nor more than 10 inches wide.

   b. The float shall be operated from bridges over the pavement with its length parallel to the centerline of the improvement, and shall be worked back and forth transversely across the slab, planing off high spots and filling depressions.

c. Floating shall continue until the surface is reasonably smooth, after which the bridges may be advanced not to exceed 2/3 the length of the surface so floated, and the operation continued.

D. After being finished by one of the above methods, the outside edges of pavement shall be rounded to a 1/2-inch radius; and transverse contact joints, expansion joints, and joints adjacent to an existing pavement shall be rounded to a 1/4-inch radius.

E. A strip of wetted burlap shall be provided, of a length not less than the width of the pavement slab.

1. The burlap shall be attached by 1 edge to a rigid frame supported over the pavement so that the free edge of the burlap will rest or drag on the surface of the concrete.

2. The burlap shall be dragged back and forth longitudinally along the pavement until the surface of the slab is of uniform texture appearance throughout its entire length.

409.03.09 JOINTS

A. Joints in concrete pavement will be designated as longitudinal and transverse contact joints, transverse expansion joints, and longitudinal and transverse weakened plane joints. Unless otherwise specified:

1. Transverse joints shall be constructed perpendicular to the centerline of the pavement.

2. Longitudinal joints shall be constructed parallel to the centerline of the pavement.

3. The faces of all joints shall be perpendicular to the finished surface of the pavement.

B. Joint filler, when required, will be as designated on the plans or in the Special Provisions.

C. **Contact Joints:**

1. Contact joints are those made by placing fresh concrete against hardened concrete at planned locations. Contact joints shall be constructed at the locations and in the manner shown on the plans.

2. Longitudinal contact joints shall be constructed by one of the following methods: A plain face, the use of tie bars, or the construction of keyways. Tie bars or keyways will be as designated on the plans or in the Special Provisions.

D. **Transverse Expansion Joints:**

1. Transverse expansion joints shall be installed at locations shown on the plans.

2. Expansion joint filler material shall have a minimum thickness of 1/2 inch, a maximum thickness of 3/4 inch, and a depth equal to the thickness of the pavement, and shall be composed of materials as specified in the Special Provisions or approved by the Engineer.

3. After the concrete has been finished, an edger of 1/4-inch radius shall be used on each side of the expansion joint filler. The expansion joint filler shall be cleaned of all concrete mortar.

E. **Weakened Plane Joints:**

1. Weakened plane joints shall be constructed at the locations shown on the plans and shall be formed by cutting a groove in the pavement with a power driven saw.

a. The groove for a transverse joint shall be cut to a minimum depth of 1-1/2 inches or 1/6 of the pavement thickness, whichever is greater; the groove for a longitudinal joint shall be cut to a depth of 1/4 of the pavement thickness; and the width shall be a minimum width possible with the saw being used, but in no case shall the width exceed 1/4 inch.

b. Any portion of the sealing compound which has been disturbed by sawing operations shall be restored by spraying the areas with additional sealing compound.

c. In the initial lane of concrete, the first transverse weakened plane joint immediately following a transverse contact joint, and every fourth weakened plane joint thereafter, shall be sawed within 10 to 24 hours after the concrete has been placed.

d. The time lapse will be subject to the approval of the Engineer.

e. Every second transverse weakened plane joint shall be sawed within 24 hours after the concrete is placed, and the remaining weakened plane joints may be sawed at such time as the Contractor may elect; except that in any lane, all weakened plane joints shall be sawed before concrete is placed in succeeding adjacent lanes and before any traffic whatsoever is permitted to use the pavement.

2. In succeeding adjacent lanes of concrete pavement, transverse weakened plane joints opposite those which have been sawed in the initial lane shall be sawed within 10 to 24 hours after the concrete has been placed.

a. The time lapse will be subject to the approval of the Engineer.

b. In all cases, no more than three consecutive transverse weakened plane joints shall be bypassed.

3. At the option of the Contractor, longitudinal weakened plane joints may be used at traffic lane lines in multi-lane monolithic concrete pavement in lieu of longitudinal contact joints. Dowel requirements will be as designated on the plans or in the Special Provisions.

409.03.10 CURING

A. **General:**

1. All Portland cement concrete pavement shall be cured for 72 hours by the methods specified in this section, subject to the conditions set forth in ***Subsection 501.03.09.A.1, "General."***

2. In case of low temperatures, the curing period will be increased according to the provisions of ***Subsection 501.03.10.B, "Cold Weather - General."***

B. **Curing Compound Method:**

1. Curing by use of curing compound shall be as specified in ***Subsection 501.03.09.A.3, "Curing Compound Method."*** The curing compound shall not be applied until all patching and surface finishing, except grinding, have been completed.

2. When deemed necessary by the Engineer during periods of hot weather, fogging of the concrete with water shall be continued after curing compound is applied or until the Engineer determines that a cooling effect is no longer required.

C. **Waterproof Membrane Method:** Curing by use of waterproof membrane material shall be as specified in ***Subsection 501.03.09.A.4, "Waterproof Membrane."***

409.03.11 PROTECTION OF PAVEMENT

A. Concrete shall not be placed on frozen ground nor shall concrete be mixed or placed while the atmospheric temperature is below 35 degrees F unless adequate means are employed to heat the aggregates and water, and provision satisfactory to the Engineer has been made for protecting the work.

B. Placing the concrete shall be stopped before rainfall is sufficient to cause a flow or wash the surface.

C. Upon written notice from the Engineer, all concrete which has been damaged shall be replaced by the Contractor at no additional cost to the Contracting Agency.

D. All concrete in pavement shall be protected from freezing or frost for a period of 5 days after placing. The temperature of the surface of the concrete shall not be allowed to drop below 40 degrees F for this period of 5 days.

E. When ordered by the Engineer or shown in the contract documents, pavement crossings shall be constructed for the convenience of public traffic.

1. The material and work necessary for the construction of these ramps, and subsequent removal and disposal of the ramps, will be paid for at the contract unit prices for the items of work involved.

2. BLANK

3. Where public traffic will be required to cross over the new pavement, Type III Portland cement shall be used in concrete.

4. When Type III Portland cement is used in concrete, and if permitted in writing by the Engineer, the pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 450 psi.

F. No traffic or Contractor's equipment, except for subgrading equipment, will be permitted on the pavement before a period of 10 calendar days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 450 psi, as determined by Test Method ASTM C293. Concrete that fails to attain a modulus of rupture of 450 psi within 10 days shall not be opened to traffic until directed by the Engineer.

G. Equipment used to prepare subgrade may be permitted to ride upon one edge of the previously placed concrete at the end of 72 hours, provided, however, that no damage is done to the pavement edge by reason of such operation. Any damage to the pavement resulting from such operations shall be repaired by the Contractor at no additional cost to the Contracting Agency prior to placing the adjacent lane.

END OF SECTION 409

SECTION 501 – PORTLAND CEMENT CONCRETE

DESCRIPTION

501.01.01 GENERAL

A. This work shall consist of Portland cement, fine aggregate, coarse aggregate, water and when specified, an air entraining admixture, proportioned, mixed, placed, and cured as herein specified. All concrete shall meet the most current requirements of American Concrete Institute (ACI) with the following additions and/or exceptions indicated in this specification.

B. As used in this section, the term Portland Cement shall be considered synonymous with the term Hydraulic Cement.

C. The use of mobile mix concrete as specified herein shall require prior written approval by the Contracting Agency. All cement used on the work shall be standard brand Portland cement conforming to the "Specifications for Portland Cement" (ASTM C150), Type V, in accordance with requirements contained in Section 701.

501.01.02 QUALITY CONTROL TESTING AND INSPECTION

A. The testing and inspection of Portland cement concrete shall comply with this specification. The inspection of the mixing plant shall comply with the ACI 311, Chapter 2. In Clark County unincorporated areas and if required by other Contracting Agencies, all field and laboratory sampling and testing for project control shall be performed by NAQTC or ACI certified technicians in an AASHTO Materials Reference Laboratory (AMRL) and Cement and Concrete Reference Laboratory (CCRL), or Construction Materials Engineering Council (CMEC) R-18 AASHTO accredited laboratory. The accreditation shall extend to the test method used on the particular project. The accreditation shall include ASTM C1077. The concrete designs shall comply with Tables 1 and 2 and the IQAC website http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx or comply with Contracting Agency requirements.

B. Testing reports shall be promptly distributed to the owner, licensed design professional responsible for the design, Contractor, appropriate subcontractors, appropriate suppliers, and building official to allow timely identification of either compliance or the need for corrective action.

C. For non-structural mobile mix concrete, the testing shall be a minimum of one set per week. The testing type and frequency shall conform to the tables on the IQAC website.

MATERIALS

501.02.01 GENERAL

A. Materials shall meet the requirements of the following sections and subsections:

Materials	Section
Aggregate for Portland Cement Products	***706***
Concrete Curing Materials and Admixtures	***702***
Hydraulic Cement	***701***
Water	***722***

501.02.02 GRADATION REQUIREMENTS

A. Refer to ACI 304R Chapters 2.1 and 2.2, and comply with the gradation requirements specified in ***Section 706, "Aggregates for Portland Cement Products,"*** and the following:

1. The gradation requirements represent the extreme limits in determining the suitability of material. The gradation from any one source shall maintain a uniformity such that variations in the fineness modulus will not exceed 0.2 from the "Base Fineness Modulus."

    a. The "Base Fineness Modulus" shall be the average of the most recent 10 fineness modulus values (or the average of all preceding values if less than 10 have been completed) from any one source.
    b. Fine aggregate from any one source having a variation in fineness modulus exceeding ±0.2 as prescribed above will be rejected, or at the discretion of the Engineer, may be accepted subject to approved changes.
    c. The fineness modulus of fine aggregate shall be determined by adding the cumulative percentages, by weight, of material retained on each of U.S. Standard sieves No. 4, No. 8, No. 16, No. 30, No. 50, and No. 100, and dividing by 100.

2. Fine aggregates from different sources of supply shall not be mixed or stored in the same stockpile and shall not be used alternately in the same class of construction or job mix without written permission. Such permission will be contingent on amending the job mix and batch masses as necessary to protect the quality of the concrete produced.

3. If the fine aggregate for a job mix is to be a composite material from 2 or more sources, material from respective sources shall be blended by methods that will maintain the degree of uniformity of gradation required by these specifications.

4. Adequate supplies of aggregate shall be produced and stockpiled sufficiently in advance of construction operations to permit sampling and testing before use.

5. Coarse aggregates which vary in gradation shall be placed in separate stockpiles or bins and recombined in approved proportions. Different sizes of aggregates shall be stored in stockpiles sufficiently removed from each other to prevent the materials from becoming intermixed.

6. If the Contractor changes the source of any size of aggregate, a new mix design shall be submitted to the Engineer for approval.

501.02.03 ADMIXTURES

A. Refer to ACI 212. Air-entraining admixtures and water reducers and retarders shall conform to the requirements of ***Subsection 702.03.02, "Air-Entraining Admixtures,"*** and ***Subsection 702.03.03, "Admixtures Other Than Air-Entraining."***

B. Admixtures that are not listed in the mix design shall not be used without written permission from the Engineer, except as otherwise provided in these specifications or in the Special Provisions.

C. Admixtures used in Class EA Concrete, Modified shall be an approved chemical admixture for concrete, meeting the requirements of ASTM C494. Use Type “A” admixture when the anticipated high temperature for the day is 80 degrees F or below. Type “D” admixture shall be used when the anticipated high temperature is above 80 degrees F. The water-cement ratio shall not be adjusted once the chemical admixture has been incorporated into the mix.

D. Admixtures shall not be used to replace cement. Admixtures containing chlorides as Cl- in excess of 1 percent by weight shall not be used in prestressed concrete. If admixtures are used to entrain air, to reduce the water-cement ratio, to retard or accelerate setting time, or to accelerate the development of strength, the admixtures shall be used at the dosage specified in the mix design, or in the contract documents, or as provided by the Engineer.

E. When the use of an air-entraining agent is specified, it shall be added in a quantity conforming to Table 2 in ***Subsection 501.03.04, "Classifications and Proportions."*** It shall be measured into each batch by equipment and methods approved by the Engineer. Adjustments shall be made in the weights of the aggregates used per batch to compensate for increased yield due to air-entrainment so that the quantities of cement per cubic yard of concrete remain constant. Such adjustments shall be made by decreasing the weight of fine aggregate without changing the weight of coarse aggregate unless otherwise approved by the Engineer.

F. When a High Range Water Reducing admixture is used, the initial slump is waived and the slump of the concrete after the admixture is added shall not exceed 8 inches.

G. Admixtures shall be measured accurately into each batch by methods approved by the Engineer.

H. Except as otherwise provided for air-entraining agents, samples of admixtures proposed for use shall be submitted by the Contractor to the Engineer in advance of intended use to permit tests to be made to determine compliance with claimed properties.

I. Any type of admixture shall be uniform throughout its use in the work. Should it be found that the admixture as furnished is not uniform, its use shall be discontinued.

J. Admixtures shall be dispensed in liquid form. Dispensers for admixtures shall have sufficient capacity to measure at one time the full quantity required for each batch. Unless admixtures are added to premeasured water for the batch, their discharge into the batch

shall be arranged to flow uniformly into the stream of water. Dosages of admixtures shall not vary from the dosage indicated in the mix design or as approved by the Engineer by more than 5 percent, with the exception of air entraining admixtures where the dosage is required to achieve the specified range. Equipment for measurement shall be designed for convenient confirmation of the accuracy of measurement. If more than one admixture is used, each shall be dispensed by separate equipment unless otherwise permitted in writing by the Engineer.

K. When water-reducing agents or water-reducing retarders are used, the permitted dosage of the admixture shall not exceed that which will result in an increase in the drying shrinkage of the concrete of 20 percent when used in precast, prestressed concrete; 10 percent when used in cast-in-place prestressed concrete; 10 percent when used in cast-in-place reinforced concrete; or 3 percent when used in non-reinforced concrete pavements.

L. Water reducers shall reduce the water demand of concrete for a given slump at least 7 percent when used at the maximum dosage recommended by the manufacturer. Set retarders shall not be used in greater dosages than those recommended by the manufacturer, nor more than that needed to obtain the desired retardation. The strength of the concrete containing the admixture in the amount approved by the Engineer shall at the age of 48 hours and longer, be not less than that of similar concrete without the admixture.

M. When the Contractor proposes to use an air-entraining admixture which has been previously approved, the Contractor shall submit a certification stating that the admixture is the same as that previously approved.

N. If an admixture offered for use is essentially the same (with only minor differences in concentration) as another previously approved material, a certification will be required stating that the product is essentially the same as the approved admixture and that no other admixture or chemical agent is present.

O. Before or during construction, the Engineer may require that the admixture selected be further tested to determine its effect upon the strength of the concrete. The 7-day compressive strength of concrete containing the admixture under test shall not be less than 88 percent of the strength of concrete made with the same materials, the same cement content, and consistency, but without the admixtures.

p. Subject to the following conditions, pozzolan conforming to ***Subsection 702.03.04, "Pozzolans (Fly Ash),"*** shall be used to a minimum of 20 percent and a maximum of 35 percent, by weight, of the required Portland cement in concrete, or as required by the Engineer.

1. The replacement of cement with pozzolan shall be at a rate of 1 pound of pozzolan for each pound of Portland cement.

2. Silica fume may be used to replace 3 percent to 7 percent, by weight, of the total cementitious material.

3. Store pozzolan in separate weather-tight facilities.

Q. The use of calcium chloride shall not be permitted.

501.02.04 CONCRETE MAKING PROPERTIES

A. The mix design procedure shall comply with the method indicated on the IQAC website (see ***Subsection 501.01.02, "Quality Control Testing and Inspection"***). The type of cement permitted, the minimum sacks of cement required, and the maximum water/cement ratio shall be as shown in Table 1.

Table 1 - Cements Permitted, Sack Requirements, and W/C Ratio

Type of Cement Permitted	Minimum Sacks of Cement Per Cubic Yard [3]	Maximum Water/Cement Ratio
Type II & Fly Ash	6.5 [2, 3]	0.45
Type MS & Fly Ash	6.5 [1, 2]	0.45
Type 1-P (MS)	6.5	0.45
Type V	6.5 [3]	0.45
Type HS	6.5 [2]	0.45
Type V & Fly Ash	6.0 [2, 3]	0.45
Type HS & Fly Ash	6.0 [1, 3]	0.45

B. The testing frequency shall comply with the Contracting Agency requirements or the special provisions.

C. Prior to mix design approval, the Contracting Agency reserves the right to verify the mix design test results, using the sources and proportions of materials as indicated by the mix design.

D. The mix design submittal shall include the information indicated in the concrete design report form on the IQAC website. For mobile mix trucks, the design shall include the model of the mixer with serial number. Each truck shall have a mix design.

501.02.05 ZERO SLUMP CONCRETE FOR THE MANUFACTURING OF PRECAST CONCRETE PRODUCTS

A. Concrete products manufactured by the zero slump method shall comply with ***Subsection 501.02.03, "Admixtures"*** and ***Subsection 501.02.04, "Concrete Making Properties."*** Zero slump concrete shall also exhibit design and performance requirements meeting IQAC and relevant ASTM specifications. Air entrainment is not required in a dry cast manufacturing process.

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[1] Maximum of 8 sacks.
[2] Sacks per cubic yard before replacement with fly ash.
[3] 5.0 sacks per cubic yard for precast products, pipe and box, with zero slump mix design.

B. For zero slump concrete, all other parts of this section do not apply.

501.02.06 LOW SLUMP CONCRETE FOR THE MANUFACTURING OF EXTRUDED SLIP FROM CONCRETE

A. Extruded slip form concrete shall comply with material requirements contained in Table 1, above, and with design and performance requirements meeting IQAC and relevant ACI specifications. The plastic properties may be adjusted on-site with an appropriate type admixture to ensure compliance with ***Subsection 501.03.04, "Classification and Proportions,"*** and to aid Contractor in placement and finishing of low slump slip form concrete.

501.02.07 SELF-CONSOLIDATING CONCRETE

A. The Contractor's use of self-consolidating concrete shall require the approval of the Engineer and shall be subject to the following requirements:

1. Substitutions. Class S concrete may be substituted for selected applications for classes A, D, Modified A, and Modified D; and Class SA concrete may be substituted for selected applications for classes AA, DA, PAA, Modified AA, and Modified DA, as approved by the Engineer.

2. Trial Placement.

   a. The Contractor shall submit details of a representative test section (mockup) for approval.
   b. Produce a trial batch of classes S and SA concrete, conforming to the proposed mix design.
   c. As part of the concrete placement demonstration, provide the labor, equipment, and materials to test the concrete. Evaluate the mixture for strength, air content, slump flow, visual stability index, J-ring value, and hardened visual stability index.
   d. Place a test section when the atmospheric conditions approximate the conditions anticipated for placing the final work. Finish and cure the mockup according to this section.
   e. If it is determined that the trial batch is not workable or not able to be properly placed or finished, modify the mix design or batching sequence. Submit the revised mix design and batching sequence to the Engineer, and place another test section. Repeat the submittal and trial pour process until a workable and finished trial batch is produced.
   f. Do not place any Class S and SA concrete until the Engineer accepts the mockup pour.
   g. A new mix design and a new trial pour will be required whenever there is a change in the source of any component material.
   h. Segregated concrete, as determined by NV Test Method SCC-2, shall not be incorporated into any component of the anticipated concrete work.
   i. When a truck mixer or agitator is used for transporting concrete, deliver the concrete to the site of the work and complete discharge within 60 minutes after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. In hot weather, or under conditions

contributing to quick stiffening of the concrete, a mixing and delivery time of less than 60 minutes may be required. A mixing and delivery time exceeding 60 minutes may be approved by the Engineer if a trial pour is performed with satisfactory results.

j. lace each successive batch within a maximum time interval of 20 minutes. Place the concrete in continuous layers. When it is necessary by reason of emergency or other delay, to place less than a complete horizontal layer in one operation, terminate each layer by using a vertical bulkhead. Do not rod or vibrate the concrete to attempt restoring the fluidity to the mix. Plan and regulate the delivery of concrete so that minor interruptions due to form repair, material testing, etc. will not impact the required 20-minute time interval between successive placements.

3. Concrete Slump Requirements. Except for concrete used in drilled shafts, the requirements of NV Test Method T438 will be performed at 2 hours, 3 hours, or for extended times depending on the concrete placement duration.

4. Drilled Shafts. Use Class S or SA concrete for drilled shaft construction. Upper portions of drilled shafts (top of shaft down to bottom of embedded vertical column reinforcing) may be constructed using the column concrete mix.

CONSTRUCTION

501.03.01 EQUIPMENT

A. With the exception of items indicated in ***Subsection 501.03.05, "Proportioning Methods,"*** and ***Subsection 501.03.06, "Machine Mixing,"*** the measurement of materials and batching shall comply to the ACI 304R, Chapters 3 and 4 recommendations and those in this section or as approved by the Engineer.

1. Certify concrete production facilities and delivery equipment by complying with National Ready-Mix Concrete Association certification requirements.

2. Methods employed in performing the work and all equipment, tools, and machinery used for handling materials and executing any part of the work shall be subject to the approval of the Engineer.

3. All equipment necessary shall be on hand and approved before concrete operations are begun by the Contractor.

B. Provide adequate internal vibrating equipment, including power, to enable the Engineer to fabricate concrete cylinders for testing purposes.

C. Furnish internal vibrators with rigid or flexible shafts, preferably powered by electric motors, capable of operating at a frequency of 7,000 vibrations per minute or greater.

1. The outside diameter or the side dimensions of the vibrating element shall be at least 3/4 inch and not greater than 1-1/2 inches.

2. The length of the shaft shall be at least 24 inches.

D. The Contractor shall maintain the equipment in good condition and adjustment. Concrete mixers and other equipment which are not adequate or suitable for the work shall be removed and suitable equipment shall be provided by the Contractor.

501.03.02 PROTECTING AND SAMPLING CEMENT

A. Suitable means of storing and protecting the cement against moisture or other injurious effects shall be provided by the Contractor. Sacked or bulk cement which, for any reason, has become partially set or which contains lumps of caked cement shall be rejected and shall be immediately removed from the worksite.

B. Different brands of cement shall not be mixed during use or in storage, nor shall different brands be used alternately in any one structure. The same brand and kind of cement shall be used in a given structure above the ground line. A change in brand of cement will require a new mix design.

C. The sacked cement shall be so piled as to permit access for tally, inspection, and identification of each shipment.

D. The Contractor shall obtain from the cement company from which the cement is purchased, a certificate stating that the cement delivered to the work complies with the specifications for the type of cement specified for use, with tests pertaining to the delivered lot. The certificate shall be dated, signed, and indicate the quantity of shipment. Two copies shall be delivered directly to the Engineer.

E. Upon receipt of the certificate of compliance, the Engineer may permit the use of the cement. When a certificate of compliance is not furnished to the Engineer, the cement shall not be used in the work until a release for its use has been received by the Contractor from the Engineer.

F. Whenever it is determined by a laboratory test of mill or field samples that the cement does not comply with the specifications, the use of that cement will be suspended until tests by a third party paid for by the Contractor can be made and the test results are approved by the Engineer.

G. All cement not conforming to the specifications and all cement damaged by exposure to moisture shall be removed immediately and permanently from the work.

501.03.03 STORAGE OF AGGREGATES

A. Refer to ACI 304R, Chapter 2.2.3. The handling and storage of aggregates shall be such as to prevent segregation or contamination by foreign materials.

B. Maintain aggregate stockpiles in saturated surface dry condition.

C. In placing materials in storage or in moving materials from storage to the mixer, any method which may cause the segregation, degradation, or the combining of material of

different gradings which will result in any stockpile or bunker material failing to meet specified requirements shall be discontinued and the materials shall be reprocessed or wasted.

501.03.04 CLASSIFICATION AND PROPORTIONS

A. For non-commercial sources, the Contractor shall notify the Engineer not less than 30 calendar days in advance of use of the proposed sources of materials and shall make arrangements for the Engineer to obtain samples as required for testing purposes.

1. The sources of materials to be used on a project shall not be changed during the job except with the written consent of the Engineer.

2. If permission to change sources of material is granted, a new job mix formula shall be required.

3. Samples shall not exceed 500 pounds for each separate grading.

B. When requested by the Contractor, exceptions to the above requirement may be granted in writing by the Engineer under either of the following conditions:

1. The concrete structures on the project are minor in nature, such as culvert headwalls, manholes, small boxes, sidewalks, etc., generally, when less than 100 cubic yards of concrete are called for on the project.

2. When the aggregate source has been previously tested within the past 1 year and accepted by the Contracting Agency.

C. The Contractor shall give the Engineer advance notice in writing when any changes are to be made in the batch proportions. In the case of Class EA concrete, no changes will be allowed without new laboratory trial testing and subsequent approval.

D. Batches of concrete shall not vary more than ±3 pounds per cubic foot in unit weight from design mix. The cement factor of any individual batch placed in the work shall not be more than 14 pounds per cubic yard less, nor more than 23 pounds per cubic yard greater than the designated cement factor. Batch aggregates and report by weight to the Engineer. The weights used may be varied as necessary to comply with the above tolerances in cement factor and unit weight.

E. For Class EA Concrete, Modified, perform laboratory trial tests to determine strength and compatibility of all materials (as specified in Table 2 of this subsection and in ***Subsection 501.02.03, "Admixtures"***) to be used. Contractor shall have an approved laboratory perform the tests and furnish documentation of such tests. Laboratory trial batches may be observed by the Engineer.

Table 2 - Concrete Mix Designation[4, 5]							
Class of Concrete	**Cementitious Range lb/yd³**	**Max. Nom. Coarse Aggregate Size inches**	**Min. 28-Day Compressive Strength[6] psi**	**Slump Range inches**	**Entrained Air Range %**	**Unit Weight Variation lb/ft³**	**Use**
A	564-705	1-1/2	3000	1-4	4-7	± 3	General use and reinforced structures
AA	564-705						
B	517-705	2	3000	1-5	4-7	± 3	Massive or lightly reinforced sections
BA				1-4			
C	470-611	2-1/2	2500	1-5	4-7	± 3	Massive unreinforced and backfill
CA	517-658						
D	564-705	3/4	3000	1-4	4-7	± 3	Thin reinforced sections, hand rails, etc.
DA	564-752						
PA A	564-752	3/4	Specified on Plans	1-4	Specified on Plans	± 3	Prestressed members
Modified A and AA	564-752	1-1/2	Specified on Plans	1-4	4-7 (AA only)	± 3	Where specified on plans
Modified D and DA	564-752	3/4	Specified on Plans	1-4[7]	4-7 (DA only)	± 3	Where specified on plans
Modified EA[8]	564-752	3/4	Specified on Plans	1/2 -4	4-7	± 3	High Performance Concrete
S and SA	639-925[9]	3/4[10]	Specified on Plans	N/A	4-7 (SA only)[11]	± 3	Self Consolidating Concrete

[4] Blend the coarse aggregate gradation from stockpiles conforming to the requirements of ***Subsection 706.03.01, "Coarse Aggregate,"*** and the stated nominal maximum size. Submit test reports for trial batches showing each stockpile sieve size and the proportions used for blending. Adhere to ***Subsection 706.02.01, "General,"*** for the combined gradation regardless of coarse aggregate gradation. If approved, coarse aggregate nominal maximum size of 1 inch may be used in lieu of 3/4 inch.

[5] Air entrainment on mixes placed above 6000 feet elevation

[6] Comply with ***Subsection 501.02.04, "Concrete Making Properties,"*** of the Standard Specifications for the moving average method of evaluating concrete specified under Statistical Evaluation of Concrete Strength.

[7] For extruding barrier or bridge rail, slump range is 0.5-4 inches.

[8] Aggregates shall consist of a blend of coarse, intermediate, and fine aggregates in order to produce a dense grading. Consideration of the grading, workability factor, and coarseness factor, as outlined in ACI 302 shall be utilized. The aggregate maximum nominal size shall consist of at least a nominal 3/4 inch stone size.

[9] The maximum shrinkage requirement of 0.06% in 28 days air dry after 28-day wet cure, ASTM C157, shall apply if the total cementitious material exceeds 752 pounds per cubic yard.

[10] If approved, 1/2 inch or 3/8 inch may be used in lieu of 3/4 inch.

[11] Air content shall be as follows: For 1/2 inch max. aggregate size, 4.5% - 7.5%, and for 3/8 inch max. aggregate size, 5% - 8%.

F. Concrete shall be composed of cement, admixtures (when approved), aggregates and water. These materials shall be as specified. The exact proportions in which these materials are to be used for different parts of the work shall be determined by the Contractor and submitted to the Engineer for review prior to use in the work. In general, the mix shall be so designed as to produce concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have maximum smoothness of surface. Mix designs where sand represents more than 41 percent of the total weight of fine and coarse aggregate shall not be permitted. The proportions shall be changed whenever necessary or desirable in the opinion of the Engineer. Concrete mixes shall be designed by a Registered Professional Engineer in the State of Nevada representing a qualified independent testing laboratory and approved in advance by the Engineer. Concrete mixing operations shall conform to ASTM C 94. Water shall not be added to concrete after leaving the batch plant unless specifically authorized by the Engineer.

501.03.05 PROPORTIONING METHODS

A. Except as hereinafter noted, aggregate bins shall conform to either 1 or 2 as follows:

1. Each specified size of aggregates shall be stored in a separate bin. Except as hereinafter specified, each bin shall be provided with an individual outlet gate, designed and constructed to prevent leakage when closed. The gates shall cut off quickly and completely.

2. Each size aggregate shall be weighed individually in a single bin, providing there is a satisfactory method employed to eliminate any excess material resulting from over-charging of the bin before the material reaches the surge hopper.

B. Conformance to 1 and 2 above will not be required when batching for culvert headwalls, manholes, small boxes, sidewalks, etc., and the total quantity of concrete called for on the project does not exceed 300 cubic yards.

C. All aggregates for use in Portland cement concrete shall be proportioned by weight, with the exception that aggregates for culvert headwalls, short pieces of curb and gutter, or small sections of sidewalk and related minor work may be proportioned either by weight or volume as the Contractor may elect. Measuring boxes of known capacity shall be furnished and used to measure each size of aggregate proportioned by volume.

D. Water shall be proportioned to maintain batching consistency with regard to stockpile moisture contents and varying absorption values for both coarse and fine aggregates. The Engineer may request the Contractor to submit a new mix design if either the coarse or fine aggregate absorption values vary from the approved mix design by more than 1 percent.Water shall be proportioned to maintain batching consistency with regard to stockpile moisture contents and varying absorption values for both coarse and fine aggregates. The Engineer may request the Contractor to submit a new mix design if either the coarse or fine aggregate absorption values vary from the approved mix design by more than 1 percent.

E. Bulk cement shall be weighed separately when the batch is 1 cubic yard or more.

1. The scale and weigh hopper for the cement shall be separate and cement hopper shall be interlocked against opening before the full amount of cement is in the hopper, against closing before the contents of the hopper are entirely discharged and the scales are back in balance, and against opening when the amount of cement in the hopper is underweight by more than 1 percent of the amount specified.

2. An interlock system will not be required on projects having less than 300 cubic yards in the bid schedule.

F. Scales utilized in the proportioning device may be of the springless dial type or of the multiple beam type.

G. If of the dial type, the dial shall be of such size and so arranged that it may be read easily from the operating platform.

H. If of the multiple beam type, the scales shall be provided with an indicator operated by the main beam which will give positive visible evidence of over or under weight.

1. The indicator shall be so designed that it will operate during the addition of the last 400 pounds of any weighing.

2. The over travel of the indicator hand shall be at least 1/3 of the loading travel.

3. The indicator shall be enclosed against moisture and dust.

I. Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the entire plant is running, the scale reading and cutoff shall not vary from the weight designated by more than 1 percent for cement and 1-1/2 percent for any size aggregate, nor 1-1/2 percent for the total aggregate in any batch.

J. Scales shall be approved with a certificate of inspection as required by ***Subsection 109.01, "Measurement of Quantities."***

K. When the entire plant is running, the scale reading and cutoff weights shall not vary from the mix design by more than 1 percent for cement, fly ash, and silica fume, 1.5 percent for any individual size aggregate, and 1 percent for the total combined aggregate in any batch. The total water shall not exceed the maximum water specified in the mix design.

L. Should separate supplies of aggregate and material of the same size group, but of different moisture content or specific gravity be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the material therein completely exhausted before starting upon another.

M. Stockpiled aggregates shall be in a saturated surface dry condition just prior to batching.

1. The moisture content of the aggregate shall be such that no visible separation of moisture and aggregate will take place during transportation from the proportioning plant to the point of mixing

2. Aggregate containing excess moisture shall be stockpiled prior to use until sufficiently dried to meet the above requirements.

N. Batches with cement in contact with damp aggregates shall be mixed within 30 minutes after being proportioned. Batch trucks hauling more than 1 batch of cement and aggregate shall be so constructed that materials do not flow from one compartment to another during haul or discharge.

O. Coarse and fine aggregate shall be handled and measured separately. Cement shall be emptied directly into the charging skip of the mixer. Water shall be measured either by volume or by weight.

P. The equipment for measuring and supplying the water to the mixer shall be so constructed and arranged that the amount of water added to the mixture can be measured in one operation into the mixing drum without dribbling.

1. The equipment shall be so designed that water from the source of supply cannot enter the measuring tank while the water is being discharged from the measuring tank into the mixer.

2. Tanks or other equipment for measuring and discharging water into the mixer shall be sufficiently accurate that the amount of water delivered to the mixer for any batch shall not vary more than 1 percent from the required quantity of water for any position of the mixer with respect to a level plane.

3. The tanks or other equipment shall be so arranged as to permit the checking of the amount of water delivered by discharging into measured containers.

501.03.06 MACHINE MIXING

A. Concrete manufactured by any procedure which results in any unmixed lumps of cement in the mixed product shall be rejected. The preparation of the mix shall be in accordance to ACI 318, Section 5.8, “Mixing,” and this section. The Cement and Concrete terminology is defined in ACI 116.

B. For structural concrete, the Operator shall provide a computer printed legible ticket and for non-structural concrete, at a minimum, a hand written ticket. The ticket shall be presented with each load, and shall contain the following information:

1. Name of Vendor.

2. Name of Contractor.

3. Number of Cubic Yards in the Load.

4. Amount of Cement and of each Size of Aggregate.

5. Amount of Water Added at the Plant.

6. Amount of Water in the Aggregate.

7. Brand and Type of Cement.

8. Brand and Amount of Admixture.

9. Time and Date of Batching.

10. For Mobile mixer add:

    a. Truck Number (the truck unit the mixer is mounted).
    b. The Model of the mixer with Serial Number.

C. Space shall be provided on the ticket so the amount of water added on the job may be indicated.

D. All concrete shall be mixed in mechanical mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in accordance with the provisions of ***Subsection 501.03.07, "Hand Mixing."***

1. Mixers shall have legible permanently attached plates showing manufacturer's rated capacity, mixing speeds, and serial number.

2. Mixers may be stationary mixers or truck mixers.

    a. Agitators may be truck mixers operating at agitating speed or truck agitators.
    b. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete, and the speed of rotation of the mixing drum or blades.

3. The Contractor, at no additional cost to the Contracting Agency, shall furnish samples of the fresh concrete and provide safe and satisfactory facilities for obtaining the samples.

4. Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer.

5. The temperature of materials as charged into the mixer shall be such that the temperature of the mixed concrete at the time it is placed in final position is not less than 50 degrees F nor more than 90 degrees F as specified in ***Subsection 501.03.10.B, "Cold Weather – General,"*** and

Subsection 501.03.10.C, "Low Temperature Protection." Aggregates and water used for mixing shall not exceed 150 degrees F.

6. Concrete for structures shall be mixed for a period of not less than 60 seconds nor more than 5 minutes after all materials, including water, are in the mixer.

7. Cement shall be batched and charged into the mixer by means that will not result either in loss of cement due to the effect of wind, or an accumulation of cement on surfaces of conveyors or hoppers, or in other conditions which may vary the required quantity of cement in the concrete mixture.

8. Stationary mixers having a capacity of 1 cubic yard or more and all paving mixers shall be operated with an automatic timing device that can be locked by the Engineer. The time device and discharge mechanisms shall be so interlocked that during normal operations no part of the batch will be discharged until the specified mixing time has elapsed.

9. The total elapsed time between the intermingling of damp aggregates and cement and the start of mixing shall not exceed 30 minutes.

10. Mixers and agitators which have an accumulation of hard concrete or mortar or worn blades shall not be used.

11. When central-mixed concrete is furnished and non-agitating hauling equipment is used for transporting concrete to the delivery point for Portland cement concrete pavement, discharge into the laydown machine shall be completed within 45 minutes after the addition of the cement to the aggregates.

E. **Ready-Mixed Concrete.**

1. Ready-mixed concrete shall be central-mixed, shrink-mixed, or transit-mixed concrete. Shrink-mixed concrete is that which has been mixed partially in a stationary mixer and the mixing completed in a truck mixer.

2. The size of batch in truck mixers and truck agitators shall not exceed the rated capacity as determined by the current Standard Requirements of Truck Mixer Manufacturers Bureau. The size of batch in stationary mixers shall not exceed the rated capacity of the mixer as determined by the standard requirements of the Associated General Contractors of America. No batches requiring fractional sacks of cement will be permitted unless all of the cement is weighed when added to the batch.

3. If the use of ready-mixed concrete is approved, the producers shall use only that cement approved by the Contracting Agency for use on the project. Contracting Agency approved cement shall be stored at the concrete plant in such a manner that it can be identified and kept separate from other cement.

4. Ready-mixed concrete for structures shall be transported in truck mixers or truck agitators.

5. The mixer, when loaded to capacity, shall be capable of combining the ingredients of the concrete within the specified time, into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity. The agitator, when loaded to capacity, shall be capable of maintaining the mixed concrete in a thoroughly mixed uniform mass and of discharging the concrete with a satisfactory degree of uniformity.

6. Mixers and agitators shall be examined periodically for changes in condition due to accumulation of hardened concrete or mortar or to wear of the blades.

    a. When any such change in condition is found, the concrete shall be subjected to the slump tests.
    b. If the tests indicate that the concrete is not being properly mixed, the faulty equipment shall be corrected before its further use is allowed.

7. Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may be readily verified. The counters shall be of the continuous-registering, non-resettable type, which accurately register the number of revolutions, and shall be mounted on the truck mixer so that the Engineer may safely and conveniently inspect them from alongside the truck.

8. When a truck mixer is used, each batch of concrete shall be mixed for not less than 70 and no more than 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of the equipment as mixing speed. If any additional mixing is done, it shall be at the speed designated by the manufacturer of the equipment as agitating speed.

9. When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

10. No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless permitted by the Engineer. If the Engineer permits additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.

11. The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of revolution of the drum in the discharge direction with the discharge gate fully open.

12. When truck mixer or truck agitator is used for transporting concrete that has been completely mixed in a stationary mixer, mixing during transportation shall be at the speed designated by the manufacturer of the equipment as agitating speed. Do not exceed a total of 300 revolutions from the time of initial batching to complete discharge of delivered concrete.

13. When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within 90 minutes after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. In hot weather, or under conditions contributing to quick stiffening of the concrete as determined by the Engineer, a delivery time of less than 90 minutes may be required. When a truck mixer is used for the complete mixing of the concrete, the mixing operations shall begin within 30 minutes after the cement has been intermingled with the aggregate.

14. If the mixing plant is such a distance from the site of the work that it is not practical to have the mixed concrete delivered and placed in forms within the time limit specified, cement and water shall not be added until such time as requirements can be complied with.

15. The organization supplying concrete shall have sufficient plant capacity and transporting apparatus to ensure continuous delivery at the rate required.

    a. The rate of delivery of concrete shall be used as to provide for the proper handling and placing of concrete.
    b. An interval of more than 45 minutes between any 2 consecutive batches or loads, or a delivery and placing rate of less than 8 cubic yards of concrete per hour shall constitute cause of shutting down work for the remainder of the day, and if so ordered by the Engineer, the Contractor shall make, at no additional cost to the Contracting Agency, a construction joint at the location and of the type directed by the Engineer in the concrete already mixed.

16. After mixing of ready-mixed concrete has been completed, it shall be agitated continuously at agitating speed until it has been discharged from the drum.

17. Wash water shall be completely discharged from the drum or mixing container before the succeeding batch is introduced. Cement balling (intermittent clumping) and mix foaming shall be prevented by controlling the batch sequence, mixing speed, and mixing time.

    a. When intermittent clumping exceeds 1-2 clumps per yard or 10 clumps per truck, the entire load will be rejected.
    b. The clumps shall not exceed 5 inches in diameter.

F. Mobile Mixers

1. The concrete mobile mix truck and placement of concrete shall comply to the ASTM C685 “Concrete Made by Volumetric Batching and Continuous Mixing” and Volumetric Mixer Manufacturers Bureau manual VMMB 100-01 “Volumetric Mixer Standards” with the exception as follows:

    a. ASTM C685 section 7.8 and VMMB 100-01 section 1.2.4 tolerance table shall be replaced with American Concrete Association 3046R section 6.2.2 tolerance table.

2. Material bins shall conform to Table 1 of VMMB 100-01 with the following addition:

   a. Reinforcing fibers and fly ash, if required, must be stored and dispensed from their own separate bin. Bins for cementitious materials shall be sealed to prevent damage to the cementitious materials by ambient air moisture.

3. Rating Plate

   a. The rating plate shall comply to ASTM C685 and VMMB 100-01. One size of volumetric mixer units of the same design and configuration shall have been approved by the VMMB to be eligible to carry the VMMB plate.
   b. Mixers that were certified by a VMMB member company subsequent to issue of the VMMB 100 standard in 2001 shall have a rating plate furnished by the VMMB attached to the mixer equipment. They shall be certified by completing the qualification report forms. These forms are on the VMMB website and shall be submitted to VMMB for review and approval.
   c. Separate VMMB qualification report forms are required for each individual mixer unit.

4. Prior to the use of the mobile mixer, it shall be inspected by the Contracting Agency. At the time of the inspection, the supplier must provide all of the documentation as required in ASTM C685.

   a. The frequency of the mixer inspection is six months.
   b. The maximum calibration interval of the flow meter shall be six months or 2500 cubic yards of production and a minimum of three calibration runs shall be performed as required by ACI 304.6R.
   c. Mixing uniformity evaluation must be performed on a minimum 1 cubic yard sample and reviewed and approved by the VMMB prior to delivery of a rating plate. Prior to initial submittal of an application package to Clark County, an initial mixing uniformity evaluation must be performed within the last 3 months.
   d. A mixing uniformity evaluation must then be performed at a maximum interval of 6 months as required by ASTM Standard C685. A mixing uniformity evaluation must be performed within the last 3 months, prior to submittal of an annual application for renewal as an approved concrete fabricator with Clark County.

5. Material

   a. For onsite materials, it shall be placed in stockpiles with tests of each in accordance to the table one test methods in section 706 and frequencies on the Clark County QAQC website:
      http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx
   b. For established offsite material sources, test results within 6 months of the mix design date shall be attached to the mix design based on the Table 1 requirements.
   c. The mix design shall include the source name and location. If the material source changes, the mix shall be re-designed and be resubmitted.
   d. The data shall include the material ASTM C33 information.

e. The documentation shall be delivered to the Contracting Agency.
f. The source material test data and vendor sheets shall be attached to the mix design.

501.03.07 HAND MIXING

A. Hand mixing shall not be permitted, except in case of an emergency or under written permission of the Engineer.

B. When permitted, hand mixing shall be done only on watertight platforms.

1. The sand shall be spread evenly over the platform and the cement spread upon it.

2. The sand and cement shall then be thoroughly mixed while dry by means of shovels until the mixture is of uniform color, after which it shall be formed into a "crater" and water added in the amount necessary to produce mortar of the proper consistency.

3. The material upon the outer portion of the "crater" ring shall then be shoveled to the center and the entire mass turned and sliced until a uniform consistency is produced.

4. The coarse aggregate shall then be thoroughly wetted and added to the mortar and the entire mass turned and returned at least 6 times and until all of the stone particles are thoroughly covered with mortar and the mixture is of a uniform color and appearance.

C. Hand mixing will not be permitted for concrete to be placed under water.

D. Preproportioned sack concrete may be used for grout caps or other nonstructural uses as approved by the Engineer.

501.03.08 RETEMPERING

A. Concrete shall be mixed only in such quantities as are required for immediate use and shall be placed before initial set has taken place. Any concrete in which initial set has begun shall be wasted and not used in the work.

B. No retempering of concrete shall be allowed.

501.03.09 CURING

A. Comply with ACI 308, Standard Specification for Curing Concrete, with the following exceptions or additions:

1. General. All concrete shall be cured for the length of time hereinafter specified. If Type III cement is used, the curing time may be reduced as directed by the Engineer. In the event of low temperatures, the time will be increased according to the procedures specified in ***Subsection 501.03.10.B, "Cold Weather – General."***

a. Cure all bridge decks and approach slabs according to Subsection 501.03.09.A.6, "Bridge Deck Curing."
b. Curing shall commence immediately upon completion of the finish. In the event that the application or placement of the curing medium is delayed, curing will be as described under 2 below.

2. **Water Method.** The concrete shall be kept continuously wet by the application of water for a minimum period of 7 days after the concrete has been placed.

a. Use fogging equipment capable of applying water through an atomizing nozzle in the form of a fine mist, not a spray. The equipment may use water pumped under adequate high pressure, or a combination of air and water pumped under high pressure. Use equipment sufficiently portable for use in the direction of any prevailing wind. Adapt equipment for intermittent use as directed to prevent excessive wetting of the concrete.
b. Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period. The cotton mats, rugs, or carpets shall be of such character that they will retain water.

3. **Curing Compound Method.** The entire surface of the concrete shall be sprayed uniformly with a curing compound. It shall be applied when just a light film of water is present on the surface. If the surface is dry, water shall be added as specified in 2 above before the curing compound is applied.

a. On decks or slabs cured by this method, foot traffic shall be held to a minimum and these surfaces shall not be used as a work area during the cure period. Should the film of the compound be damaged before the expiration of 7 days, the damaged portions shall be repaired immediately with additional compound.
b. Uniformly spray the entire surface of the concrete with a curing compound conforming to Subsection 702.03.01, "Curing Materials," except as hereinafter specified for concrete bridge decks that are to be the roadway surface. The curing compound shall be applied to the exposed surface at a uniform minimal rate of 1 gallon per 150 square feet of area.
c. Do not apply the curing compound until all patching and surface finishing, except grinding, have been completed. When ordered during periods of hot weather, continue fogging of the concrete with water after curing compound is applied until no longer required.
d. The curing compound shall be delivered to the work in ready-mixed form. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. The compound shall not be diluted or altered in any manner, unless dilution is recommended by the manufacturer.
e. Provide curing compounds which remain sprayable at temperatures above 40 degrees F and do not hard settle in storage.
f. Curing compound that has become chilled to such an extent that it is too viscous for satisfactory application shall be warmed to a temperature not exceeding 100 degrees F

g. Curing compound shall be packaged in clean 55-gallon steel barrels or round 5-gallon steel containers or supplied from a suitable storage tank located at the jobsite.
   1) Each 55-gallon barrel shall be equipped with a built-in agitator having 2 sets of blades, one at the bottom and one midway between top and bottom, and with removable lids and airtight band fasteners.
   2) On-site storage tanks shall be kept clean and free of all contaminants. Each tank shall be provided with a permanent system designed to completely redisperse any settled material without introducing air or any other foreign substance.
   3) Barrels shall be filled in a manner that will prevent skinning.
   4) Ring seals and lug type crimp lids shall be used to seal 5-gallon containers well.
   5) Containers shall be provided with lining that will resist the solvent of the curing compound and will not permit skins to be loosened into the body of the curing compound.
   6) Each container shall be labeled with the manufacturer's name, batch number, type of compound, number of gallons, and date of manufacture. Each container shall also be labeled with an Interstate Commerce Commission Red Label warning concerning flammability. The label shall also warn that the curing compound shall be well stirred before use.
   7) When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall be supplied with each load containing the same information as that required herein for container labels.

h. Curing compound may be sampled by the Engineer at the source of supply, at the job site, or at both locations.
i. Curing compound not used within 6 months of the date of manufacture will require certification from the manufacturer that the curing compound still conforms to ASTM C309. Curing compound more than 1 year old or without a manufacture date on the container will not be allowed for use.

4. Waterproof Membrane.

a. Keep the exposed finished surfaces of concrete damp with water using an atomizing nozzle, as specified in Subsection 501.03.09.A.2, "Water Method," until the concrete has set.
b. Place the curing membrane after the concrete has set.
   1) The membrane shall be formed into sheets of such width as to provide a complete cover of the entire concrete surface.
   2) All joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint.
   3) Overlap of sheets shall have a minimum lap of 18 inches.
   4) The sheets shall be securely weighted down by placing a bank of earth on the edges of sheets or by other means satisfactory to the Engineer.
   5) Sheeting material shall conform to Subsection 702.03.01, "Curing Materials."
c. The curing membrane shall remain in place for a period of not less than 7 days.

d. Should any portion of the sheets be broken or damaged before the expiration of the curing period, the broken or damaged portion shall be immediately repaired with new sheets properly cemented into place, or water curing as described above shall commence immediately.
e. Sections of the membrane which have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing shall not be used.

5. Form Method.

a. If forms are kept on the concrete surfaces, this will be considered adequate cure for these surfaces.
b. However, should the forms be removed within 7 days after the concrete has been placed, one of the above methods shall be used on the exposed surfaces.
c. Comply with Subsection 502.03.11, "Removal of Falsework and Forms."

6. Bridge Deck Curing.

a. Submit a quality control plan for concrete placement and curing, for review and approval, a minimum of 30 days prior to the pre-pour conference for bridge decks and approach slabs. The plan shall include, but not be limited to, information on the procedures for when and how the concrete and the curing system is to be placed, frequency for monitoring, maintaining, and re-wetting the curing system chosen, and a list of personnel responsible for performing such work. Include in the plan, equipment to be used for placement of concrete and the curing system, methods of protecting the covers from displacement from wind or weather, and methods of preventing loss of heat and moisture.
b. Describe procedures to be followed in the event of equipment breakdown or inclement weather during concrete placement. In addition, describe the method to be used to protect pedestrian and vehicular traffic under the structure.
c. Use Figure 2.1.5 from ACI 305R, Hot Weather Concreting, to determine the evaporation rate. Additional protection measures shall be provided if the rate of evaporation exceeds 0.1 pound per square foot per hour.
    1) Accurate record of placement location, air temperature, relative humidity, concrete temperature, and wind velocity shall be provided.
    2) Readings shall be taken an hour prior to the concrete placement and at 1-hour increments during concrete placement, until the final curing blanket is placed.
    3) Required data shall be submitted to the Engineer.

d. Concrete temperature shall be monitored during the entire curing period by utilizing recording thermocouples embedded at 1 inch below the concrete surface and 1 inch above the bottom concrete surface.
    1) A minimum of 2 sets of thermocouple installations will be required per each day's placement.
    2) The thermocouple shall be capable of recording the concrete temperature as a function of time.
    3) Acceptable devices include thermocouples connected to electronic data loggers.

4) The recording time intervals shall be a maximum of 30 minutes.
5) The recording devices shall be accurate to within ±1.8 degrees F. Concrete temperature between the top and bottom of the slabs and the supporting girders shall be maintained to a maximum differential temperature of 30 degrees F.
6) If differential temperatures exceed the requirements, measures shall be taken to correct the curing process.
7) Required data shall be submitted to the Engineer.

e. Immediately after the concrete is placed, the moisture content shall be maintained by humidifying the air directly above the concrete surface until the curing covers are placed. Fogging equipment described in Subsection 501.03.09.A.2, "Water Method," shall be used, mounted on a finishing bridge that is separate from the concrete placing equipment.
f. Begin placing pre-soaked burlap within 30 minutes after finishing has started. Wet curing of the surface shall be performed for 10 days, unless otherwise directed, with the following covering:
   1) Burlap and Polyethylene Covering. Burlap conforming to Subsection 702.03.01, "Curing Materials," and polyethylene (white or reflective) conforming to ASTM C171 shall be furnished. Soaker hose shall be placed or other approved method shall be used to provide continuous wetting of burlap between the burlap and polyethylene covering.
g. Pre-wetted curing coverings shall be placed with a finishing bridge. Covers shall be placed directly behind the concrete fogging operation.
h. The covering shall be maintained uniformly wet during the entire curing period. Provide 24-hour monitoring of the wet curing for the full length of the curing period. Water temperature shall not be more or less than 20 degrees F from the temperature of top of bridge deck.
i. Covers shall be lapped a minimum of 18 inches. All lapped edges shall be sealed to prevent loss of heat and moisture.
j. If the ambient temperature drops below 45 degrees F during the first 4 days of curing, additional protection shall be provided according to Subsection 501.03.10.C, "Low Temperature Protection."
k. After completion of wet curing and removal of curing covering, immediately remove excess water and apply an application of curing compound according to Subsection 501.03.09.A.3, "Curing Compound Method."
l. All cracks on new bridge decks and approach slabs shall be repaired. Requested method of repair shall be submitted for approval.

7. Maturity Meter Method:

a. This method may be used if referred to in the contract special provisions.
b. The method specified in ASTM C1074 may be used in order to reduce the cure time. This method requires training and certification of the Quality Assurance and Control personnel.
c. This method shall not be used for acceptance but for reducing the time required for form removal. The Contractor shall have a plan of action approved by the Engineer and monitored by a third party engineer for meter placement and monitoring.

501.03.10 WEATHER LIMITATIONS

A. **General.** If impending inclement weather conditions exist, the Contractor shall decide whether or not to begin the placement and the Contractor shall have sole responsibility for Contractor's decision.

1. Before any concrete is placed, the Contractor shall have adequate provisions readily available as approved by the Engineer, to protect the concrete from any impending weather conditions.

2. In case precipitation should occur after placing operations have started, the Contractor shall provide ample covering to protect the work.

3. The placing of concrete shall be stopped before the quantity of precipitation is sufficient to cause a flow or to wash the surface.

4. All exposed concrete surfaces shall be sprayed liberally with an evaporation retarder such as Confilm by Masterbuilders or approved equal, when the ambient air temperature is greater than 100 degrees F.; or when the ambient air temperature is above 90 degrees F. and the wind speed is above 20 mph; or as directed by the Engineer. Spraying shall be per manufacturer's recommendation and shall occur immediately upon completion of the finish.

B. **Cold Weather – General.** Comply with ACI 306, Cold Weather Concreting, with the following exceptions or additions:

1. All concrete shall be maintained at a temperature of not less than 50 degrees F for 3 days or not less than 40 degrees F for 7 days. The count of time shall commence immediately upon completion of final placement and vibration. The three 50-degree F days need not be consecutive.

2. One 24-hour period shall constitute 1 day.

3. The temperature of the concrete shall be determined by placement of thermometers on the concrete surfaces and properly insulating these devices to record the surface temperature of the concrete.

    a. Temperature shall be monitored continuously throughout the total protection time required by this subsection.
    b. In case the surface temperature of the concrete falls below 40 degrees F for a duration of 3 hours or more in any 24-hour period during the time of temperature protection, the time shall be increased 1 day for each day this occurs.
    c. An absolute minimum temperature of 35 degrees F shall be maintained for the total time of protection specified in this subsection.
    d. Should the temperature of the concrete fall below 35 degrees F at any time, damage may occur.
    e. The assessment of damage will be determined by a professional engineer registered in Nevada and paid for by the contractor and concrete so damaged may require repair or replacement at the option of the Engineer.

4. The concrete shall have a temperature of at least 50 degrees F and not more than 90 degrees F at the time of placing. (Also, comply with temperature constraints specified in ***Subsection 501.03.06, "Machine Mixing."***)

   a. Heating equipment or methods which alter or prevent the entrainment of the required amount of air in the concrete shall not be used.
   b. The equipment shall be capable of heating the materials uniformly.
   c. Aggregates and water used for mixing shall not be heated to a temperature exceeding 150 degrees F.
   d. Concrete containing frost or lumps at the time of placing shall not be used.

5. Stockpiled aggregates may be heated by the use of dry heat or steam. Aggregates shall not be heated directly by gas or oil flame or on sheet metal over fire.

6. Reinforcing steel shall be free of ice, snow, and frost during placement of concrete. Concrete shall not be placed on frozen ground.

7. Concrete shall not be placed on frozen ground, nor shall it be placed when atmospheric temperature is below 40 F. and within 24 hours of the time that the concrete is to be placed, except with the written permission of the Engineer and only after such precautionary measures for the protection of the concrete have been taken as the Engineer may direct.

C. **Low Temperature Protection.** Refer to guidelines in ACI 306, Cold Weather Concreting, with the following exceptions or additions:

1. **General.** After the concrete has been placed, means shall be taken to protect the concrete from any impending low temperatures.

   a. Methods and materials not hereinafter prescribed may be used if approved by the Engineer and the following requirements adhered to:
      1) Materials shall be fire resistant
      2) Materials shall be waterproof
      3) Materials shall not adhere, abrade or damage the surface of the concrete.

   b. Approval of the Engineer shall not relieve the Contractor from obtaining specification results.

2. **Insulating Blankets.**

   a. Insulating blankets used to protect concrete from low temperatures shall be fire resistant and waterproof.
   b. The blankets shall be secured and overlapped along the edges and joints to ensure that no opening will exist in the protection during high winds or other adverse conditions.
   c. Provisions shall be made to allow the reading of thermometers placed inside of the protection.

d. When depositing concrete against previously cast concrete, the blanket insulation shall extend at least 14 inches onto the existing concrete and shall be securely held in place.

3. **Low Temperatures Protection – Heating and Housing.**

a. In order to meet the provisions of ***Subsection 501.03.09, "Curing,"*** paragraphs A and B, the concrete may be protected by applying artificial heat within an enclosure.
b. The enclosure shall be constructed with fire resistant material, unless otherwise directed by the Engineer, and shall be subject to Engineer's approval.
c. The heating system shall be so arranged as to provide uniform heating, ensuring that the concrete farthest from the source of heat is receiving adequate protection without drying the concrete near the source of heat so as to cause shrinkage cracks.

4. The temperature of the concrete will be determined by placement of thermometers on the concrete surfaces and properly insulating these devices to record the surface temperature of the concrete according to NV Test Method T440.

a. Temperature will be monitored continuously throughout the total projection time required by this subsection.
b. If the surface temperature of the concrete falls below 50 degrees F during the first 3 days and 40 degrees F during the next 4 days of the temperature protection for a duration of 3 hours, the curing time will be increased 1 day for each day this occurs.
c. Should the temperature of the concrete fall below 35 degrees F at any time during the 7 days of temperature protection or if the surface temperature of the concrete falls below 40 degrees F during the first 24 hours of temperature protection period, the assessment of damage will be determined by a Nevada registered professional engineer paid for by the Contractor and damaged concrete shall be repaired or replaced at the option of the Engineer.
d. Contractor shall be responsible for all costs associated with damage assessment and repair.

D. **Hot Weather.** Comply with guidelines in ACI 305, Hot Weather Concreting, with the following exceptions or additions:

1. The maximum temperature of cast-in-place concrete shall not exceed 90 degrees F immediately before placement.

2. For continuous placement of concrete on the deck with reinforcing steel units, retard the initial set of the concrete sufficiently to ensure that concrete remains plastic for subsequent placement.

3. For both simple and continuous spans, submit a retardation schedule for approval.

4. The consistency of the concrete as placed shall allow the completion of initial finishing operations without the addition of water to the surface. When conditions are

such that additional moisture is needed for initial finishing, the required water shall be applied to the surface fog spray only, and shall be held to a minimum amount. Apply fog spray for this purpose as specified in ***Subsection 501.03.09.A.2, "Water Method."*** Fog spray for this purpose may be applied with hand-operated fog equipment, as approved by the Engineer.

5. From the time of initial strike-off until final finish is complete, the unformed surfaces of slab concrete shall be protected from rapid evaporation of mixing water from the concrete due to wind, high temperature, low humidity, or combination thereof.

6. Equipment for fogging, type of evaporation retarder, and method of application shall be approved by the Engineer. Equipment shall be portable, adapted for intermittent use, and operable in the direction of any prevailing wind.

7. Use fogging equipment capable of providing a fog mist, as necessary, to the area between the finishing machine and the tining machine. The fogging equipment shall meet the requirements of ***Subsection 501.03.09.A.2, "Water Method."*** If at any time it becomes apparent that the combination of fogging and curing application are not, or will not be effective in preventing plastic shrinkage cracking, stop the concrete placement until environmental conditions improve substantially, or until other preventative measures are approved in writing by the Engineer.

8. After all finishing operations are complete a final curing membrane shall be applied.

9. When the temperature is 90 F. or above, or is likely to rise above 90 F. within the 24-hour period after concrete placement; or when there is any combination of high air temperature, low relative humidity and wind velocity which would impair concrete strength or quality, follow the recommendations of ACI 305R and the following:

   a. Keep concrete as cool as possible during placement and curing
   b. Do not allow concrete temperature to exceed 90° F. at placement.
   c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
   d. Dampen subgrade and forms with cool water immediately prior to placement of concrete.
      Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.
   e. Take appropriate precautions per ACI 305R when the actual or anticipated evaporation rate equals or exceeds 0.2 pounds per square foot per hour as determined from ACI 305R, Figure 2.1.4.

501.03.11 TRIAL SLAB AND PROCESS CONTROL TESTING

A. If silica fume is used in bridge deck concrete, construct a trial slab at least 30 days prior to placement of concrete on a bridge deck. Submit a written plan for the casting of decks. Include in this plan, at a minimum, the location of slab, the equipment and personnel used for construction, and disposal of slab. Prior to placement of the trial slab, conduct a Pre-Activity Meeting.

B. Use approved mix designs. Place concrete at a location other than the bridge deck, but under similar conditions to those that exist during bridge deck concrete placement.

1. The trial slab shall have a minimum length and width of 50 feet and a depth of 8 inches.

2. Reinforce slab with a top and bottom mat of no. 5 bars spaced 6 inches longitudinally and transversely.

3. Place top mat at a depth of 2-1/2 inches from the top of the slab.

4. Place bottom mat at a depth 1-1/2 inches from the bottom of slab.

5. The trial slab shall be wet-cured in accordance with the specifications.

6. Use personnel such as superintendent, key operators, and finishers that are the same personnel who will be involved in the final construction of the bridge deck.

7. Demonstrate the use of equipment, proficiency of personnel, and techniques for mixing, transporting, placing, and curing of the concrete during the trial.

8. Fifteen days after the placement of the trial slabs, conduct a post construction critique of the trial slab placement in writing.

C. Do not commence placement of bridge deck concrete until after any issues from the post construction critique of trial slab construction have been resolved to satisfaction of the Engineer.

D. Upon notification, remove and dispose of trial slabs according to ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

501.03.12 MORTAR

A. Cement mortar shall consist of a mixture of Portland cement, sand, and water. Cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with the required amount of water.

1. Cement mortar shall be designated by class and proportioned by loose volume as follows:

Table 3 - Mortar Proportioning

Designation	Proportions
Class "A" Mortar	1 Part Cement to 1 Part Sand
Class "B" Mortar	1 Part Cement to 1-1/2 Parts Sand
Class "C" Mortar	1 Part Cement to 2 Parts Sand
Class "D" Mortar	1 Part Cement to 2-1/2 Parts Sand
Class "E" Mortar	1 Part Cement to 3 Parts Sand
Class "F" Mortar	1 Part Cement to 3-1/2 Parts Sand

2. The quantity of water to be used in the preparation of mortar shall be only that required to produce a mixture sufficiently workable for the purpose intended.

3. Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Re-tempering of mortar will not be permitted.

B. **Cement.** Cement shall conform to the requirements of ***Section 701, "Hydraulic Cement."***

C. **Sand.** Sand shall conform to the requirements of ***Subsection 706.03.04, "Grout and Mortar Sand."*** In proportioning the sand it shall be measured loose (without shaking or compacting) in measuring boxes or other suitable containers of known capacity.

D. **Admixtures.** No admixture shall be used in mortar unless otherwise specified or approved by the Engineer.

501.03.70 CORROSION PROTECTION REQUIREMENT

A. Pipe, conduit, dowels and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there shall be a minimum of two inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement shall not be permitted.

501.03.71 PREPARATION OF SURFACES FOR CONCRETING

A. Native material surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud and debris at the time of placing concrete.

B. Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, in the opinion of the Engineer, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be leveled with a wooded float to provide a reasonably smooth surface. A surface consisting largely of coarse aggregate shall be avoided. The joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material.

C. No concrete shall be placed until all form work, installation of parts to be embedded, and preparation of surfaces involved in the placing have been approved by the Engineer.

501.03.72 EXCLUSION OF WATER

A. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited under water without the explicit permission of the Engineer and then only in strict accordance with the Engineer's directions, nor shall the Contractor, without explicit permission from the

Engineer, allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as to injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing groundwater, if required, shall be subject to the approval of the Engineer and shall be the responsibility of the Contractor. Said items shall be considered incidental to construction and no additional compensation shall be made.

501.03.73 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogenous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement.

501.03.74 CARE AND REPAIR OF CONCRETE

B. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which for any other reason does not conform to the specifications, shall be removed and replaced at the Contractor's expense.

METHOD OF MEASUREMENT

501.04.01 MEASURMENT

A. Portland cement concrete will be measured for payment in accordance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

BASIS OF PAYMENT

501.05.01 PAYMENT

A. Portland cement concrete shall be paid for in accordance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

501.05.02 TRIAL SLAB PAYMENT

A. Full compensation for construction and removal of trial slabs and trial pours shall be considered as included in the contract unit price paid for other appropriate items and no separate payment will be made therefor.

END OF SECTION 501

SECTION 502 – CONCRETE STRUCTURES

DESCRIPTION

502.01.01 GENERAL

A. This work shall consist of furnishing and placing Portland cement concrete in bridges, culverts, headwalls, retaining walls, barrier rail, and all other types of concrete structures.

B. The concrete structures shall be constructed to the lines and grades given by the Engineer and in accordance with the design shown on the plans.

C. The concrete shall be of the class or classes of concrete specified in the contract documents and shall conform to the requirements of Section 501, "Portland Cement Concrete," unless otherwise specified.

D. This work shall also include construction of headwalls, wingwalls, u-channels, trapezoidal channels, stilling basins, outlet structures, connection and transition/splitter structures, and pre-cast concrete box culverts. This shall include the construction of temporary head walls necessary to support the travel lanes and/or work adjacent to the excavation for the reinforced concrete box culvert and roadway.

MATERIALS

502.02.01 GENERAL

A. The materials used shall be those prescribed for the several items which constitute the finished work and shall conform to the requirements for such materials in the following sections:

Materials	Section
Portland Cement Concrete	501
Concrete Curing Materials and Admixtures	702
Joint Material	707
Reinforcement	713
Miscellaneous Metal	712
Elastomeric Bearing Pads	725

CONSTRUCTION

502.03.01 DEPTH OF FOOTINGS

A. The elevation of the bottoms of footings as shown on the plans shall be considered as approximate only and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be necessary to secure a satisfactory foundation.

502.03.02 FORMS

A. All forms shall be built mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations.

1. Forms previously used shall be thoroughly cleaned of all dirt, mortar, and foreign matter before being reused.
2. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly coated with an approved coating or form oil.
3. Coating or form oil shall leave no film on the surface of the form that can be absorbed by the concrete.
4. When required by the Engineer and immediately before placing concrete, the forms shall be thoroughly wetted with water.

B. When requested by the Engineer, the Contractor shall submit detailed plans of form work for examination by the Engineer. If such plans are not satisfactory to the Engineer, the Contractor shall make such changes as may be required, but it is understood that the Engineer's concurrence in the use of the plans as submitted or corrected shall in no way relieve the Contractor of responsibility in obtaining satisfactory results.

C. The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours.

1. The design of the forms shall take into account the effect of vibration on the concrete as it is placed.
2. Forms shall be filleted at all exposed corners unless corners are rounded as hereinafter provided.
    a. Triangular molding used for fillets shall have 2 equal sides.
    b. In general, the width of the equal sides of moldings shall be 3/4 inch.
    c. For massive work, such as heavy pier copings and columns, the width shall be 1-1/2 to 2 inches.
    d. Top edges of walls may be filleted or rounded as hereinafter provided for curbs.
    e. Top edges of curbs and slabs shall be rounded with an edging tool to a radius of 1/2 inch to 3/4 inch.

D. When concrete is placed in excavation, forms shall be provided for all vertical surfaces unless otherwise permitted by the Engineer.

1. On thin walls, such as abutments, wing walls, and retaining walls, the forms on 1 face may be built up as the concrete is poured, but only to such elevation as will permit proper placing and thorough spading, and in no case greater than the height which can be placed in 1 day's run.
2. Ports shall be provided in high, thin walls to permit thorough cleaning before placing concrete.
3. If the forms develop any defects, such as bulging or sagging, after the concrete has been placed, that portion of the work shall be corrected in a manner satisfactory to the Engineer, without additional compensation to the Contractor.
4. During the erection and after the completion of the forms, the forms shall be protected in such a manner as to preclude shrinkage, warping, curling, and distortion.

5. Form lumber used a second time shall be free from bulge or warp and shall be thoroughly cleaned.

E. Forms for concrete over or in the vicinity of operating railroads shall be so constructed and placed that standard clearances demanded by the railroad company will be maintained at all times.

F. The falsework and forms supporting the bottom slab of the superstructure of box girder structures shall remain in place until the curing period of the deck of the superstructure has expired.

1. Unless otherwise permitted by the Engineer, forms for the webs of box girders shall be removed before the deck slab is poured.

2. All interior forms in box girders, except those permitted to remain in place, shall be completely removed and the inside of the box girder cleared of all loose material and swept clean.

G. Side Forms:

1. Side forms for beams, girders, columns, railing, or other members of the structure wherein the forms do not resist dead load bending may be removed as specified in ***Subsection 502.03.11, "Removal of Falsework Forms."***

2. The side forms for arch rings, columns, and piers shall be removed before the members of the structure which the forms support are poured or placed, so that the quality of the concrete may be inspected.

3. All such side forms shall be so constructed that the forms may be removed without disturbing other forms which resist direct load or bending stresses.

H. The condition of the forms will have a direct bearing upon the amount of finishing required.

I. Form Requirements and Physical Design:

1. Full pieces of forms shall be used and shall extend from the bottom to the top of the wall or post.

2. Curved surfaces shall be formed to provide a smooth surface without visible breaks.

3. The forms shall be so constructed that portions, where finishing is required, may be removed without disturbing portions of forms to remain.

4. Forms shall be of sufficient strength to carry the dead weight of the concrete as a liquid without a deflection in excess of L/270, and if such deflection occurs, the deflection shall be sufficient cause for rejection of the work.

5. Forms for girders and slabs shall be cambered in such amounts as may be required by the Engineer.

6. Approved form clamps or bolts shall be used to fasten forms. The use of ties consisting of twisted wire loops to hold forms in position during the placing of concrete will not be permitted.

7. Bolts or form clamps shall be positive in action and shall be of sufficient strength and number to prevent spreading of the forms.

a. The clamps shall be of such type that the clamps can be entirely removed or cut back sufficiently to allow finishing of the concrete.

b. All forms for the outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales.

8. Plywood for forms shall be "exterior type" of the grade Concrete-Form Exterior.

a. Plywood form panels shall be furnished and placed in 4-foot widths and in uniform lengths of not less than 8 feet, except where the dimensions of the member form are less than the specified panel dimensions.

b. Where form panels are attached directly to the studding of joints, the panel shall not be less than 5/8 inch thick.

c. Form panels less than 5/8 inch thick, otherwise conforming to the requirement herein specified, may be used with continuous backing of 1 inch nominal thickness surfaced material.

d. All form panels shall be placed in a neat symmetrical pattern subject to the approval of the Engineer.

e. The panel shall be placed with the long dimensions perpendicular to the studs.

9. Plywood for left-in-place forms in box girders may be of any grade and thickness that will satisfy the other requirements of this subsection.

10. Fabricated stay-in-place metal forms may be used for concrete floor slabs at the Contractor's option when so noted on the plans.

11. Metal forms to remain in place for concrete floor slabs shall be fabricated from steel conforming to ASTM A466 (Grades A through E) having a coating class of G165.

12. The following criteria shall govern the design of permanent stay-in-place steel bridge deck forms:

a. The steel forms shall be designed on the basis of dead load of form, reinforcement, and plastic concrete plus 50 pounds per square foot for construction loads. The unit working stress in the steel sheet shall not be more than 0.725 of the specified minimum yield strength of the material furnished, but shall not exceed 36,000 pounds per square inch.

b. Deflection under the weight of the forms, the plastic concrete and reinforcement shall not exceed L/180 of the form span or 1/2 inch, whichever is less, but in no case shall this loading be less than 120 psf total.

c. The permissible form camber shall be based on the actual dead load condition. Camber shall not be used to compensate for deflection in excess of foregoing limits.

d. The design span of the form sheets shall be the clear span of the form plus 2 inches measured parallel to the form flutes.

e. Physical design properties shall be computed in accordance with requirements of the American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members, latest published edition.

f. All reinforcement shall have minimum concrete cover of 1 inch.

g. The plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck shall be maintained.

h. Permanent steel bridge deck form shall not be considered as lateral bracing for compression flanges of supporting structural members.

i. Permanent steel bridge deck form shall not be used in panels where longitudinal deck construction joints are located between stringers.

j. Welding shall not be permitted to flanges in tension or to structural steel bridge elements fabricated from nonweldable grades of steel.

J. Fabricator's shop and erection drawings shall be submitted to the Engineer for approval. These drawings shall indicate the material properties and grade of steel, the properties of geometric sections for all permanent steel bridge deck form sheets, and all locations where the forms are in the vicinity of steel beam flanges subject to tensile stresses.

K. Form Supports:

1. Form sheets shall not be permitted to rest directly on the top of the stringer or floor beam flanges.

2. Sheets shall be securely fastened to form supports and shall have a minimum bearing length of 1 inch at each end.

3. Form supports shall be placed in direct contact with the flange of stringer or floor beam.

4. All attachments shall be made by permissible welds, bolts, clips, or other approved means.

5. Welding of form supports to flanges of steel not considered weldable and to portions of flange subject to tensile stresses shall not be permitted.

6. Welding and welds shall be in accordance with the provisions of AWS D2.0 pertaining to fillet welds except that 1/8-inch fillet welds will be permitted.

L. Any permanently exposed form metal where the galvanized coating has been damaged shall be thoroughly cleaned, wire brushed, and painted with 2 coats of zinc oxide zinc dust primer, Federal Specification TT-P-641D, Type II, no color added, to the satisfaction of the Engineer. Minor heat discoloration in areas of welds need not be touched up.

M. Transverse construction joints shall be located at the bottom of the flute and 1/4-inch weep holes shall be field drilled at not more than 12 inches on center along the line of the joint.

N. Emphasis shall be placed on proper vibration of the concrete to avoid honeycomb and voids.

1. Pouring sequences, procedures, and mixes shall be approved by the Engineer.

2. Calcium chloride or any other admixture containing chloride salts shall not be used in the concrete placed on permanent steel bridge deck forms.

O. The Contractor's method of construction shall be carefully observed during all phases of the construction of the bridge deck slab.

1. These phases include installation of the metal forms; location and fastening of the reinforcement; composition of concrete items; mixing procedures, concrete placement, and vibration; and finishing of the bridge deck.
2. Should the Engineer determine that the procedures used during the placement of the concrete warrant inspection of the underside of the deck, the Contractor shall remove at least 1 section of the forms at a location and time selected by the Engineer for each span in the contract.
3. This should be done as soon after placing the concrete as practicable in order to provide visual evidence that the concrete mix and the Contractor's procedures are obtaining the desired results.
4. An additional section shall be removed if the Engineer determines that there has been any change in the concrete mix or procedures warranting additional inspection.

P. After the deck concrete has been in place for a minimum period of 2 days, the concrete shall be tested for soundness and bonding of the forms by sounding with a hammer as directed by the Engineer.

1. If areas of doubtful soundness are disclosed by this procedure, the Contractor will be required to remove the forms from such areas for visual inspection after the pour has attained adequate strength.
2. This removal of the permanent steel bridge deck forms shall be at no additional cost to the Contracting Agency.
3. At locations where sections of the forms are removed, the Contractor will not be required to replace the forms, but the adjacent metal forms and supports shall be repaired to present a neat appearance and ensure their satisfactory retention.
4. As soon as the form is removed, the concrete surfaces will be examined for cavities, honeycombing and other defects.
5. If irregularities are found, and it is determined by the Engineer that these irregularities do not justify rejection of the work, the concrete shall be repaired as the Engineer may direct and shall be given an Ordinary Surface Finish.
6. If the concrete where the form is removed is unsatisfactory, additional forms, as necessary, shall be removed to inspect and repair the slab, and the Contractor's methods of construction shall be modified as required to obtain satisfactory concrete in the slab.
7. All unsatisfactory concrete shall be removed or repaired as directed by the Engineer.

Q. The amount of sounding and form removal may be moderated, at the Engineer's discretion, after a substantial amount of slab has been constructed and inspected, if the Contractor's methods of construction and the results of the inspections as outlined above indicate that sound concrete is being obtained throughout the slabs.

502.03.03 FALSEWORK

A. Detailed plans of the falsework or centering shall be furnished by the Contractor to the Engineer in accordance with ***Subsection 105.02, "Plans and Working Drawings,"*** for

any structures having a clear cast-in-place span of 20 feet or over or any cast-in-place structure over traffic. If such plans are not satisfactory to the Engineer, the Contractor shall make such changes in the plans as may be required.

B. In addition to the detailed drawings of the falsework or centering which are to be furnished to the Engineer as specified herein, the Contractor shall also furnish the Engineer with a copy of falsework or centering design calculations.

C. All falsework or centering shall be designed and constructed to provide the necessary rigidity and to support the loads.

1. Falsework for the support of superstructures for box girder spans shall be designed to support the loads that would be superimposed were the entire superstructure poured at 1 time.

2. For designing falsework and centering, a weight of 150 pounds per cubic foot shall be assumed for green concrete (120 pounds for lightweight concrete) and an allowance of not less than 25 pounds per cubic foot for forms, live load, and impact.

3. Falsework or forms shall be constructed to produce in the finished structure the lines and grades indicated on the plans.

4. Suitable screw jacks or wedges in pairs shall be used in connection with falsework or centering to set the forms to grade or cambered as shown on the plans, or to take up any settlement in the form work either before or during the placing of concrete.

5. Excessive use of blocking and shims shall be cause for rejection of the falsework.

6. Falsework failures shall become the sole responsibility of the Contractor.

D. Immediately prior to placing bridge or slab concrete, the Contractor shall check all falsework and wedges or jacks and shall make all necessary adjustments.

1. Care shall be exercised to ensure that settlement and deflection due to the added weight of the deck or slab concrete will be minimal.

2. Suitable means such as telltales shall be provided by the Contractor to permit ready measurement of settlement and deflection as it occurs.

E. Falsework or centering shall be founded on a solid footing safe from undermining and protected from softening. Falsework which cannot be founded on a satisfactory footing shall be supported on piling which will be spaced, driven, and removed in a manner approved by the Engineer.

F. Arch span shall be removed uniformly and gradually beginning at the crown and working toward the spring, to permit the arch to take its load slowly and evenly. Centering for bridges having 2 or more adjacent arch spans will be struck simultaneously.

G. Falsework supporting the main carrying members of all continuous structures shall not be removed from any span until all spans between expansion joints are cured.

H. Falsework and forms left in place in the cells of box girders shall not exceed 12 pounds per square foot of deck. All supports between the top and bottom slabs in the cells of box girders shall be water soaked for a period of not less than 48 hours.

502.03.04 REINFORCEMENT

A. Reinforcing shall be furnished and placed as shown on the plans and in accordance with the applicable provisions of ***Section 505, "Reinforcing Steel,"*** of these specifications.

502.03.05 COFFERDAMS AND CRIBS

A. Cofferdams for foundation construction shall be carried well below the bottom of the footings and shall be well braced and as watertight as practical. The interior dimensions of cofferdams shall be such as to provide sufficient clearance for constructing forms and, when no seal is placed, to permit pumping outside the forms.

B. The Contractor shall submit for approval, drawings showing proposed method of construction of cofferdams or cribs in accordance with ***Subsection 105.02, "Plans and Working Drawings."***

1. Approval of such drawings shall in no way relieve the Contractor of Contractor's responsibility under the contract for the successful completion of the improvement.

2. Cofferdam construction shall not start before the submitted drawings are approved and returned.

C. After the completion of the substructure, the cofferdams with all sheeting and bracing shall be removed to 1 foot below the stream bed, by the Contractor, and such removal shall be performed in such a manner as not to disturb or mar the finished concrete foundation. Removal of cofferdams, sheeting, and bracing shall be considered subsidiary to other pay items of work and no further payment will be made therefor.

502.03.06 PUMPING WATER

A. Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete.

B. No pumping will be permitted during the placing of concrete or for a period of at least 24 hours thereafter, unless it be done from a suitable pump separated from the concrete work by a watertight wall or other effective means.

C. Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure.

502.03.07 MIXING CONCRETE

A. All concrete shall be mixed and proportioned as specified in ***Section 501, "Portland Cement Concrete."***

502.03.08 HANDLING AND PLACING CONCRETE

A. **General.** In preparation for the placing of concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from the interior of forms.

1. Struts, stays, and braces serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary.

2. These temporary members shall be entirely removed from the forms and not buried in the concrete.

B. No concrete shall be used which does not reach its final position in the forms within the time and temperature stipulated under ***Section 501, "Portland Cement Concrete."***

C. Surfaces on which concrete is to be placed shall be thoroughly moistened with water immediately before placing concrete.

D. Concrete shall be placed so as to avoid segregation of the material and the displacement of the reinforcement.

1. The use of long troughs, chutes, and pipes for conveying concrete from the mixer to the forms shall be permitted only on written authorization of the Engineer.

2. In case an inferior quality of concrete is produced by the use of such conveyors, the Engineer may order discontinuance of their use and the substitution of a satisfactory method of placing.

3. Open troughs and chutes shall be of metal or metal lined; where steep slopes are required, the chutes shall be equipped with baffles or be in short lengths that reverse the direction of movement.

4. All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run; water used for flushing shall be discharged clear of the structure.

E. When placing operations would involve dropping the concrete more than 5 feet, concrete shall be deposited through sheet metal or other approved pipes, except when placing concrete for thin vertical walls less than 15 inches thick, double belting may be used in lieu of adjustable pipes or elephant trunks.

1. As far as practicable, the pipes shall be kept full of concrete during placing and the lower ends of pipe shall be kept buried in the newly placed concrete.

2. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the projecting ends of reinforcement bars.

F. All concrete placed in concrete structures, except tremie seal concrete, shall be compacted by means of mechanical vibration subject to the following provisions:

1. The number of vibrators employed shall be ample to consolidate incoming concrete to a proper degree within 15 minutes after concrete is deposited in the forms. In all cases, at least 2 vibrators shall be available at the site of the structures in which more than 25 cubic yards is being placed.

2. The vibration shall be internal unless special authorization of other methods is given by the Engineer or as provided herein.

3. Vibrators shall be capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.

4. The intensity of vibration shall be such as to visibly affect a mass of concrete of 1-inch slump over a radius of at least 18 inches.

5. Vibrators shall be manipulated to thoroughly work the concrete around the reinforcement and imbedded fixtures and into the corners and angles of the forms.

6. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators shall be inserted and withdrawn out of the concrete slowly.

7. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued at any 1 point to the extent that localized areas of grout are formed.

8. Application of vibrators shall be at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibly effective.

9. Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration.

10. Vibration shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

11. Vibration shall be supplemented by such spading as is necessary to ensure smooth surfaces and dense concrete, along form surfaces and in corners and locations impossible to reach with the vibrators.

12. The provisions of this article shall apply to the filler concrete for steel grid floor except that the vibrator shall be applied to the steel.

G. Immediately following the discontinuance of placing concrete, all accumulations of mortar splashed upon the reinforcement steel and the surface of forms shall be removed.

1. Dried mortar chips and dust shall not be puddled into the unset concrete.

2. If the accumulations are not removed prior to the concrete becoming set, care shall be exercised not to injure or break the concrete-steel bond at and near the surface of the concrete while cleaning the reinforcement steel.

H. **Culverts.**

1. The base slab or footings of box culverts shall be placed and allowed to set before the remainder of the culvert is constructed. Suitable provisions shall be made for bonding the sidewalls to the culvert base.

2. Walls and top slab shall not be constructed as a monolith on box culverts where the depth of pour below the bottom of the top slab exceeds 4 feet unless approved in writing by the Engineer. When this method of construction is used, any necessary construction joints shall be vertical and at right angles to the axis of the culvert.

3. When walls are poured separately, in non-rigid frame box culverts, the concrete in the walls shall be placed and allowed to set a minimum of 2 hours before the top slab is placed.

4. When walls are poured separately, in rigid frame box culverts, the concrete in the walls shall be placed and allowed to set a minimum of 12 hours before the top slab is placed.

5. Each wing wall shall be constructed, if possible, as a monolith. Construction joints, where unavoidable, shall be horizontal and so located that no joint will be visible in the exposed face of the wing wall above the ground line.

I. **Girders, Slabs, and Columns.**

1. When the height of a web in a "T" beam is more than 3 feet, the top slab shall be poured independently.
2. When the distance from a construction joint to the top of the web in a box girder exceeds 3 feet, the top slab shall be poured independently.
3. Concrete in slab spans shall be placed in 1 continuous operation for each span unless otherwise specified.
4. Concrete in columns shall be placed in 1 continuous operation, unless otherwise specified. The concrete shall be allowed to set at least 12 hours before the succeeding pour is started.
5. Before pouring concrete for superstructure, the forms on base of columns shall be exposed sufficiently to determine the character of the concrete in the columns.

502.03.09 CONCRETE DEPOSITED UNDER WATER

A. If conditions render it impossible or inadvisable, in the opinion of the Engineer, to dewater excavation before placing concrete, the Contractor shall deposit under water, by means of a tremie or underwater bottom dump bucket, a seal course of concrete of sufficient thickness to thoroughly seal the cofferdam.

1. The concrete shall be carefully placed in a compact mass and shall not be disturbed after being deposited.
2. Still water shall be maintained at the point of deposit.

B. The use of an aluminum tremie for placing concrete is prohibited.

C. A tremie shall consist of a watertight tube having a diameter of not less than 10 inches with a hopper at the top.

1. The tube shall be equipped with a device that will prevent water from entering the tube while charging the tube with concrete.
2. The tremie shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering when necessary to retard or stop the flow of concrete.
3. The tremie shall be filled by a method that will prevent washing of the concrete.
4. The discharge end shall be completely submerged in concrete at all times and the tremie tube shall contain sufficient concrete to prevent any water entry.
5. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete.
6. The flow shall be continuous until the work is completed and the resulting concrete seal shall be monolithic and homogeneous.

D. The underwater bucket shall have an open top and the bottom doors shall open freely and outward when tripped.

1. The bucket shall be completely filled and slowly lowered to avoid backwash and shall not be dumped until it rests on the surface upon which the concrete is to be deposited.

2. After discharge, the bucket shall be raised slowly until well above the concrete.

E. Concrete deposited in water shall be in accordance with ***Section 501, "Portland Cement Concrete,"*** with 10 percent extra cement added.

1. The exact thickness of the seal will depend upon the hydrostatic head, bond, and spacing of piles, size of cofferdam, and other related factors, but in no case shall the seal be less than 2 feet in thickness, unless otherwise shown on the plans.

2. Before dewatering, the concrete in the seal shall be allowed to cure for not less than 5 days after placing.

F. If a seal which is to withstand hydrostatic pressure is placed in water having a temperature below 45 degrees F, the curing time before dewatering shall be increased.

1. Periods of time during which the temperature of the water has been continuously below 38 degrees F shall not be considered as curing time.

2. After sufficient time has elapsed to ensure adequate strength in the concrete seal, the cofferdam shall be dewatered and the top of the concrete cleaned of all scum, laitance, and sediment.

3. Before fresh concrete is deposited, local high spots shall be removed as necessary to provide proper clearance for reinforcing steel.

G. Groundwater may be encountered on this project. In such case, the Contractor will dewater the excavated area and subbase for the concrete structures improvements in such a manner that the concrete will not be placed in any standing water.

502.03.10 CONSTRUCTION JOINTS

A. Construction joints shall be made only where located on the plans or shown in the pouring schedule, unless otherwise approved by the Engineer.

B. Construction joints where the placing of concrete is delayed until the concrete has taken its initial set and for which no expansion is provided, shall be planned in advance and shall be subject to approval by the Engineer.

1. The placing of concrete shall be continuous from joint to joint.

2. These joints shall be perpendicular to the principal lines of stress and, in general, located at points of minimum shear.

3. Only joints shown on the plans will be permitted in a cantilevered member.

4. Horizontal joints at piers and abutments, except where specified, shall be avoided, and when used shall not be located within 2 feet of the normal water level.

C. Unless otherwise specified, construction joints shall be struck off but not troweled.

D. When making a horizontal construction joint, care shall be taken to have the concrete as dry as possible, and any excess water or creamy material shall be drawn off before the concrete sets. On all exposed surfaces, the line of the proposed joint shall be made

straight by placing a temporary straightedge on the inside of the form and pouring the concrete so that it will set flush with the edge as provided.

E. To avoid visible joints as far as possible upon exposed faces, the top surfaces of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather edge" might be produced at a construction joint, as in the slope top surface of a wing wall, an insert form block shall be used to produce a blocked out portion in the proceeding layer which shall produce an edge thickness of not less than 6 inches in the succeeding layer.

F. When the work is unexpectedly interrupted by breakdowns, storm, or other causes, and the concrete as placed would produce an improper construction joint, the Contractor shall either rearrange the freshly deposited concrete or continue by hand mixing, if necessary, until a suitable arrangement is made for a construction joint. When such a joint occurs at a section on which there is shearing stress, the Contractor shall provide adequate mechanical bond across the joint by inserting reinforcing steel or by some other means satisfactory to the Engineer, which will prevent a plane of weakness.

G. In resuming work, the surface of the concrete previously placed shall be thoroughly cleaned of dirt, scum, laitance, or other soft or porous materials by 1 of the following methods:

1. Concrete surface of fresh concrete (not more than 8 hours after placement) shall be cleaned with air and water jets in such a manner that the surface is thoroughly cleaned and the aggregate is not loosened.

2. Hardened concrete surface (more than 8 hours after placement) shall be cleaned by abrasive blast methods in such a manner that the aggregate is not loosened or the edges of the concrete shattered.

H. The surface of the joint shall be thoroughly washed with clean water and the forms tightened to close contact with the previously placed work, after which the concreting may proceed. The surface of the joint shall be wet just prior to placing new concrete.

502.03.11 REMOVAL OF FALSEWORK AND FORMS

A. **General.**

1. Methods of form removal likely to cause overstressing of the concrete shall not be used.

   a. Forms and their supports shall not be removed without the approval of the Engineer.

   b. Supports shall be removed in such a manner as to permit the concrete to uniformly and gradually take the stresses due to its own weight.

2. Compressive strengths will be determined by ASTM C39 and ASTM C31 and will be considered information tests only and not acceptance tests as described in ***Subsection 501.02.04, "Concrete Making Properties."***

3. Comply with ***Subsection 501.03.09, "Curing."***

B. **Falsework.**

1. Where stresses will be placed on the concrete, in arch centers, centering under beams and girders, and in floor slabs, falsework shall not be removed until the

concrete has reached an age of 10 days and it has reached 75 percent of the required 28-day compressive strength.

2. In the event of cold weather, the 10-day time requirements shall be increased 1 day for every day the curing time is increased as prescribed in ***Subsection 501.03.10.B, "Cold Weather — General."***

3. In case the concrete does not reach the desired strength within the time specified, the Engineer shall determine when the strength is adequate to allow removal of falsework.

4. Form removal and replacement with shoring will not be permitted.

C. **Forms.**

1. Forms on parapets and curbs shall not be removed until concrete has set sufficiently to prevent distorting or cracking.

2. Forms for columns, walls, side of beams, girders and all other parts that are not subjected to stress shall not be removed until the concrete has reached a minimum age of 40 hours unless authorized by the Engineer.

3. Forms that are subjected to stresses shall not be removed until the requirements of Subsection 502.03.11.B have been satisfied, unless otherwise approved by the Engineer.

502.03.12 EXPANSION AND FIXED JOINTS AND BEARINGS

A. All joints shall be constructed according to details shown on the plans and as specified in this subsection.

B. **Open Joints.**

1. Open joints shall be placed in the locations shown on the plans and shall be constructed by the insertion and subsequent removal of a wood strip, metal plate, or other approved material.

2. The insertion and removal of the template shall be accomplished without chipping or breaking the corners of the concrete.

3. Reinforcement shall not extend across an open joint unless so specified on the plans.

C. **Filled Joints.**

1. Poured expansion joints shall be constructed similar to open joints.

2. When premolded types are specified, the filler shall be placed in correct position before concrete is placed against the filler.

3. Holes and joints in the filler shall be filled with mastic to prevent the passage of mortar or concrete from 1 side of the joint to the other.

4. The edges of the concrete at the joint shall be edger finished.

D. **Steel Joints.**

1. The plates, angles, or other structural shapes shall be accurately shaped, at the shop, to conform to the section of the concrete floor.

2. The fabrication and painting shall conform to the requirements of these specifications covering those items.
3. When called for on the plans or in the Special Provisions, the materials shall be galvanized in lieu of painting.
4. Care shall be taken to ensure that the surface in the finished plane is true and free of warping.
5. Positive methods shall be employed in placing the joints to keep the joints in correct position during the placing of the concrete.
6. The opening at expansion joints shall be that designated on the plans at normal temperature, and care shall be taken to avoid impairment of the clearance in any manner.

E. **Waterstops.**

1. Waterstops shall be furnished and installed in accordance with the details shown on the plans.
2. The edge of the waterstop shall be supported in a manner satisfactory to the Engineer.
3. Waterstops shall be manufactured from either natural rubber, synthetic rubber, or polyvinyl chloride (PVC) at the option of the Contractor.
4. Waterstops shall be manufactured with an integral cross section which shall be uniform within ±1/8 inch in width, and the web thickness or bulb diameter, within +1/16 inch and -1/32 inch .
    a. No splices will be permitted in straight strips.
    b. Strips and special connection pieces shall be well cured in a manner such that any cross section shall be dense, homogeneous, and free from porosity.
    c. Junctions in the special connection pieces shall be fully molded.
    d. During the vulcanizing period, the joint shall be securely held by suitable clamps.
    e. The material at the splices shall be dense and homogeneous throughout the cross section.
5. Field splices for either natural or synthetic rubber waterstops shall be either vulcanized, mechanical, using stainless steel parts, or made with a rubber splicing union of the same stock as the waterstop, at the option of the Contractor. All finished splices shall have a full size tensile strength of 600x (width in inches) pounds.
6. Field splices for polyvinyl chloride waterstops shall be formed by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations.
    a. A thermostatically controlled electric source of heat shall be used to make all splices.
    b. The heat shall be sufficient to melt but not char the plastic.

7. Waterstops, when being installed, shall be cut and spliced at changes in direction as may be necessary to avoid buckling or distortion of the web or flange.

F. **Bearing Devices.**

1. Bearing plates, bars, rockers, assemblies, and other expansion or fixed devices shall be constructed in accordance with the details shown on the plans and shall be hot-dip galvanized after fabrication in accordance with ***Section 715, "Galvanizing."***

2. Structural steel and cast steel shall conform to the provisions in ***Section 506, "Steel Structures,"*** for those items.

3. The bearing plates shall be set level and the rockers or other expansion devices shall be set to conform to the temperature at the time of erection or to the setting specified.

4. When bearing assemblies or masonry plates are shown on the plans to be placed (not embedded) directly on concrete, the concreted bearing area shall be constructed slightly above grade and shall be finished by grinding or other approved means to a true level plane which shall not vary perceptibly from a straightedge placed in any direction across the area. The finished plane shall not vary more than 1/8 inch from the elevation shown on the plans.

5. When elastomeric bearing pads, elastic bearing pads, preformed fabric pads, or asbestos sheet packing are shown on the plans, the concrete surfaces on which pads or packing are to be placed shall be wood float finished to a level plane which shall not vary more than 1/16 inch from a straightedge placed in any direction across the area. The finished plane shall not vary more than 1/8 inch from the elevation shown on the plans.

6. Where bearing assemblies or masonry plates are shown on the plans to be placed on grout pads, they shall be placed in accordance with the provisions in ***Subsection 506.03.25, "Bearing and Anchorage."***

G. **Elastomeric Bearing Pads.**

1. Pads over 1 inch in thickness shall be laminated.

2. Laminated pads shall consist of alternate laminations of elastomer and metal or elastomer and fabric bonded together.

3. All elastomeric bearing pads shall be 50 durometer.

4. Pads shall be installed where designated on the plans.

502.03.13 CURING

A. Curing of formed concrete shall conform to the requirements of ***Subsection 501.03.09, "Curing."***

502.03.14 PATCHING

A. After removal of forms, all metal ties except those to be used to aid future forming shall be cut back and patched.

1. Honeycomb shall be removed and patched.

2. When honeycomb is determined by the Engineer to be excessive, the excessive honeycombing shall be sufficient cause for rejection of all or a part of the structure.

B. Loose or broken material shall be chipped away until a dense, uniform surface exposing solid coarse aggregate is obtained.

1. Feather edges shall be cut away to form a face perpendicular to the surface being patched.

2. All surfaces of the cavity shall be thoroughly saturated with water.

3. Contact surfaces shall be coated with an approved bonding agent.

4. Bonding agent may be mixed with mortar in lieu of coating the contact surfaces.

C. Patching mortar shall consist of 1 part cement and 3 parts sand.

1. White cement or other approved tinting materials shall be used on all surfaces where an "ordinary finish" is final.

2. For patching large or deep areas, coarse aggregate shall be added to the patching mortar.

D. The patching mortar shall be thoroughly tamped into place.

1. Mortar may be placed pneumatically when approved by the Engineer.

2. The surface of the mortar shall be floated with a wooden float before initial set takes place.

3. The patch shall present a neat and workmanlike appearance.

E. The patched surface shall be cured by 1 of the methods described in ***Subsection 501.03.09, "Curing."***

F. Patching is the only treatment required for those portions of the structure below ground.

502.03.15 FINISH OF HORIZONTAL SURFACES

A. Concrete bridge decks shall be struck off with a template immediately after pouring to provide the proper crown and shall be finished to a smooth even surface by means of both longitudinal and transverse wooden floats, or other suitable means.

1. When a transversely broomed finish is used, the allowable variations noted herein shall be independent of the depth of the broom marks.

2. No variations will be permitted that will tend to prevent complete drainage on all parts of the deck.

3. The surface shall be corrected by grinding off the high spots, or other approved method, as may be required to conform to these limits.

4. An edging tool shall be used at expansion joints and deck edges not armored.

B. Approach slabs to concrete bridges shall be finished to the tolerances specified for bridge decks.

C. Finishing Bridge Decks.

1. A smooth riding surface of uniform texture, true to the required grade and cross section, shall be obtained on all bridge roadway decks.

2. The Contractor may use hand tools, or finishing machines, or a combination of both, conforming to the requirements specified herein for finishing bridge roadway deck concrete.

3. Finishing of concrete placed in bridge decks shall consist of striking off the surface of the concrete as placed and floating with longitudinal floats the surface so struck off.

4. The placing of concrete in bridge roadway decks will not be permitted until the Engineer is satisfied that:

    a. The rate of producing and placing concrete will be sufficient to complete the proposed placing and finishing operations within the scheduled time.

    b. Experienced finishing machine operators and concrete finishers are employed to finish the deck.

    c. Fogging equipment and all necessary finishing tools and equipment are on hand at the site of the work and in satisfactory condition for use.

5. Finishing machines shall be set up sufficiently in advance of use to permit inspection by the Engineer during the daylight hours before each pour.

6. The adjustment and operation of deck finishing machines shall be verified by moving the machine over the full length of the deck section to be placed and traversing the float completely across all end bulkheads before placement of concrete is begun.

7. Unless adequate lighting facilities are provided by the Contractor, the placing of concrete in bridge decks shall cease at such time that finishing operations can be completed during daylight hours.

8. Rails for the support and operation of finishing machines and headers for hand-operated strike off devices shall be completely in place and firmly secured for the scheduled length for concrete placement before placing of concrete will be permitted.

    a. Rails for finishing machines shall extend beyond both ends of the scheduled length for concrete placement a sufficient distance that will permit the float of the finishing machine to fully clear the concrete to be placed.

    b. Rails or headers shall be adjustable for elevation and shall be set to elevations, with allowance for anticipated settlement, camber, and deflection of falsework, as required to obtain a bridge roadway deck true to the required grade and cross section.

    c. Rails or headers shall be of a type and shall be so installed that no springing or deflection will occur under the weight of the finishing equipment, and shall be so located that finishing equipment may operate without interruption over the entire bridge roadway deck being finished.

    d. Rails or headers shall be adjusted as necessary to correct for unanticipated settlement or deflection which may occur during finishing operations.

9. Should settlement or other unanticipated events occur, which in the opinion of the Engineer would prevent obtaining a bridge deck conforming to the requirements of

these specifications, placing of deck concrete shall be discontinued until corrective measures satisfactory to the Engineer are provided.

a. In the event satisfactory measures are not provided prior to initial set of the concrete in the affected area, the placing of concrete shall be discontinued and a bulkhead installed at the location determined by the Engineer.

b. All concrete in place ahead of the bulkhead shall be removed.

10. Unless otherwise permitted by the Engineer, bridge deck concrete shall be placed in a uniform heading approximately parallel to the bridge pier or bent caps. The rate of placing concrete shall be limited to that which can be finished before the beginning of initial set, except that concrete for the deck surface shall not be placed more than 10 feet ahead of strike-off.

11. After the concrete has been placed and consolidated, the surface of the concrete shall be carefully struck off by means of a hand-operated strike board operating on headers, or by a finishing machine operating on rails. A uniform deck surface true to the required grade and cross section shall be obtained.

12. Following strike off, the surface of the concrete shall be floated longitudinally.

a. In the event strike off is performed by means of a hand-operated strike board, 2 separate hand-operated float boards for longitudinal floating shall be provided.

b. The first float shall be placed in operation as soon as the condition of the concrete will permit and the second float shall be operated as far back of the first float as the workability of the concrete will permit.

13. In the event the strike off is performed with a finishing machine, longitudinal floating of the concrete shall be performed by means of a hand-operated float board or a finishing machine equipped with a longitudinal wooden float.

a. The longitudinal wooden float on the finishing machine shall have a length of not less than 8 feet nor more than 12 feet.

b. When both strike off and longitudinal floating are to be performed by finishing machines, 1 machine, with operator, shall be used for strike off and a second machine, with second operator, shall be used for longitudinal floating.

c. Longitudinal floating may be performed with the same finishing machine that is used for strike off provided that the length of deck unit being placed is not more than 30 feet and the strike off operation is completed for the deck unit before the condition of the concrete requires that longitudinal floating be started.

14. Finishing machines used for strike off having a wheel base 6 feet or less shall be followed by 2 separate hand-operated float boards for longitudinal floating. All the provisions in this section pertaining to hand-operated float boards shall apply to the 2 separate float boards for longitudinal floating.

15. Longitudinal floats, either hand-operated or machine-operated, shall be used with the long axis of the float parallel to the centerline of the bridge roadway.

a. The float shall be operated with a combined longitudinal and transverse motion planing off the high areas and floating the material removed into the low areas.

b. Each pass of the float shall lap the previous pass by 1/2 the length of the float.

c. Floating shall be continued until a smooth riding surface is obtained.

D. In advance of curing operations, the surface of the concrete shall be textured by brooming with a stiff bristled broom or by other suitable devices which will result in uniform scoring. Brooming shall be performed transversely from finishing bridges.

E. Hand-operated float boards shall be from 12 feet to 16 feet long, ribbed and trussed as necessary to provide a rigid float and shall be equipped with adjustable handles at each end.

1. The float shall be wood, not less than 1 inch thick and from 4 inches to 8 inches wide.

2. Adjusting screws spaced at not to exceed 24 inches on centers shall be provided between the float and the rib.

3. The float board shall be maintained true and free of twist.

F. Hand-operated float boards shall be operated from transverse finishing bridges.

1. The finishing bridges shall span completely the roadway area being floated and a sufficient number of finishing bridges shall be provided to permit operation of the floats without undue delay.

2. Not less than 2 transverse finishing bridges shall be provided when hand-operated float boards are used.

3. When a finishing machine is used for longitudinal floating, 1 finishing bridge equivalent to the transverse finishing bridge specified herein shall be furnished for use by the Engineer.

G. Finishing bridges shall be of rigid construction and shall be free of wobble and springing when used by the operators of longitudinal floats and shall be easily moved.

H. Fogging equipment furnished shall be capable of applying water to the concrete in the form of a fine fog mist in sufficient quantity to curb the effects of rapid evaporation of mixing water from the concrete on the deck. The fog mist shall be applied at the time and in the manner approved by the Engineer.

I. Immediately following completion of the deck finishing operations, the concrete in the deck shall be cured as specified in ***Subsection 501.03.09, "Curing."***

J. The finished surface of the concrete shall be tested by means of a straightedge 12 feet long.

1. The surface shall not vary more than 0.01 foot from the lower edge of the straightedge.

2. All high areas in the hardened surface in excess of 0.01 foot as indicated by testing shall be removed by abrasive means.

3. After grinding by abrasive means has been performed, the surface of the concrete shall not be smooth or polished, but shall have a surface texture satisfactory to the Engineer.

4. Ground areas shall be of uniform texture and shall present neat and approximately rectangular patterns.

K. Where the concrete of the bridge deck is to be covered by bituminous surfacing, earth, or other cover, 1 inch or more in thickness, the surface of the concrete shall not vary more than 0.03 feet from the lower edge of the 12-foot straightedge.

L. Bridge deck surfaces under the curbs, railings, and sidewalks shall be struck off to the same plane as the roadway and left undisturbed when future widening is shown on the plans.

M. The top and face of the finished parapet and curb shall be true and straight, and the top surface shall be of uniform width, free from humps, sags, or other irregularities. When a straightedge 12 feet long is laid on top of the face of the curb or on the face of the parapet, the surface shall not vary more than 1/8 inch from the theoretical grade or alignment in 12 feet, except that proper allowance shall be made for curves and camber.

N. Manual methods, other than specified in this subsection, or other machine methods for finishing bridge deck concrete may not be permitted, unless directed by Engineer.

502.03.16 FORMED SURFACES REQUIRING FINISHING

A. Structures requiring a "fine surface finish (F.S.F.)" will be noted on the plans.

B. All structures not requiring a fine surface finish shall be given an ordinary surface finish.

C. Only exposed surfaces of structures will require finishing (ordinary or fine).

D. Exposed surfaces are defined as follows:

1. Exterior vertical faces of slab spans, rigid frames, arches, and box girders.

2. The underside of overhanging slabs to point of junction of the supporting beams.

3. Vertical surfaces of piers, columns, bent caps, abutments, wing walls, and retaining walls which are exposed to view after all backfill and embankment is placed. Exposed surfaces in this case are considered to extend to 1 foot below finished grade.

4. The inside of culvert barrels over 4 feet in height for the same distance as the height of the opening when seen from a traveled way.

5. The underside of superstructures in urban areas.

502.03.17 ORDINARY SURFACE FINISH

A. The surface shall have all holes left by form ties and all other holes 1/4 inch or more in largest diameter repaired in accordance with ***Subsection 502.03.14, "Patching."*** The surface shall be true and even, free from stone pockets, depressions, or projections beyond the surface.

B. All fins and projections shall be knocked off or ground flush. Offsets greater than 1/8 inch shall be filled or tapered back to present a smooth appearance. A uniform color and appearance shall be obtained on all patched surfaces.

502.03.18 FINE SURFACE FINISH

A. Where it is indicated on the plans that a fine surface finish is required, the finish shall conform to the requirements for "Bonded Grout Finish" as specified below.

1. Before the finish is applied, the surface shall be true and even and free from stone pockets, depressions, or projections beyond the surface.
2. All fins and projections shall be knocked off or ground flush.
3. Offsets greater than 1/8 inch shall be filled or tapered back to present a smooth appearance.
4. All holes 1/4 inch or more in largest diameter shall be patched in accordance with ***Subsection 502.03.14, "Patching."***

B. **Bonded Grout Finish.**

1. This finish shall be an application of grout consisting of sand and other pigments and mineral fillers combined with a suitable binder.
   a. The sand shall pass a No. 30 sieve.
   b. The binder shall be either an epoxy, acrylic, vinyl, or phenolic resin.
   c. This mixture may be thinned by not more than 25 percent water by volume.
2. The finish shall be of such consistency and composition that it will provide a uniform appearance in color and texture when applied as specified below, and shall meet the requirements set forth in ***Section 727, "Concrete Surface Finishing Material."***
3. At least 30 days in advance of placing bonded grout finish, the Contractor shall furnish the Engineer a quart sample or larger, of the complete mixture for testing.
   a. The Contractor shall also furnish 2 certificates, issued by the manufacturer, certifying that the product complies with the specifications.
   b. The certificates shall be delivered to the Engineer at least 30 days in advance of placing the material.
4. The grout shall be applied by spray, using conventional spray equipment with a 1/4-inch round spray head.
   a. Material shall be supplied by either a surge pump with a 12-to-1 ratio or an auger type pump, with air pressure sufficient to achieve uniform texture.
   b. Worn spray heads shall be replaced as required to achieve a uniform finish.
5. Application shall be at the rate of 25-40 square feet per gallon.
6. The finish surface shall present a uniform appearance.
7. Color of fine surface finish to be applied will be shown on the plans. Where the color of the fine surface finish that is to be applied is not indicated on the plans, it

shall conform to Federal Color No. 37875 as shown in Table I of Federal Standard No. 595.

8. Surfaces of concrete shall be thoroughly cleaned just before applying fine surface finish. This may be accomplished by:

   a. Application of a 10 percent solution of muriatic acid or a 25 percent zinc sulfate solution, which shall be applied to completely remove oily film and to lightly etch the surface, or

   b. Thorough cleaning by an approved abrasive as required to remove all oily film.

9. Following cleaning, the surface shall be thoroughly rinsed with clean water. Surface to be finished need not be completely dry, but may be damp, prior to application of finish.

10. **CAUTION:** Do not apply finish unless temperature is at least 40 degrees F and is rising. Application shall be stopped if temperature is 40 degrees F and is dropping.

502.03.19 LIVE LOADS

A. Live loads such as traffic or superimposed earth loads shall not be allowed on the structure until concrete has reached an age of 14 days and has reached the 28-day compressive strength required.

B. Live loads may be allowed on the structure, with the approval of the Engineer, when the concrete has reached an age of 8 days and/or the 28-day compressive strength required in cases where the use of a special high-early strength concrete mix design has been approved.

C. Approach slabs shall be treated as concrete paving under ***Section 409, "Portland Cement Concrete Pavement."***

D. In the event of cold weather, the above specified time requirement shall be increased 1 day for every day the curing time is increased as prescribed in the ***Subsection 501.03.10.B, "Cold Weather — General."***

E. In case the concrete does not reach the desired strength within the time specified, the Engineer shall determine when the strength is adequate to carry live loads.

502.03.70 TEMPORARY HEAD WALL

A. The Contractor may utilize the temporary head walls for support of the required travel lane(s) and/or work areas adjacent to open excavation. If the Contractor chooses to utilize temporary head walls, the Contractor shall provide the Engineer with design plans and calculations for such head walls and/or supports. The design plans shall be in detail, showing all information as required by the Engineer, and shall bear the seal of a Nevada Registered Engineer.

END OF SECTION 502

SECTION 505 – REINFORCING STEEL

DESCRIPTION

505.01.01 GENERAL

A. This work shall consist of furnishing and placing reinforcing steel and mesh reinforcing in accordance with ACI 318 Chapter 7 and ACI 315 with the additions or exceptions listed below.

MATERIALS

505.02.01 GENERAL

A. Materials shall conform to the requirements specified in the following subsections:

Materials	Subsection
Fabricated Steel Bar or Rod Mats Reinforcement	***713.03.02***
Bar Steel Reinforcement	***713.03.01***
Welded Steel Wire Fabric Reinforcement	***713.03.03***

B. Bar steel reinforcement shall be Grade 60 bar steel reinforcement unless otherwise specified on the plans.

C. Spiral Reinforcement may be either Bar Steel Reinforcement or Steel Wire, of the equivalent size of the bar steel.

D. Epoxy coatings for steel reinforcing bars shall conform to ASTM D3963. Epoxy coatings listed in the NDOT QPL, found on the web at http://www.nevadadot.com, shall be used.

E. Tie wire shall be commercial quality 16 gage minimum, black annealed soft iron wire, unless otherwise approved. Tie wires used on epoxy coated reinforcing steel shall be coated with plastic or an equal type coating as approved.

F. At selected locations as indicated on the Contract Drawings, reinforcing steel shall be galvanized (zinc coated), in accordance with ASTM A767 or epoxy-coated.

G. At the expansion joint locations shown on the Contract Drawings or as directed by the Engineer, reinforcing steel shall be sprayed, coating the entire circumference of the bar, with a zinc-rich formulation conforming to ASTM A767.

505.02.02 SAMPLES

A. One extra bar of each diameter shall be furnished for each 100 tons or fraction thereof.

1. This bar shall be selected from the longest bar of each size so that the bar, or a portion of it, can be used to replace any bar of that diameter that is selected to be used as a field sample.

2. Supplied field sample shall be of sufficient length to provide two 30-inch samples of each diameter.

3. The extra bars shall be indicated on the fabricator's details.

505.02.03 SPECIFICATIONS FOR COATING REINFORCING STEEL

A. Coating of reinforcing steel shall conform to AASHTO M284.

4. The coating fabricator for epoxy coated reinforcing steel shall be certified by the Concrete Reinforcing Steel Institute's Certification Program for Fusion Bonded Epoxy Coating Applicator Plants.

5. A copy of the Epoxy Coating Certification along with notification starting date of coating application shall be submitted.

H. Notification shall be given of the date and location of the coating operation, in writing, at least 10 days before the planned date for beginning the coating operation.

1. The Engineer shall be allowed free access to plant of the coating applicator for inspection.

2. If the representative so elects, preparation, coating, and curing of the bars shall be performed in the representative's presence.

I. Patching or repair material that is in compliance with AASHTO M284 shall be made available from the coating manufacturer.

CONSTRUCTION

505.03.01 REINFORCING STEEL LIST

A. In accordance with ACI 315, before placing reinforcing steel, the Contractor shall submit shop drawing details and furnish 2 copies of a list of all reinforcing steel showing sizes, lengths, and numbers of pieces and bends required to the Engineer at the site for Engineer's use in administering the contract.

1. Furnishing such lists to the Engineer shall not be construed to mean that the lists will be reviewed for accuracy.

2. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing all bar reinforcing steel in accordance with the details shown on the plans and as specified.

505.03.02 PROTECTION OF MATERIALS

A. Reinforcing steel shall be protected at all times from damage.

J. When placed in the work, the reinforcing steel shall be free from dirt, detrimental scale, paint, oil, or other foreign substance.

K. However, when steel has on its surface loose mill scale or dust that is easily removable, it may be cleaned by a satisfactory method, if approved by the Engineer.

505.03.03 BENDING

A. Bent bar reinforcement shall be cold bent to the shape shown on the plans.

L. Unless otherwise provided on the plans or by authorization, bends shall be made in accordance with the ACI Manual of Standard Practice for Detailing Reinforced Concrete Structures.

505.03.04 PLACING AND FASTENING

A. In accordance with ACI 315, all bar reinforcement shall be accurately placed in the positions shown on the plans and firmly held during the placing and setting of concrete.

M. When the spacing of bars exceeds 1 foot in either direction, all intersections shall be tied.

N. Distances from the vertical and horizontal forms shall be maintained by means of stays, blocks, ties, hangers, or other approved supports.

1. Blocks used for holding reinforcing bars from contact with the forms or between layers of bars shall be precast mortar blocks of approved shape and dimensions and shall have a compressive strength of not less than 3,000 psi.

2. Metal chairs that are in contact with the exterior surface of the concrete shall be fabricated of galvanized steel, or have the steel tips plastic coated to at least 3/4 inch into the concrete, or be of stainless steel conforming to the requirements of ASTM A493, Type 430.

3. The use of pebbles, pieces of broken stone or brick, metal pipe, and wooden blocks will not be permitted.

O. Reinforcement in any member shall be placed, and then inspected and approved by the Engineer, before the placing of concrete begins. Concrete placed in violation of this provision may be rejected and its removal required.

P. If mesh reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.

505.03.05 SPLICING

A. In accordance with ACI 315, all reinforcement bars shall be furnished in the full lengths indicated on the plans.

Q. Splicing of bars, except where shown on the plans, will not be permitted without the written approval of the Engineer.

1. Splices shall be staggered as far as possible.

2. Unless otherwise shown on the plans, bars near the top of beams and girders having more than 12 inches of concrete under the bar shall be lapped 35 diameters and all other bars shall be lapped 20 diameters to make the splice.

3. In lapped splices, the bars shall be placed in contact and wired together.

R. Welding of reinforcing steel shall be done only if detailed on the plans or authorized by the Engineer in writing. Welding shall conform to the specifications for Welded Highway and Railway Bridges of the American Welding Society.

S. Lapped splices in reinforcement shall not be used for sizes larger than No. 11.

T. Tensile reinforcement shall preferably not be spliced at points of maximum stress. The length of lap for deformed bars shall not be less than 24 and 36 bar diameters for Grade 40 and Grade 60, respectively, nor less than 12 inches.

U. Where lapped splices are used in reinforcement in which the critical design stress is compressive and with concrete having a strength of 3,000 psi or more, the length of lap for deformed bars shall be 20 bar and 24 bar diameters for Grade 40 and Grade 60,

respectively, but not less than 12 inches. When the specified concrete strengths are less than 3,000 psi, the amount of lap shall be 1/3 greater than the values given above.

V. Splices in spiral steel shall be made by welding or a lap of 1-1/2 turns.

W. Sheets of mesh reinforcement shall overlap each other sufficiently to maintain a uniform strength and shall be securely fastened at the ends and edges. The edge lap shall not be less than 1 mesh in width.

505.03.06 SUBSTITUTIONS

A. Substitution of different size bars will be permitted only with specific authorization by the Engineer.

X. The bars substituted shall have an area equivalent to the design area or larger.

END OF SECTION 505

SECTION 506 – STEEL STRUCTURES

DESCRIPTION

506.01.01 GENERAL

A. This work shall consist of furnishing, fabricating, casting, machining, or otherwise preparing, transporting, erecting, and painting structural steel, rivet and eye bar steel, steel forgings, casting, and any other metal of the type, shape, dimensions, and quality, required by these specifications or as shown on the plans.

MATERIALS

506.02.01 GENERAL

A. Materials shall meet the pertinent requirements of the following sections:

Materials	Section
Structural and Eyebar Steel	***710***
Aluminum for Bridge Rail	***711***
Miscellaneous Metal	***712***
Paint and Pavement Markings	***714***
Galvanizing	***715***
Elastomeric Bearing Pads	***725***

B. Turned bolts shall meet the material specifications set forth for Structural Rivet Steel. Anchor bolts, nuts, and washers shall be of structural steel, galvanized in accordance with ASTM A153. Bolts for fastening tubes to the rail posts sockets shall be stainless steel.

C. Steel bridge and pedestrian railing shall be primed and painted in accordance with ***Subsection 714.03.01, "Iron and Steel Use Items Classifications."***

D. Bridge or pedestrian rail and posts made of aluminum shall not be painted.

E. Shims shall be either aluminum alloy or asbestos sheet packing, at the Contractor's option.

1. Aluminum Alloy Shims shall conform to ASTM B209, Alloy 1100-0.
2. Asbestos sheet packing shall be composed essentially of asbestos fibers bonded together with a cementing medium rendering it tough and pliable.
3. The deformation of the packing under a load of 10,000 pounds per square inch shall be less than 16 percent of the thickness and the loss on ignition shall not be more than 25 percent.

F. Insulating material for insulating the base of aluminum rail posts from concrete and from steel anchor bolts shall be an aluminum impregnated light colored caulking compound of the consistency of putty.

G. Shims for steel railing shall be galvanized steel plates.

H. All bolts, nuts, and washers shall be either steel galvanized in accordance with ASTM A153; stainless steel conforming to ASTM A276; or steel cadmium plated in accordance with ASTM B766, Type TS.

CONSTRUCTION

506.03.01 SHOP DRAWINGS

A. Shop drawings shall consist of shop detail, erection, and other working drawings showing dimensions, size of material, details, and other information necessary for the complete fabrication and erection of the metal work.

1. The drawings shall be prepared on sheets 24 inches by 36 inches.
2. Eetails shall be drawn so that the prints will be clear and legible.

B. Unless otherwise requested, the Contractor shall submit to the Engineer, for approval, 3 sets of drawings.

1. The Engineer reserves the right to refuse prints of shop drawings which are not clear and legible.
2. Upon approval, the Contractor shall furnish the Engineer with the number of sets of shop drawings requested.
3. All shop plans shall be submitted for approval at least 15 days before fabrication is started and no material shall be fabricated until the plans have been finally approved by the Engineer.

C. After approval, there shall be no deviation from the shop drawings or changes made thereon without the prior approval of the Engineer.

D. Approval of shop drawings shall be understood to be an acceptance of the character and sufficiency of the details and not a check of any dimensions. Checking shop drawings is intended as a means of facilitating the work and avoiding errors, but it is expressly understood that it will not relieve the Contractor from the responsibility for errors or omissions on the shop drawings.

E. The contract price shall include the cost of furnishing all shop drawings and the Contractor will be allowed no extra compensation for shop drawings.

506.03.02 NOTICE OF BEGINNING WORK

A. The Contractor shall give the Engineer ample notice of manufacturing of material at the mill so that inspection may be provided. "Mill" means any rolling mill or foundry where material for the work is to be manufactured.

B. No material shall be manufactured or fabrication begun without authorization by the Engineer.

C. The Engineer may inspect the material, as provided for in ASTM A6, at Engineer's option.

D. Material not inspected at the place of manufacture shall be subject to inspection as provided for in ***Subsection 506.03.03, "Inspection and Testing."***

E. Prior to the beginning of fabrication, a 15-day written notice shall be provided by the Contractor to the Engineer.

F. Any purchase of material prior to inspection at the mill or fabrication of any work without authorization from the Engineer shall be at the Contractor's risk.

506.03.03 INSPECTION AND TESTING

A. The Engineer will examine and test as necessary all material before fabrication.

1. Adequate facilities and free access to the necessary work areas will be provided to the Engineer by the manufacturer and fabricator.
2. Required test samples will be furnished free of charge.
3. Material not inspected at the place of manufacture shall be subject to all chemical, physical, and workmanship requirements established for the material supplied.
4. Materials or workmanship not in conformity with the specified product may be rejected.

B. The Engineer may inspect and test all material by any visual, destructive, or non-destructive method to evaluate the material for its specified properties.

1. Mill orders and certificates, showing test values obtained, shall be furnished in triplicate to the Engineer.
2. All certified test values shall include physical and chemical results and steel making process used.
3. Test samples will be obtained from all steel not identified by mill heat numbers.
4. Acceptance of any material at the mill or fabrication shop prior to incorporation shall not prevent the rejection of the material or finished member if defects are discovered during the fabrication process.

C. Inspection in the fabrication shop is intended as a means of facilitating the work and avoiding errors as far as possible.

1. It is expressly understood that shop inspection does not relieve the Contractor from responsibility for material or fabrication defects or errors and the necessity for replacement or correction of rejected materials and workmanship.

D. Shop inspection of rail pipe and tubes will, in most cases, be waived and the Contractor permitted to ship subject to inspection at the project site.

1. The field inspection will cover the general appearance, size, thickness, etc., of the pipe and tubing.
2. Conformance of chemical and mechanical properties to requirements of the specifications will also be considered before the material is approved.
3. Shop inspection of rail posts will be made on the first few rail post castings furnished for each project in order to establish a satisfactory class of finish and workmanship.
4. When shop inspection is waived on a portion of the handrail posts for a project, a careful inspection will be made in the field to determine the acceptability of these posts on the basis of the finish and workmanship as compared to that of the other posts previously inspected and approved.

E. Fabrication of aluminum alloy material shall, in general, conform to or be equivalent to fabrication methods and practices recommended in the handbook of the major producers of aluminum materials and specifically the following requirements:

1. Material shall be sawed, routed, or milled.

2. Flame cutting is not permissible.

3. Tubing may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 15 minutes to facilitate bending.

4. Holes in pipe tubing shall be drilled. Holes in castings shall be cored and reamed, or drilled from the solid. Seats for pipe shall be finished smooth.

F. The fabrication and handling of aluminum materials in the shop and field shall be performed in a manner to prevent scoring or marring of the surfaces.

1. An objectionable appearance resulting from such scoring or marring shall be cause for rejection of the material.

2. Sleeves and rails shall be fabricated in lengths indicated on the plans.

G. The finishing of rail posts shall be performed after fabrication is completed. All fins, pipes, and other casting irregularities and all drilling, reaming, and other fabrication marks shall be removed.

506.03.04 STORAGE

A. The loading, transporting, unloading, storing, and handling of structural steel shall be conducted so that the metal will be kept clean and free from injury.

1. When unloaded, the material shall be placed on skids above the ground.

2. All material for the project shall be stored separate from "in stock" materials.

3. Girders and beams shall be placed upright and shored.

4. Long members, such as columns and chords, shall be supported on skids placed near enough together to prevent injury from deflections.

B. Different grades and classifications of material shall be color coded, as provided for in ASTM A6. This color code shall be transferred throughout fabrication.

C. If the contract covering the erection of the steel does not include the fabrication, the Contractor shall check the material received by Contractor and report promptly, in writing to the Engineer, any shortage or injury discovered.

506.03.05 STRAIGHTENING

A. Rolled material before being laid out or worked shall be straight. Subassemblies and completed members shall be straight before being incorporated into the work.

B. If straightening is necessary, it shall be done by methods acceptable to the Engineer. Details of methods proposed for straightening shall be submitted in writing to the Engineer prior to their use.

C. After straightening, evidence of fracture or other damage will be cause for rejection of the material.

D. Dimensional tolerances and repairs of surface irregularities described in ASTM A6 shall govern for the acceptance of repaired material.

506.03.06 SUBPUNCHING, DRILLING, AND REAMING

A. Unless otherwise specified, rivet holes and connections and splices (shop and field) of main truss or arch members, continuous beams, plate girders and rigid frames and rivet holes in plate girder flanges, and stiffeners, intermediate stiffeners intended as supports for concentrated loads, and web splices shall either be subpunched (or subdrilled) and reamed while shop assembled or drilled to full size from the solid while assembled at the shop.

B. The assembly, including camber, alignment, accuracy of holes and mill joints, shall be approved by the Engineer before reaming is commenced.

C. Unless otherwise specified, each individual (full length) truss, arch, continuous beam, or girder shall be assembled at the shop before reaming or drilling is commenced. During shop assembly, all members shall be supported at such intervals and in such manner as is necessary to avoid undesirable deflections.

D. All holes for floor beams and stringer field end connections shall be subpunched and reamed to a steel template.

506.03.07 BOLTS AND BOLTED CONNECTIONS

A. **Bolted Connections:**

1. Bolted connections shall not be used unless called for in the contract documents.
2. Where bolted connections are permitted, the bolts furnished shall be as hereinafter specified.
    a. Ribbed high-tensile strength bolts or high-tensile strength bolts may be substituted for field rivets in locations where, in the opinion of the Engineer, it is impractical to drive rivets.
    b. Bolts shall be of such length that they will extend entirely through the nut, but not more than 3/8 inch beyond.
    c. The Contractor shall furnish sufficient bolts of each type for each size and length to bolt such connections as called for with an ample surplus to replace bolts lost or rejected.
3. The holes, except holes in end diaphragms, shall be truly cylindrical.
    a. Holes shall be at right angles to the surface of the metal so that both head and nut will bear squarely against the metal.
    b. Bolts shall be driven accurately into the holes without damaging the thread.
    c. A snap shall be used to prevent damaging the heads.
4. Bolt holes in end diaphragms shall be slotted 1/2 inch in addition to the dimensions shown on the plans, in the direction to facilitate erection. At all locations where such slotted bolt holes are required, circular washers shall be placed on each side of the bolted connection, and the necessary bolt length adjusted accordingly.
5. Bolts in end diaphragms to girder connections shall not be tightened until the deck pour has been completed.

6. All bolted connections shall be fastened with high-tensile strength bolts or ribbed high-tensile strength bolts. The use of unfinished bolts or plain ribbed bolts will not be permitted.

B. **High-Tensile Strength Bolts.** The use of high strength bolts in structural connections shall comply with Article 2.10.20, "Construction Using High Strength Bolts," of the current AASHTO Standard Specifications for Highway Bridges.

506.03.08 SHOP ASSEMBLY

A. Shop assembly of trusses, arches, continuous beams, continuous plate girders, plate girders, and rigid frames shall be according to ***Subsection 506.03.06, "Subpunching, Drilling, and Reaming."*** All members shall be match marked before being disassembled.

B. Complete shop assembly of an entire structure, including floor system, which may be necessary in the case of complicated design or of skewed or super-elevated structure shall be done only if required by the Special Provisions.

1. The several component parts of a built-up member shall be straight and close fitting.
2. Surfaces of metal in contact shall be cleaned before assembling.
3. The parts of a member shall be assembled, well pinned, and firmly drawn together with bolts before drilling, reaming, or riveting is commenced.
4. Assembled pieces shall be taken apart, if necessary, for the removal of burrs and shavings produced by the operations.
5. The member shall be free from twists, bends, and other deformations.
6. End connections, angles, stiffener angles, and similar parts shall be carefully adjusted to correct positions and bolted, clamped, or otherwise firmly held in place until riveted.

C. The drifting done during assembling shall be such as to bring the parts into position, and not sufficient to enlarge the holes or distort the metal. If any holes must be enlarged to admit the rivets, they shall be reamed.

D. Parts not completely riveted in the shop shall be secured by bolts insofar as practicable to prevent damage in shipment and handling.

E. Connecting parts assembled in the shop for the purpose of reaming holes in field connections shall be match marked, and a diagram showing such marks shall be furnished to the Engineer.

506.03.09 EDGE PLANING

A. Sheared edges of plates more than 5/8 inch in thickness and carrying calculated stress shall be planed to a depth of 1/4 inch.

B. Re-entrant cuts shall be filleted to a radius of 3/4 inch.

506.03.10 FACING OF BEARING SURFACES

A. The surface finish of bearing and base plates and other bearing surfaces that are to come in contact with each other or with concrete shall meet the American Standards Association

surface roughness requirements as defined in ASA B46.1-55, Surface Roughness, Waviness and Lay, Part 1:

Steel Slabs	ASA 2,000
Heavy Plates in Contact in Shoes to be Welded	ASA 1,000
Milled Ends of Compression Members, Stiffeners, and Fillers	ASA 500
Bridge Rollers and Rockers	ASA 250
Pins and Pin Holes	ASA 125
Sliding Bearings	ASA 125

B. Surfaces of bronze bearing plates intended for sliding contact shall be planed parallel to the movement of the spans and polished.

506.03.11 ABUTTING JOINTS

A. Abutting joints in compression members of trusses and in columns shall be milled.

B. Opening and abutting joints in tension members shall not exceed 1/4 inch.

C. Abutting joints of continuous I-beam spans shall be square and tight-fitting.

D. Abutting joints in top and bottom flanges of plate girders shall be square and tight-fitting.

506.03.12 FLAME CUTTING

A. Preparation of material for flame cutting shall be in accordance with the provisions of AWS D2.0, Paragraph 302.

506.03.13 END CONNECTION ANGLES

A. Floor beams, stringers, and girders having end connection angles shall be built to exact length shown on the plans measured between the heels of the connection angles, with a permissible tolerance of minus 1/16 inch.

B. Where continuity is required, end connections shall be faced.

C. The thickness of the connection angles shall not be less than 3/8 inch, nor less than that shown on the detail drawings.

506.03.14 LACING BARS

A. The ends of lacing bars shall be neatly rounded unless another form is required.

506.03.15 WEB PLATES

A. In girders having no cover plates and not to be encased in concrete, the top edge of the web plate shall not extend above the backs of the flange angles and shall not be more than 1/8 inch below at any point.

1. Any portion of the plate projecting beyond the angles shall be chipped flush with the backs of the angles.

2. Web plates or girders having cover plates may be 1/2 inch less in width than the distance back to back of flange angles.

B. Splices in webs of girders without cover plates shall be sealed on top by welding.

C. At web splices, the clearance between the ends of the web plates shall not exceed 3/8 inch. The clearance at the top and bottom ends of web splice plates shall not exceed 1/4 inch.

506.03.16 STUD SHEAR CONNECTORS

A. Stud shear connectors shall be of a design suitable for end welding and shall be end welded to steel beams, girders, or plates with automatically timed stud welding equipment.

1. The type, size or diameter, placement pattern, and length of stud shall be as specified in the contract documents. (See Figure No. 1, below, for allowable tolerances or dimensions).
2. A maximum variation of 1 inch from the location shown will be accepted provided the adjacent studs are not closer than 2-1/2 inches center to center.
3. The clear distance between the edge of a girder flange and the edge of the shear connectors shall be not less than 1 inch.
4. Fillet welds varying in size from 3/16 inch to 5/16 inch are satisfactory provided the studs pass all other tests required.
5. Adequate provision shall be made in fabrication of structural members to compensate for loss of camber due to welding of the shear connectors.

B. Studs shall not be painted or galvanized.

1. The studs shall be free from rust, scale, rust pits, and oil at the time of welding and immediately before the concrete is placed.
2. The beam surface to which the studs are welded shall be free from excessive mill scale, rust, dirt, paint, grease, or any other material which might impair the quality of the weld.
3. When necessary to obtain satisfactory welds, the areas on the beam, girder, or plate to which the studs are to be welded shall be wire-brushed, peened, prick-punched, or ground free of scale or rust.

C. The Contractor shall submit to the Engineer for approval before installation, information on the studs to be furnished as follows:

1. The name of the manufacturer.
2. A detailed description of the stud and arc shield.
3. A certification from the manufacturer that the stud is qualified as specified in AWS D2.0. The certification must also indicate the heat from which the studs were manufactured.

D. Welding specifications and procedure requirements shall conform to AWS D2.0.

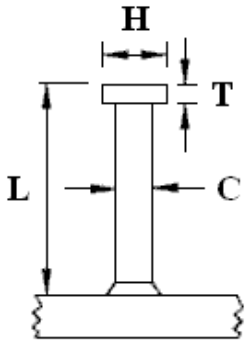
STEEL STRUCTURES	STANDARD DIMENSIONS			
	C	L*	H	T
	3/4" +0.000" –0.010"	4" +0.062" –0.125"	1-1/4" ±1/64"	3/8" minimum
	7/8" +0.000" –0.010"	4" +0.062" –0.125"	1-3/8" ±1/64"	3/8" minimum
	*NOTE: 4" length is standard. Other lengths may be obtained by special order.			

Figure 1. DIMENSIONS AND TOLERANCES

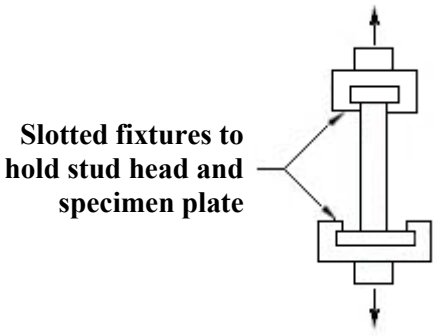


Figure 2. TYPICAL TENSILE TEST FIXTURE

506.03.17 WELDING

A. Welding of steel structures when authorized in accordance with the provisions contained herein, called for in the contract documents, or upon written permission from the Engineer shall conform to the most recent edition of the American Welding Society's *Bridge Welding Code*, except as modified in this subsection.

B. All welding shall be performed in the fabrication shop, except as otherwise noted on the plans or permitted by the Engineer.

C. **Inspection and Testing of Shop Welds:**

1. **Radiographic Inspection:**

   a. The procedure, techniques, and standards of acceptance shall be in conformance with the current AWS D2.0 Specifications.

   b. The Engineer will make all final interpretations of weld defects and film quality.

   c. All radiographs will be the property of the Contracting Agency during and after completion of the project.

2. **Ultrasonic Inspection.** The procedure, techniques, and standards of acceptance shall be in conformance with the current AWS D2.0 Specifications except as modified in this subsection.

3. **Magnetic Particle Inspection.** This procedure and technique shall be in conformance with ASTM E709, "Standard Guide for Magnetic Particle Testing."

D. **Inspection and Testing of Field Welds:**

1. The Contracting Agency will make magnetic particle inspections, ultrasonic inspections, or radiographic inspections of field welds when so required by the plans or the Special Provisions.

2. The acceptability of welds will be judged in accordance with the Inspection and Testing of Shop Welds for the type of inspection employed.

E. Welds shall be painted according to the applicable provisions of ***Section 614, "Painting."***

F. All groove welds on primary members shall be finished smooth and flush with the base metal on all surfaces by grinding in the direction of applied stress, leaving surfaces free from depressions. Chipping may be used provided it is followed by such grinding.

506.03.18 FIT OF STIFFENERS

A. End stiffeners of girders and stiffeners intended as supports for concentrated loads shall be milled or ground to secure an even bearing against the flange.

1. Intermediate stiffeners shall fit sufficiently tight to exclude water after being painted.

2. Fillers under stiffeners shall fit within 1/4 inch at each end.

B. Welding will be permitted in lieu of milling or grinding if noted in the contract documents. Where stiffeners are required on 1 side of the web only, they shall be welded to the compression flange.

506.03.19 ANNEALING AND STRESS RELIEVING

A. Members such as bridges shoes, pedestals, or other parts which are built up by welding sections of plate together, and stress relieving is called for in the contract documents, stress relieving shall be in accordance with the provisions of the American Welding Society.

506.03.20 PINS AND PIN HOLES

A. Rollers shall be of structural carbon steel, and pins shall be carbon steel forgings meeting the requirements of ***Subsection 710.03.08, "Pins and Rollers."***

1. Pins and rollers shall be accurately turned to the dimensions shown on the drawings and shall be straight, smooth, and free from flaws.

2. Final surface shall be produced by a finishing cut.

B. In pins larger than 9 inches in diameter, a hole not less than 2 inches in diameter shall be bored full length along the axis after the forging has been cooled to a temperature below the critical range under suitable conditions to prevent injury by too rapid cooling, and before being annealed.

C. Pin holes shall be bored true to the specified diameter, smooth and straight, at right angles with the axis of the member, and parallel with each other unless otherwise specified.

D. The distance outside to outside of holes in tension members and inside to inside of holes in compression members shall not vary from that specified more than 1/32 inch. Boring of holes in built-up members shall be done after the assembly is completed.

E. The diameter of the pin hole shall not exceed that of the pin by more than 1/50 inch for pins 5 inches or less in diameter, or more than 1/32 inch for larger pins.

F. Screw threads for all bolts and pins for structural steel construction shall conform to the American National Coarse Thread Series, Class 2, free fit, except that pin ends having a diameter of 1-3/8 inches or more shall be threaded 6 threads to the inch.

G. Pilot and driving nuts shall be used in driving pins.

1. They shall be furnished by the Contractor without charge.
2. Two pilot nuts and 2 driving nuts for each size of pin shall be furnished, unless otherwise specified.
3. Pins shall be so driven that the members will take full bearing.
4. Pin nuts shall be screwed up tight and the threads burred at the face of the nut with a pointed tool.

506.03.21 SHOP PAINTING

A. Unless otherwise provided, the application of shop paints shall conform to the requirements of ***Section 614 "Painting."***

B. Surfaces to be in contact after shop riveting is completed shall be cleaned but shall not be painted.

506.03.22 MARKING AND SHIPPING

A. Each member shall be painted or marked with an erection mark for identification and an erection diagram shall be furnished with erection marks shown thereon.

B. Members weighing more than 3 tons shall have the weight marked thereon.

C. Structural members shall be loaded on trucks or cars in such a manner that they may be transported and unloaded at their destination without being excessively stressed, deformed, or otherwise damaged.

D. All girders shall be shipped with the web vertical, which position shall be maintained in subsequent operations.

506.03.23 ERECTION METHODS AND EQUIPMENT

A. Before starting work, the Contractor shall inform the Engineer fully as to the method of erection the Contractor proposes to follow and as to the amount and character of the equipment the Contractor proposes to use, the adequacy of which shall be subject to the approval of the Engineer.

1. The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety and adequacy of Contractor's methods or equipment or from carrying out the work in full accordance with the plans and specifications.
2. No work shall be done without the sanction of the Engineer.

B. Spot welding for the purpose of eliminating field erection bolts or for holding steel parts together while fastening will not be permitted.

C. All work of erection shall be subject to inspection.

1. The Contractor shall furnish facilities for inspection of material and workmanship.

2. Material and workmanship not previously inspected shall be inspected after delivery to the site of the work.

D. The Contractor shall provide the falsework and all tools, machinery, and appliances, including drift pins and fitting-up bolts necessary for the expeditious handling of the work.

E. Anchor bolts for rail posts shall be galvanized high-strength bolts set with suitable templates in exact position and securely fixed to prevent displacement during the concreting operations.

1. The areas of concrete upon which posts are to be set shall be dressed by grinding or rubbing to a true plane for the proper seating of the posts.

2. All surfaces of aluminum alloy posts and adjustment shims to be in contact with concrete or with the steel anchor bolts nuts and washers shall be coated with aluminum insulating compound.

F. Rail posts shall be erected in sections.

1. Erection of sections of rails and posts shall continue successively until all or an approved portion of the required rail is erected.

2. The rail shall then be aligned and the nuts on the anchor bolts tightened.

3. In final adjustment, no posts shall deviate more than 1/8 inch from true alignment and there shall be no abrupt break in alignment of any location.

4. Aluminum shims may be slotted for ease in placing if approved by the Engineer.

506.03.24 FALSEWORK

A. The falsework shall be designed and substantially constructed and maintained for the vertical and lateral loads that will be applied to the structure.

1. The Contractor shall prepare and submit to the Engineer for approval plans for falsework or for changes in an existing structure necessary for maintaining traffic.

2. Approval of the Contractor's plans shall not be considered as relieving the Contractor of any responsibility.

B. Upon completion of the erection and before final acceptance, the Contractor shall remove all falsework, excavated or useless materials, rubbish and temporary buildings, replace or renew any fences damaged, restore in an acceptable manner all property, both public and private, which may have been damaged during the prosecution of the work, and leave the structure site and adjacent highway in a neat and presentable condition satisfactory to the Engineer.

C. All excavated material or falsework placed in the stream channel before construction shall be removed by the Contractor before final acceptance.

506.03.25 BEARING AND ANCHORAGE

A. Masonry bearing plates shall not be placed upon bridge seat bearing areas which are improperly finished, deformed, or irregular.

1. Bearing plates shall be set level in exact position and shall have a full and even bearing upon the masonry.

2. Unless otherwise directed by the Engineer, the bearing plates shall be placed on a layer of canvas and red lead applied as follows:

a. Thoroughly swab the bridge seat bearing area with red lead paint and place upon it 3 layers of 12-ounce to 14-ounce duck, each layer being thoroughly swabbed on its top surface with red lead paint.

b. Place the superstructure shoes or pedestals in position while the paint is plastic.

c. As an alternate to canvas and red lead, sheet lead may be used if called for on the plans.

B. The milled and finished surfaces of castings or bearing plates shall have the shop coat of tallow, white lead, or oil removed immediately prior to placing in the structure. Surfaces designed for sliding movement, one upon the other, shall be given a field coat of graphite grease when placed in the structure.

C. The Contractor shall drill the holes and set the anchor bolts, except where the holes are formed or the bolts are built into the masonry.

1. The bolts shall be set accurately and fixed with Portland cement grout, completely filling the holes.

2. The location of the anchor bolts in relation to the slotted holes in the expansion shoes shall correspond with the temperature at the time of erection.

3. The nuts on anchor bolts at the expansion ends of spans shall be adjusted to permit free movement of the span.

D. Elastomeric bearing pads shall conform to ***Subsection 502.03.12, "Expansion, Fixed Joints and Bearings."***

506.03.26 FIELD ASSEMBLING

A. The parts shall be accurately assembled as shown on the plans and match-marks shall be followed.

1. The material shall be carefully handled so that no part will be bent, broken, or otherwise damaged.

2. Hammering which will injure or distort the members shall not be done.

3. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.

4. Unless erected by the cantilever method, truss spans shall be erected on blocking so placed as to give the trusses proper camber.

5. The blocking shall be left in place until the tension chord splices are fully fastened and all other truss connections pinned and bolted.

6. Splices of butt joints of compression members, in railings, and in other field splice connections shall have 1/2 of the connection holes filled with bolts and cylindrical erection pins (half bolts and half pins) before fastening.

7. Splices and connections carrying traffic during erection shall have 3/4 of the holes so filled.

B. Cylindrical erection pins shall be 1/32 inch larger than the fitting up bolts.

506.03.27 MISFITS

A. The correction of minor misfits involving nonharmful amounts of reaming, cutting, and chipping shall be considered a legitimate part of the erection.

B. However, any error in the shop fabrication, or deformation resulting from handling and transportation, which prevents the proper assembling and fitting up of the parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be reported immediately to the Engineer and Engineer's approval of the method of correction obtained.

C. The correction shall be made in the Engineer's presence.

D. The Contractor shall be responsible for all misfits, errors, and injuries and shall make the necessary corrections and replacements.

506.03.28 FIELD PAINTING

A. Structural steel, unless otherwise specified, shall be painted as specified in ***Section 614, "Painting."***

END OF SECTION 506

SECTION 601 – PIPE CULVERTS-GENERAL

DESCRIPTION

601.01.01 GENERAL

A. This section includes general requirements that are applicable to all types of culvert pipes regardless of the material or culvert use with the following exceptions:

1. Structural plate pipe,
2. Water distribution systems and sanitary sewer system specifications will specify the pipe to be used in their respective installations.

B. This work shall consist of furnishing and installing pipe culverts, siphons, end sections, end walls, and so forth, as may be required to complete the work shown on the plans or established by the Engineer.

C. The pipe shall comply with AASHTO Design and Construction LRFD Specifications most current edition and these specifications. The more stringent requirements shall apply.

D. This work shall also consist of preparing utility final location information as described on the project drawings and in Section 622 of these Special Provisions.

MATERIALS

601.02.01 GENERAL

A. The materials used shall conform to the requirements in the following subsections:

Materials	Section/Subsection
Bituminous Coated Corrugated Metal Pipe and Pipe Arches	***709.03.02***
Clay Pipe	***708.03.04***
Corrugated Aluminum Pipe	***709.03.04***
Corrugated Metal Pipe and Pipe Arches	***709.03.01***
Grout and Mortar Sand	***706.03.04***
Nonreinforced Concrete Pipe	***708.03.02***
Hydraulic Cement	***701***
Reinforced Concrete Pipe	***708.03.01***
Rubber Gaskets	***707.03.06***
Thermoplastic Pipe	***709.03.10***

B. When the location of manufacturing plants allows, the plants will be inspected periodically for compliance with specified manufacturing methods.

1. Material samples will be obtained for laboratory testing for compliance with materials quality requirements as specified in the referenced specifications.
2. This can be the basis for acceptance of manufacturing lots.

C. All materials will be subject to inspection for acceptance as to condition at the latest practicable time the Engineer has the opportunity to check for compliance prior to or during incorporation of materials in the work.

D. The lengths shown on the plans are approximate.

E. BLANK

CONSTRUCTION

601.03.01 EARTHWORK

A. Excavation and backfill shall conform to the requirements of ***Section 206, "Structure Excavation,"*** and ***Section 207, "Structure Backfill,"*** or ***Section 208, "Trench Excavation and Backfill,"*** when the culvert is placed in a trench.

1. The pipe shall be bedded as shown in the plans and/or drawings appended to the plans or as specified in the Special Provisions.

2. When no bedding class is specified, the requirements for normal bedding as shown in the Uniform Standard Drawings shall apply.

3. The lines and grades will be established by the Engineer or as designated in the contract documents.

B. Where pipes are to be installed in new embankments on a steep slope or in a difficult location, the height of new embankments may be varied as directed by the Engineer before installing pipes.

C. When headwalls are not required and granular materials are used for backfilling, the fill at the ends of the structure shall be sealed against the infiltration of water by bedding the ends of the structure using Class II CLSM or concrete.

601.03.02 HEADWALLS

A. Where shown on the plans, inlet and outlet headwalls shall be constructed or installed in connection with culvert pipes.

B. Where headwalls are constructed or installed, the ends of pipes shall be placed flush or cut off flush with the headwall face, unless otherwise permitted by the Engineer.

C. Headwalls shall be constructed to conform ***to Section 501, "Portland Cement Concrete"*** and ***Section 502, "Concrete Structures."***

601.03.03 END SECTIONS

A. The bed for the end section shall be excavated to the required width and grade.

B. For metal end sections with toe plates, a trench shall be excavated for the toe plate in a manner to permit the toe plate from being against the inner face of the trench when the end section is in its final position. After end sections have been properly secured to the pipe, this trench shall be backfilled and firmly compacted.

C. Precast concrete end section shall be placed with its tongue (or groove) fully entered in the groove (or tongue) of the pipe.

D. Thermoplastic pipe greater than 30 inches shall not be used at the open-end sections.

601.03.04 JACKED PIPES

A. Culvert pipe to be jacked in place between the limits shown on the plans shall conform to the requirements of the respective section of pipe culverts.

B. The strength of pipe or gauge of pipe will be determined for vertical load only in embankment conditions. Any additional reinforcement or strength required to withstand jacking pressure shall be determined and furnished by the Contractor at no additional cost to the Contracting Agency.

C. Variation from theoretical alignment and grade at the time of completion of placing shall not exceed 0.2 foot for each 20 feet of pipe placed.

D. The diameter of the excavated hole shall not be more than 0.1 foot greater than the outside diameter of the pipe.

1. Sluicing and jetting with water will not be permitted.

2. When the material tends to cave in from outside these limits, a shield shall be used ahead of the first section of pipe or the face of excavation shall not extend beyond the end of the pipe greater than 1-1/2 feet unless permitted by the Engineer.

E. Areas resulting from caving or excavating outside the above limits shall be backfilled with sand or grout by a method that will fill the voids.

601.03.05 LAYING CULVERT PIPE

A. Laying of culvert pipe shall conform to the requirements of the respective sections of culvert pipe.

601.03.06 EXTENDING EXISTING CULVERTS

A. Where shown on the plans or directed by the Engineer, existing culverts shall be extended in accordance with the provisions for installing new culverts and the following additional provisions.

B. Existing headwalls shall be demolished and removed and disposed of or moved to the extended location as indicated on the plans or ordered by the Engineer. Comply with ***Section 202, "Removal of Structures and Obstructions."***

C. A headwall that is not to be reset shall be demolished without injury to the existing culvert and removed and disposed of in accordance with the provisions of ***Section 202, "Removal of Structures and Obstructions."*** If shown on the plans or ordered by the Engineer, a new concrete headwall shall be constructed in accordance with the provisions of ***Section 501, "Portland Cement Concrete,"*** of these specifications or a flared end section shall be attached thereto.

601.03.07 VIDEO INSPECTION

A. Unless otherwise approved by the Contracting Agency, all video inspection shall be completed by a National Association of Sewer Service Companies (NASSCO) certified operator, certified at the user level minimum.

1. The user shall have completed the Pipeline Assessment and Certificate Program (PACP).

2. Video inspection reports must follow the NASSCO format and use standard sewer defect codes.

B. The following paragraphs define the requirements for internal video inspection of storm drain facilities after installation.

1. The Contractor shall inspect the storm drain facility interior using a color closed circuit television (CCTV) camera and document the inspection on image with audio location and date information, image title information, and hard copy inspection logs. The CCTV inspection shall be performed after the installation has been completed.

2. Field operator(s) of inspection equipment must have current National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) Certification.

3. Television Inspection Camera. Equipment shall be operative in 100 percent humidity conditions. Lighting intensity shall be remote controlled and shall be adjusted to minimize reflective glare. Lighting and camera quality shall provide a clear, in-focus picture of the entire inside periphery of the storm drain facility.

4. Digital Storage Medium. The inspection shall be recorded, stored and submitted on CD's (or DVD's) in high quality MPG format on CD -R/+R disks formatted for use with PC systems. The audio portion of the composite CD shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report.

5. Footage Counter. A footage counter device, which measures the distance traveled by the camera in the storm drain facility, shall be accurate to plus or minus 2 feet in 1,000 feet.

6. Video Tilting. Pan and tilt unit, with adjustable supports specifically designed and constructed for operation in connection with storm drain facility inspection.

7. Flow in Storm Drain Facility. During internal video inspections the Contractor shall provide temporary dry conditions in the storm drain facility unless otherwise agreed upon by the Engineer.

C. Inspection Methods for Internal Video:

1. Verbal Commentary. None required except to note operational problems such as camera failure, or restart of inspection.

2. Access. The Engineer shall have access to observe the monitor and all other operations at all times. The system of cabling employed to transport the camera and transmit its signal shall not obstruct the camera's view.

3. Inspection Rate. The camera shall be pulled through the storm drain facility in either direction, but all inspections at each location shall be in the same direction. Rate of travel shall be such that a comprehensive inspection/analysis may be performed but at no time shall exceed 30 feet per minute when recording.

4. Image Perspective. The camera image shall be down the center axis of the storm drain facility when the camera is in motion. The Contractor is required to provide a

360-degree view of the interior. Points of interest shall also be shown on the video and shall include, but not be limited to, all joints, defects, encrustations, mineral deposits, debris, sediment, any location determined not to be clean or part of a proper installation or defects in the materials.

5. Storm Drain Facility Identification. All inspection documentation shall include the location referenced to the project survey control specifically the pipe stationing.

6. Defect Coding. National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) coding system, latest version, shall be used to document all defects visible on the image recordings.

7. Quality Control. The Engineer will review CD's or DVD's and logs to ensure compliance with the requirements listed in this specification and contract documents.

8. The Contractor shall be responsible for modifications to his equipment and/or inspection procedures to achieve report material of acceptable quality. No work shall commence prior to approval of the material by the Engineer. Once accepted, the report material shall serve as a standard for the remaining work.

9. Contractor shall maintain a copy of all inspection documentation (CDs, databases, and logs) for the duration of the work and warranty period.

601.03.70 MARKER BALLS

A. Marker balls shall be installed per local entity requirements.

END OF SECTION 601

SECTION 603 – REINFORCED CONCRETE PIPE

DESCRIPTION

603.01.01 GENERAL

A. This work shall consist of furnishing circular or elliptical, reinforced concrete pipe, siphons, and conduits of the size, classes, and dimensions and at locations shown on the plans or established by the Engineer and in accordance with ASTM C76, ASTM C655, or ASTM C507, with design basis in accordance with ***Section 708, "Concrete and Clay Pipe and Drains,"*** and where indicated in these specifications.

B. The installation shall conform to the AASHTO LRFD Bridge Construction Specifications and these specifications.

C. This work shall also consist of providing storm drain connections for the storm drain and laterals as directed by the Engineer.

MATERIAL

603.02.01 GENERAL

A. Materials and their use shall conform to ***Subsection 601.02.01, "General,"*** and the requirements below.

B. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and ***Section 708, "Concrete and Clay Pipe and Drains,"*** from an authorized source approved by the Interagency Quality Assurance Committee (IQAC).

C. Flared end sections (precast) shall conform to the details and dimensions shown on the plans and, except for shape, shall conform to the material requirements of this section for reinforced concrete pipe.

D. Rubber gaskets are required for all circular pipes and elliptical pipes. Rubber gaskets shall conform to ***Subsection 707.03.06, "Rubber Gaskets."***

E. If joint mortar is required, it shall be as specified in ***Subsection 501.03.12, "Mortar," Class "C."***

1. Sand shall conform to ***Subsection 706.03.04, "Grout and Mortar Sand."***
2. The materials shall be mixed to a consistency suitable for the purpose intended.
3. All mortar shall be used within 30 minutes after the mixing water has been added.
4. Admixtures of hydrated lime, fire clay, diatomaceous earth, or other approved inert material may be used in the mortar to facilitate workability if the Contractor elects.
5. The amount of admixture to be added shall be the quantity determined by the Engineer.

CONSTRUCTION

603.03.01 GENERAL

A. Construction methods shall conform to ***Subsection 601.03.01, "Earthwork,"*** through ***Subsection 601.03.06, "Extending Existing Culverts,"*** and shall meet the requirements below. All pipe installations shall conform to the workmanship and inspection requirements of the AASHTO LRFD Bridge Construction Specifications and this specification as applicable.

B. No pipe shall be laid that is excessively cracked (in accordance with ***Subsection 603.03.07, "Inspection"***), checked, spalled, or damaged, and all such sections of pipe shall be permanently removed from the work. Pipes that show defects due to handling shall be rejected at the site of the installation regardless of prior acceptance.

603.03.02 EARTHWORK

A. Where pipes are to be installed in new embankment (projection), the embankment shall first be constructed to the required elevation as set forth below. The height of embankment to be constructed in advance of installing the pipe may be varied when permitted by the Engineer.

B. In the case of pipes 24 inches or less in diameter, the roadway embankment shall be constructed to an elevation of 6 inches above the grade proposed for the top of the pipe, after which the trench shall be excavated and the pipe installed.

C. In the case of pipes more than 24 inches in diameter, the roadway embankment shall be constructed to an elevation of 30 inches above the grade proposed for the bottom of the pipe, after which the trench shall be excavated and the pipe installed.

D. When pipe having bells or hubs is used, cross trenches shall be excavated for them to prevent non-uniform loading of the joints.

603.03.03 LAYING CULVERT PIPE

A. Construction installation shall comply with the AASHTO LRFD Bridge Construction Specifications; ***Section 208, "Trench Excavation and Backfill"***; and this subsection.

1. The installation shall be conducted by a certified supervisor/foreman at the crew level who is responsible for the work.
2. The certified person is the designated installation inspector for the Contractor and shall generate a daily report attesting to the workmanship for each of the installation components described below.
3. This does not relieve the Contractor of responsibility for other Quality Control aspects of this and other specifications.

B. Installation Components:

1. Bedding.
2. Pipe Condition.
3. Pipe Installation.
4. Haunch Compaction.
5. Complete Pipe Zone Compaction.

C. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe. Blocking shall not be used to bring the pipe to grade.

D. Pipe sections shall be checked for alignment and grade at the time of joining the sections.

1. Pipe laying shall begin at the downstream end of the pipeline except for extensions of existing pipes.

2. Place the bottom of the pipe in contact with the shaped bedding throughout its full length.

3. The first section of pipe to be laid shall be firmly placed to the designated line and grade at the outlet end with the groove end or bell end pointing in the direction to be followed by the pipe laying.

4. Maintain the manufacturer's recommended minimum and maximum cover at all times unless otherwise shown in the contract.

5. Pipe will be inspected before any backfill is placed.

6. Ensure that no rocks greater than 3 inches or other rigid or jagged material is present in the bedding material where pipe may be laid directly on the material.

7. Take up and relay or replace pipe that is out of alignment, unduly settled, or damaged.

E. The interior of the pipe shall be kept free of dirt, and other foreign material as the pipe laying progresses, and left clean at the completion of the work. Any pipe, which is not in true alignment or which shows any undue settlement after laying, or is damaged, shall be taken up and re-laid at the Contractor's expenses.

F. **Backfill:** Prior to placing backfill material, all lifting holes in concrete culverts shall be completely filled with grout.

603.03.04 RUBBER GASKETED JOINTS

A. Circular reinforced concrete culvert pipe shall use rubber or neoprene gasketed joints.

B. Rubber gaskets shall not be exposed to the direct rays of the sun for more than 72 hours.

C. The Contractor shall make every effort to provide a concrete-to-concrete connection and pull the pipe completely home.

1. Should gapping occur due to changes or corrections in horizontal or vertical alignment or radius turns, the gaps shall not exceed the gap tolerance indicated in Table 1.

2. If pipes are laid that exceed these tolerances, the inner annular space between the pipe sections shall be completely filled with cement mortar (where pipe diameters allow for entry).

3. If pipes are laid that exceed the tolerances in Column 2, the pipe will need to be removed and re-laid or an acceptable concrete collar will need to be installed.

Table 1 - Maximum Joint Gap Tolerances[1]

	Column 1	Column 2
Inner Diameter of Pipe	**Maximum Joint Gap Tolerance**	**Maximum Joint Gap Tolerance (with Grouting)**
12-inch to 36-inch	5/8 inch	3/4 inch
42-inch to 48-inch	7/8 inch	1-1/8 inch
54-inch to 90-inch	1 inch	1-1/4 inch
96-inch	1- 5/8 inch	1-3/4 inch
Above 96-inch up to 144-inch	As recommended by Manufacturer	As recommended by Manufacturer

D. Where reinforced concrete collars or bells with rubber gaskets are used at the pipe joints, mortar will not be required in the outer annular space.

E. Where pipes are used with exposed metal surfaces at the joint, both the inner and outer annular joint spaces between pipe sections must be completely filled with cement mortar, except that pipes less than 24 inches in diameter may be pointed inside by brushing smooth and removing all surplus mortar.

F. The rubber gasket shall be the sole element depended upon to make the joint watertight for the purposes intended.

603.03.05 SIPHONS AND PRESSURE PIPE

A. Reinforced concrete pipe used for siphons or pressure pipe shall be laid in accordance with the above provisions, be connected by flexible, watertight rubber gasket joint and, prior to backfilling, be subject to the following hydrostatic test:

1. The pipeline shall be filled with water at a hydrostatic head of that required to maintain the design pressure.
2. The pressure head shall be maintained for a period of not less than 24 hours and any visible leak or other defects that develop under test shall be corrected by the Contractor at no additional cost to the Contracting Agency.
3. Sweating that does not develop into a flow or drip will not be considered as leakage.
4. The test shall be repeated until all leaks or other defects are eliminated

603.03.06 JUNCTIONS

A. All junctions of laterals with a main line or junctions of 2 or more main lines, which are not made in a manhole or concrete junction structure, shall be in a manufactured wye or tee.

B. The wye or tee shall be of the same material as the conduits to which they are joined, and shall have the same or greater stiffness as the pipe.

603.03.07 INSPECTION

A. All pipe joints and lengths shall be 100 percent inspected.

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[1] In no case shall maximum joint gap tolerance exceed ½ of the length where the gasket seats within the pipe

1. Inspection and testing shall be performed by the Contractor during and after installation to ensure proper performance.
2. Installation, placement, and compaction of bedding and backfill materials shall comply with this section.
3. During the initial phases of the installation process, inspection shall concentrate on detecting improper practice and poor workmanship.
4. Errors in line and grade, improper assembly, and improper backfill techniques shall be corrected prior to placing significant backfill or trench fill.
5. Bell/spigot joints shall be properly assembled to prevent the infiltration of soil fines.
6. Gaskets shall be properly seated to prevent groundwater infiltration and shall appear uniformly oriented around the pipe.
7. Shallow cover installations shall be checked to ensure the minimum cover level is provided.

B. After the pipe has been bedded and backfilled to subgrade level, internal quality inspection shall be paid for and performed by the Contractor a minimum of 30 days after final backfill has been placed and prior to final acceptance by the Contracting Agency.

1. The line shall be cleaned and inspected for cracks and joint gaps using visual physical measurement or other devices, including but not limited to calibrated television or video cameras, subject to approval by the Engineer.
2. Cracks in pipes (both longitudinal and circumferential) that are less than 0.10 inch in width are generally considered non-structural flaws and need not be repaired.
3. Cracks that are equal to or exceed 0.10 inch in width shall require an evaluation by a Nevada licensed professional engineer.
4. The Contractor's engineer shall provide a recommendation regarding removal or repair subject to approval by the Contracting Agency.
5. Pipe joints and lengths that do not meet the specification shall be repaired or pipe replaced at no additional cost to the Contracting Agency.

C. All inspection results shall be submitted and approved by the Engineer before final payment.

1. Any replacement pipe shall also be subject to the same testing.
2. All inspection and testing results shall be submitted to the Engineer for approval.

D. The Engineer shall be allowed access to randomly inspect at least 10 percent of the total number of pipe runs.

E. Internal Video Inspection. Internal video inspection shall be performed by the Contractor a minimum of 30 days after final backfill has been placed and prior to final acceptance by the Contracting Agency. This inspection includes 360 degree taping of all storm drain lateral joints. The line shall be cleaned and inspected per ***Subsection 601.03.07 "Video Inspection."***

END OF SECTION 603

SECTION 609 – CATCH BASINS, MANHOLES AND INLETS

DESCRIPTION

609.01.01 GENERAL

A. This work shall consist of constructing or reconstructing catch basins, manholes, inlets, and similar structures, consisting of Portland cement concrete with necessary reinforcement, metal frames, grates, and lids, including required excavation and backfilling.

B. This work shall also consist of preparing utility final location information as described on the project drawings and in Section 622 of these Special Provisions.

MATERIALS

609.02.01 GENERAL

A. Materials shall conform to the following sections and subsections:

Materials	Section/Subsection
Portland Cement Concrete	***501***
Reinforcing Steel	***505***
Miscellaneous Metal	***712***
Gray Iron Castings	***712.03.02***

B. Casting shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting strength and value for the service intended.

1. Casting shall be boldly filleted at angles and the arises shall be sharp and perfect.
2. Casting shall be sand blasted or otherwise effectively cleaned of scale and sand so as to present a smooth, clean, and uniform surface.

C. The Contractor shall obtain from the fabricator of the structural steel grates, frames, and gray iron castings a Certificate of Compliance stating that the fabrications meet these specifications, and giving certified shop weights for the fabrications.

D. Mortar for setting grates shall be mixed in the proportions of 1 part cement to 3 parts of fine aggregate.

E. Pipe crossbars for drop inlets shall be unpainted standard weight black pipe conforming to ASTM A53. Straps shall be unpainted ASTM A36 steel.

F. Grout shall conform to ASTM C476 and shall have a minimum strength of 2000 psi. Fine grout shall be proportioned by volume of one part Portland cement and 2-1/4 to 3 parts sand. Coarse grout shall consist of one part Portland cement, 2-1/2 to 3 parts sand, and 1 to 2 parts course aggregate.

G. Laboratory design mixes for grout, approved by a Licensed Professional Engineer in the State of Nevada, are acceptable in lieu of the above proportions and are required if the maximum strength is more than 2000 psi. Grout shall be of a fluid consistency with proper proportions of sand to gravel for pouring and pumping.

H. All exposed steel shall be hot-dipped galvanized per section 715.

CONSTRUCTION

609.03.01 GENERAL

A. Catch basins, inlets, and manholes shall be constructed in accordance with ***Section 501, "Portland Cement Concrete."***

B. Inlet and outlet pipes shall be placed prior to pouring concrete.

C. Grates shall be set in full mortar beds or otherwise secured as shown on the plans. Grates shall be set accurately to the final elevations so that no subsequent adjustments will be necessary.

D. Concrete covers, when indicated on the plans, shall be constructed to fit snugly and be readily removable.

E. Structural steel grates shall be painted as specified in ***Section 614, "Painting."***

F. Pipe or tile placed in masonry for inlet or outlet connections shall extend through the walls and beyond the outside surfaces of the walls a sufficient distance to allow for connections with conduit, and the masonry shall be carefully constructed around the pipe or tile to prevent leakage around their outer surfaces.

G. Commercially prefabricated frames and grates of equal or greater capacity and strength may be substituted for the design shown on the plans for drop inlets provided prior approval is obtained in writing from the Engineer.

H. Frames and grates shall be matchmarked in pairs before delivery to the work and grates shall fit into the frames without rocking.

609.03.02 ADJUSTING CATCH BASIN, MANHOLE, AND INLET COVERS

A. Unless otherwise provided on the plans or by the contract, existing covers including frames, grates, lining, and lids shall be adjusted to the required elevation.

B. Remove the existing covers and adjust the top of the existing structures by removing or adding concrete, brick masonry, concrete block masonry, high density polyethylene adaptor rings, or steel or cast iron adaptor rings, as applicable.

C. Reinstall the fixtures by supporting them on a satisfactory collar of concrete constructed to hold the fixtures firmly in place.

D. Concrete collars for manholes shall be constructed in accordance with Uniform Standard Drawing No. 408.1 “Concrete Collar Around Manholes, 30 Inch Ring and Cover.”

609.03.03 CLEAN OUT

A. All catch basins, manholes, inlets, and similar structures shall be thoroughly cleaned of any accumulations of silt, debris, or foreign matter of any kind, and shall be clean of accumulations at the time of final inspection.

609.03.04 EARTHWORK

A. Structure excavation and structure backfill shall conform to ***Section 206, "Structure Excavation"*** and ***Section 207, "Structure Backfill."***

END OF SECTION 609

SECTION 610 – SLOPE AND CHANNEL PROTECTION

DESCRIPTION

610.01.01 GENERAL

A. This work shall consist of constructing slope and channel protection structures to the lines and grades established by the Engineer using riprap or wire mesh gabions in accordance with the design shown on the plans and these specifications.

B. Riprap construction shall consist of furnishing and placing riprap (with or without grout) or sacked Portland cement concrete riprap.

C. Wire mesh gabion construction shall consist of furnishing, assembling, tying, and filling open mesh wire baskets with stone.

MATERIALS

610.02.01 GENERAL

A. All materials shall conform to the following sections and subsections:

Materials	Section/Subsection
Water	***722***
Hydraulic Cement	***701***
Grout and Mortar Sand	***706.03.04***
Riprap Grout	***706.03.05***

B. When so provided and with prior approval of the Engineer, crushed concrete may be substituted for the above designated stone. In such a case, the concrete shall be sound and meet all requirements as specified for stone.

610.02.02 GROUT

A. Grout shall be composed of 1 part by volume of Portland cement and 3 parts by volume of sand and shall be of such consistency that it will fill all voids in the riprap.

B. Comply with ***Subsection 706.03.05, "Riprap Grout."***

610.02.03 SACKED CONCRETE

A. Sacked concrete shall be composed of sacks filled with Portland cement concrete.

1. The mixed concrete shall contain a minimum of 376 pounds (4 sacks) of Portland cement per cubic yard.

2. The amount of water added at the time of mixing shall be such as will produce a mixture with a slump of from 3 inches to 5 inches.

B. Unless otherwise provided in the Special Provisions, aggregate for use in sacked concrete riprap shall consist of river run material of a sandy, gravelly nature, clean and free from roots, vegetable matter, and other deleterious substances. When tested on laboratory sieves, river run material shall conform to the following gradation requirements.

1. Passing a 2-inch sieve: 80 to 100 percent.
2. Passing a No. 200 sieve: 0 to 4 percent

C. Sacks for concrete riprap shall be made of at least 10 ounce burlap, and shall be approximately 19-1/2 inches by 36 inches measured inside the seams when the sack is laid flat.

1. The capacity of each sack shall be approximately 1.25 cubic feet.
2. Sound reclaimed sacks may be used.

610.02.04 STONES FOR RIPRAP

A. Stones used for riprap shall be hard, durable, angular in shape, resistant to weathering and erosion, and free from spoils, cracks, and organic matter.

1. The stone for non-grouted riprap shall have a minimum of 2 fractured faces with neither width nor thickness of a single stone less than 1/3 its length.
2. The specific gravity of the riprap shall not be less than 2.45.
3. The nominal stone size shall be as follows:

RIPRAP GRADATIONS

Percent Passing By Mass	Riprap D50=12" (Inches)	Heavy Riprap D50=18" (Inches)
100	20	30
70-85	18	27
35-50	12	18
5-15	5	7
0	2	3

B. This stone shall conform to the following requirements:

Source Requirements Test	Test Method	Requirements
Percent of Wear (500 Rev.)	ASTM C131	45% Maximum
Bulk Specific Gravity	ASTM C127	2.5 Minimum

C. Control of gradation will be by visual inspection.

1. Upon request by the Engineer, the Contractor shall provide a sample of stone of at least 5 tons meeting the gradation for each location riprap is indicated.
2. Each sample shall be located at the construction site near the location where the riprap is to be placed.
3. The sample shall be used as a frequent reference for judging the gradation of the riprap supplied.
4. The sample riprap shall be in place and acceptable to the Engineer before riprap

placing work begins.

5. The Contractor shall maintain the placed riprap until the project is completed and any material displaced by any cause shall be repaired to the lines and grades indicated on the plans.

D. Caliche stone or cementitious materials meeting the requirements of this section may be used as riprap with prior approval of the Engineer.

1. The riprap shall be fully cemented material. Only materials designated as hard (scratches leave only dust, requires many hammer blows to break) or very hard (difficult to scratch or break) shall be utilized.

2. Moderately hard (crumbles with several hammer blows) or partially cemented materials are not acceptable.

E. The Contractor may be required to provide riprap test results from an approved testing laboratory and a Certificate of Compliance in accordance with ***Subsection 106.05, "Certificate of Compliance."***

610.02.05 STONES FOR GABIONS

A. Stones for filling the gabions shall be well graded, hard stones, conforming to the testing requirements specified in ***Subsection 610.02.04, "Stones for Riprap."***

B. Size and gradation shall be such that the predominant size is between 4 inches and 8 inches, 85 percent by weight.

1. Minimum stone dimensions shall be 3 inches and maximum stone dimension shall be 8 inches.

2. For gabion baskets less than 1 foot in height, the maximum stone dimension shall be 6 inches.

610.02.06 FILTER MATERIAL

A. When filter material is specified or shown on the plans, the material shall consist of mineral aggregate that is clean, hard, durable, and free of any deleterious matter or harmful adherent coatings.

B. Gradation of the filter material shall conform to the requirements specified by the Engineer or as shown in the Special Provisions.

610.02.07 FILTER FABRIC

A. When filter fabric is specified or shown on the plans, the fabric shall consist of a geotextile that is made from synthetic fibers.

B. The filter fabric shall be in accordance with AASHTO M288, Section A4, and shall conform to the requirements specified by the Engineer.

610.02.08 WIRE MESH GABIONS AND GABION MATTRESSES

A. Wire mesh gabions and gabion mattresses shall be fabricated from either twisted wire mesh or welded wire mesh.

1. All wires shall be galvanized prior to fabricating the mesh and in compliance with

ASTM A90.

2. Only 1 type of wire mesh may be used in any 1 structure.

B. Gabion and gabion mattress dimensions of width, height, and length shall be as shown on the plans.

1. Each gabion unit shall not vary more than 5 percent from the dimensions shown on the plans.

2. Gabions come 1 foot or greater in height, 3 feet in width, and are compartmentalized into cells not larger than 3 feet by 3 feet by attaching to the base single diaphragm panels made of the same type and size mesh as the gabion panels.

3. Gabion mattresses come 9 inches or less in height, 6 feet in width, and are compartmentalized into cells not larger than 6 feet by 3 feet by attaching to the base single diaphragm panels made of the same type and size mesh as the gabion mattress panels.

C. The baskets shall be assembled with the necessary panels and diaphragms secured to the base in accordance with ASTM A975-97, Table 2 requirements. Pleating the base panel to obtain the diaphragms is prohibited.

D. Fabrication of the wire mesh gabions and gabion mattresses shall be as follows:

1. Twisted Wire Mesh Gabions and Gabion Mattresses:

a. Gabion panels for the twisted mesh style shall be manufactured from galvanized steel wire, Class 3, soft temper, conforming to ASTM A641, or from aluminized steel wire, soft temper, conforming to ASTM A809.

1) The wire shall have a minimum tensile strength of 60,000 psi when tested in accordance with ASTM A370.

2) Twisted wire mesh gabions and gabion mattresses shall comply with ASTM A975-97 standards.

b. The mesh shall be formed with non-raveling double twists by twisting each pair of wires through two 360-degree turns. The mesh openings shall be hexagonal in shape and uniform in size and shall comply with the mesh dimensions and requirements shown on Table 1 and Table 2 below.

c. All perimeter edges of the mesh panels forming the gabion basket shall be securely tied to a selvedge wire so that the selvedge-to-mesh connection has at least the same strength as the body of the mesh. Selvedge wire shall be the same kind and type of material used for the mesh, except that wire diameters shall be as shown on the tables below.

d. When specified by the Engineer, the galvanized or aluminized wire shall be coated with a polyvinyl chloride (PVC) material. The coating shall be accomplished by using either extruded or extruded and bonded PVC material, and shall be applied before twisting the wire into mesh panels.

e. All wire used for twisted mesh gabions and gabion mattresses shall meet the following nominal requirements:

Table 1 - Nominal Requirements for Twisted Wire Mesh Gabions			
Type of Basket	**Mesh Size**	**Mesh Wire**	**Selvedge Wire**
Baskets 1 foot or greater in height	3.25-inch by 4.5-inch	0.120 inch	0.148 inch
Baskets 1 foot or greater in height with PVC coating	3.25-inch by 4.5 inch	0.106 inch, plus the PVC coating	0.134 inch, plus the PVC coating

Table 2 - Nominal Requirements for Twisted Wire Mesh Gabion Mattresses			
Type of Basket	**Mesh Size**	**Mesh Wire**	**Selvedge Wire**
Baskets 9 inches or less in height	2.5-inch by 3.25 inch	0.087 inch	0.106 inch
Baskets 9 inches or less in height with PVC coating	2.5-inch by 3.25 inch	0.087 inch, plus the PVC coating	0.106 inch, plus the PVC coating

2. Welded Wire Mesh Gabions and Gabion Mattresses:

   a. Gabion panels for the welded mesh style shall be manufactured from welded wire fabric conforming to ASTM A185 and ASTM A974-97, Type 1.

   b. Galvanized wire shall have a Class 3 coating as indicated in ASTM A641.

   c. Aluminized wire shall have a minimum coating as indicated in ASTM A809.

   d. The wire shall be soft tempered with a minimum tensile strength of 60,000 psi when tested in accordance with ASTM A370.

   e. Welded wire mesh gabions and gabion mattresses shall comply with ASTM A974-97 standards.

   f. The mesh shall form a square or rectangular grid pattern with the maximum diagonal dimension of any grid opening not to exceed 4.5 inches.

   g. The welded wire mesh shall be galvanized or aluminized prior to welding into mesh and shall comply with the dimensions and requirements shown on Table 3 and Table 4 below.

   h. When specified by the Engineer, the welded wire mesh shall be coated with a polyvinyl chloride material. The PVC coating shall be fusion bonded to the galvanized or aluminized wire after fabrication of the gabion mesh panels.

   i. All wire used for welded mesh gabions and gabion mattresses shall meet the following nominal requirements:

Table 3 - Nominal Requirements for Welded Wire Mesh Gabions		
Type of Basket	**Mesh Size**	**Mesh Wire**
Baskets 1 foot or greater in height	3-inch by 3-inch	0.120 inch
Baskets 1 foot or greater in height with PVC coating	3-inch by 3 inch, plus the PVC coating	0.106 inch, plus the PVC coating

Table 4 - Nominal Requirements for Welded Wire Mesh Gabion Mattresses		
Type of Basket	**Mesh Size**	**Mesh Wire**
Baskets 9 inches or less in height	1.5-inch by 3-inch	0.087 inch (2.21 mm)
Baskets 9 inches or less in height with PVC coating	1.5-inch by 3-inch, plus the PVC coating	0.087 inch, plus the PVC coating

j. For polyvinyl chloride coated either twisted or welded mesh gabions and gabion mattresses, the PVC coating shall have a nominal thickness of 0.020 inch and a minimum thickness of 0.015 inch. The coating shall be grey, silver, green, or black and conform to the following:

1) Specific Gravity: In the range of 1.20 to 1.40, ASTM D792.

2) Abrasion Resistance: The percentage of weight loss shall be less than 12 percent, when tested according to ASTM D1242, Method B at 200 cycles, CSI-A Abrader Tape, 80 Grit.

3) Brittleness Temperature: Not higher than 15 degrees F, ASTM D746.

4) Tensile Strength: Extruded Coating - Not less than 2,980 psi, ASTM D412. Fusion Bonded Coating - Not less than 2,275 psi, ASTM D638.

5) Modulus of Elasticity: Extruded Coating - Not less than 2,700 psi, at 100 percent strain, ASTM D412. Fusion Bonded Coating - Not less than 1,980 psi. at 100 percent strain, ASTM D638.

6) Ultraviolet Light Exposure: A test period of not less than 3,000 hours, using apparatus Type E at 145.4 degrees F, ASTM G23.

7) Salt Spray Test: A test period of not less than 3,000 hours, ASTM B117.

610.02.09 INTERNAL CONNECTING WIRES

A. Internal connecting wires to reinforce the side panels of individual gabion baskets shall meet the same specifications as the wire used in the gabion body, except wire nominal diameter shall be 0.087 inches or larger. Alternate preformed stiffeners acceptable to the gabion manufacturer and the Engineer may also be used.

610.02.10 LACING WIRE

A. Lacing wire to assemble, interconnect, and close the gabion baskets shall meet the same specifications, as the wire used in the gabion body except its nominal diameter shall be 0.087 inches.

610.02.11 WIRE FASTENERS

A. Machine formed spiral wire binders with a 3-inch pitch and 2.5-inch inside diameter maximum are the standard fastener for welded wire mesh gabions and gabion mattresses, and shall be formed from wire meeting the same quality and coating thickness requirements as specified above for the gabions and gabion mattresses.

B. As an alternative to lacing wire and spiral binders, wire fasteners including interim fasteners, interlocking ring fasteners, overlapping (hog) ring fasteners, and twist ties may be used, subject to the approval of the Engineer.

C. The Contractor shall demonstrate that:

1. The proposed fastener can consistently resist an opposed tension force of at least 600 pounds without pulling apart.

2. The proposed fastener system can consistently produce a joint with strength of at least 1,400 pounds per linear foot while encompassing the number of wires as intended for its use. When PVC coated wire is used, the joint strength shall be at least 1,200 pounds per linear foot.

3. The proposed fastener system does not cause damage to the protective coating on the wire.

4. The Contractor has the proper equipment and trained employees to correctly install the fasteners.

5. Proper installation can be readily verified by visual inspection.

D. The Contractor shall provide a complete description of the fastener system, including the number of fasteners required, the number and size of wires that the fastener is capable of properly joining, and a description of a properly installed fastener, including drawings or photographs, if necessary.

E. Properly formed fasteners shall meet the following requirements:

1. Each interlocking fastener shall be locked and closed.

2. Each overlapping ring fastener shall be closed and the free ends shall overlap a minimum of 1 inch.

3. Spiral binders shall be crimped to secure the spiral in place.

4. Twist ties shall have a minimum of 2 complete revolutions.

F. If gauges or other aids are needed to verify the proper installation of the fasteners, the Contractor shall furnish the Engineer the gauges or aids in numbers as may reasonably be required.

1. If more than 1 wire fastener is proposed, e.g. different gauge or length of wire, for different joints, the fasteners shall be readily distinguishable.

2. Wire fasteners shall not be used to join more wires, or larger wires, than for which they were tested and approved.

3. As a minimum, a fastener shall be installed at intervals of 4 inches to 6 inches at the location where mesh wire meets selvedge or edge wire.

G. Fastener Materials:

1. Galvanized wire fasteners shall be used with galvanized gabions.

2. Aluminized wire fasteners shall be used with aluminized gabions.

3. Stainless steel overlapping rings or interlocking rings shall be used for stainless steel gabions.

4. PVC coated wire spiral binders shall be used for PVC coated gabions.

H. Fastener Properties:

1. Galvanized wire fasteners shall conform to ASTM A764 with Type III coating.
2. Aluminized wire fasteners shall conform to ASTM A809 for wire diameter and coating, with tensile strength equal to ASTM A764, Table 2.
3. Stainless steel wire fasteners shall conform to ASTM A313, Grade 302.
4. Spiral binder fasteners shall be formed with wire having at least the same thickness and coating as the basket mesh wire.
5. Twist tie fasteners shall meet the requirements of lacing wire, as specified in Subsection 610.02.10, "Lacing Wire."

CONSTRUCTION

610.03.01 EARTHWORK

A. The areas where riprap or wire mesh gabions are to be placed shall be graded to the required lines and grades as shown on the plans or as directed by the Engineer.

B. Any excavations or backfill required to achieve such grade shall conform to the provisions of ***Section 206, "Structure Excavation,"*** and ***Section 207, "Structure Backfill."***

610.03.02 FILTER PLACEMENT

A. Filter material shall be spread uniformly on the prepared foundation surface in a manner satisfactory to the Engineer, and to the slopes, lines, and grades as shown on the plans or as specified by the Engineer.

1. Placing of a filter material by methods that will segregate particle sizes will not be permitted.
2. Any damage to the foundation surface during filter placement shall be repaired before proceeding with the work.
3. The filter materials shall be placed and placement shall be approved and accepted before proceeding with the work.
4. The filter materials shall be placed and finished to present a reasonably even surface free from mounds or windrows.
5. Compaction of the filter materials shall conform to the requirements shown on the plans or as outlined in the Special Provisions.

B. Filter fabric shall be installed in accordance with the manufacturer's recommendations and in manner that will not tear, puncture, or shift the fabric.

C. Joining edges of the filter fabric shall be overlapped a minimum of 18 inches.

D. Filter fabric placed behind and/or beneath gabion or gabion mattress structures shall have a minimum permeability of 0.15 inch/second and shall be designed to retain the fine particles of the subsoil while releasing any hydrostatic pressure buildup.

610.03.03 RIPRAP

A. Stone for riprap shall be placed in a manner that will produce a well-graded mass of stone with a minimum percentage of voids.

1. The entire mass of stone shall be placed in conformance with the lines, grades, and thicknesses shown on the plans.
2. Riprap shall be placed to its course thickness in 1 operation and in such a manner as to avoid displacing underlying material.
3. When filter fabric is used under the riprap, the height from which the stone is dropped shall be minimized to avoid fabric damage.
4. Placement of stones shall begin at the bottom of the slope and proceed upward to the top.

B. The large stones shall be well distributed and the entire mass of stone shall conform to the gradation specified.

1. All material placed as riprap protection shall be so placed and distributed that there is no large accumulation of either the larger or smaller sizes of stone.
2. Placing of riprap in layers, or by dumping into chutes, or by similar methods likely to cause segregation will not be permitted.

610.03.04 GROUTED RIPRAP

A. When grouted riprap is specified, the stone shall be laid as set forth above for riprap.

B. The spaces between the stones shall then be filled with grout as directed, and in accordance with ***Subsection 706.03.05, "Riprap Grout."***

C. Sufficient grout shall be used to completely fill all voids, except that the face surface of the stone shall be left exposed.

D. After grouting is completed, the surface shall be cured as specified in ***Section 502, "Concrete Structures"*** for a period of at least 3 days.

610.03.05 SACKED CONCRETE RIPRAP

A. The sacks shall be filled with concrete, loosely placed, with enough room left at the top to fold to retain the concrete at the time of placing.

1. Not more than 1 cubic foot of concrete shall be placed in each sack.
2. Immediately after being filled with concrete, the sacks shall be placed and lightly trampled to cause them to conform with the earth face and to adjacent sacks in place.

B. The slopes on which the sacked concrete riprap is to be placed shall be finished true to line and grade.

1. The first course shall consist of a double row of stretchers laid in a neatly trimmed trench.
2. The second course shall consist of a single row of headers.
3. The third and remaining courses shall consist of stretchers.

4. Courses shall be placed in such a manner that joints in succeeding courses are staggered.
5. All dirt and debris shall be removed from the top of the sacks before the next course is laid thereon.
6. Stretchers shall be placed so that the folded ends will not be adjacent.
7. Headers shall be placed with the folds toward the earth face.
8. Not more than 4 vertical courses of sacks shall be placed in any tier until initial set has taken place in the first course of any such tier.

C. When, in the opinion of the Engineer, there will not be proper bearing or bond for the concrete due to delays for any cause, a small trench shall be excavated back of the row of sacks already in place. The trench shall be filled with fresh concrete before the next layer of sacks is laid.

D. Sacked concrete riprap shall be cured in accordance with **Section 702, "Concrete Curing Materials and Admixtures."**

610.03.06 WIRE MESH GABIONS AND GABION MATTRESSES

A. Prior to the assembly and placement of the wire mesh gabions, a representative of the gabion manufacturer shall be present at the construction site for 1 day of placement or construction to demonstrate the method of assembling, interconnecting, stone filling, and closing the gabion, unless otherwise specified in the Special Provisions.

B. Construction of the gabion structure shall not proceed until the Engineer approves the Contractor's assembly and placement methods.

C. Gabion baskets shall first be assembled as empty units.

1. The panels and diaphragms shall be connected to the base panel, rotated into position, and joined along the edges with lacing wire, spiral binders, or approved wire fasteners.
2. When joined with lacing wire, the lacing wire shall be tightly looped at intervals of not more than 6 inches along the seams so that single and double loops are alternated.
3. When joined with preformed spiral binders, thread the spirals along the panels' edges through every mesh and crimp the spirals ends to secure them in place.
4. When joined with alternate fasteners, the fasteners shall be properly installed as specified in ***Subsection 610.02.11, "Wire Fasteners."***
5. For either method, there shall not be any opening greater than 2 inches (maximum line dimension) along the joined edges or at the corner of the gabion basket.

D. Empty gabion baskets shall be placed into position, over the filter fabric when required, on the prepared foundation.

1. Empty gabion baskets shall be joined successively to the next empty gabion basket before filling with stone.
2. Each row, tier, and layer of baskets shall be reasonably straight and shall conform to the line and grade shown on the plans or established by the Engineer.

3. The empty gabion baskets shall be fastened to the adjacent baskets along the top and vertical edges.

4. Each layer shall be fastened to the underlying layer along the front, back, and ends.

5. Unless otherwise shown on the plans, the vertical joints between basket units of adjacent tiers or layers shall be staggered by at least one cell along the length of the structure.

E. All fastening of adjacent baskets shall be done with lacing wire, spiral binders, or approved wire fasteners in order to obtain a monolithic structure. The method of fastening shall meet the same requirements as that specified for assembling individual gabion baskets.

F. Fastening shall be made through selvedge-to-selvedge or selvedge-to-edge wire connection. Mesh-to-mesh or selvedge-to-mesh wire connection is allowed along vertical edges or in the case where baskets are offset or stacked, and selvedge-to-mesh or mesh-to-mesh wire connection would be necessary.

G. Before filling each gabion basket with stone, tension may be applied to the empty baskets to achieve a uniform alignment and shall be accomplished to prevent any possible unraveling.

1. Welded wire mesh gabions do not require stretching.

2. The finished gabion structure shall have no gaps along the perimeter of the contact surfaces between adjoining gabion basket units.

H. The gabion cells shall be carefully filled with stone placed by hand and/or machine so that the alignment of the structure will be maintained to avoid bulges and minimize voids.

1. All exposed stone surfaces shall have a reasonable smooth and neat appearance.

2. No sharp stone edges shall project through the wire mesh.

I. The gabion baskets stone-fill may be either cobbles or crushed stone.

1. The stone shall be clean, hard, durable, and of suitable quality to ensure suitable performance in the gabions or gabion mattresses.

2. The stone shall be free from cracks, seams, and other defects that would tend to increase its deterioration in the gabion baskets.

3. The inclusion of dirt, sand, clay, debris, and rock fines will not be permitted.

4. Stone-fill used in the gabions and gabion mattresses shall be a well-graded mixture with sizes ranging between 4 inches and 8 inches in diameter for gabions 1 foot or greater in height, and between 3 inches and 6 inches in diameter for gabion mattresses 9 inches or less in height.

J. The gabion cells in any row or layer shall be filled in stages so that local deformations may be avoided.

1. At no time shall any cell be filled to a depth exceeding 12 inches more than any adjacent cell.

2. The maximum height from which the stone may be dropped into the basket units shall be 3 feet.

K. During filling operations, internal connecting wires shall be placed in all exposed front and side gabion units in the following manner:

1. For gabion cells with a 36-inch height:

a. Stone shall be placed to a depth of 1/3, 12 inches, after which a minimum of 2 equally spaced internal connecting wires shall be placed in each cell, connecting the front and back faces of the compartment.

b. For corner units, internal connecting wires shall be placed in both directions.

c. The connecting wires shall be looped around 2 twisted wire mesh openings, or a welded wire joint, at each basket face, and the wire terminals shall be securely wrapped to prevent their loosening.

1) This operation shall be repeated when the cell is 2/3 full.

2) In welded mesh gabions, these cross-ties or stiffeners are made from lacing wire and placed across the comers of the gabion cells at 12 inches from the comers, thus providing a diagonal bracing. Lacing wire or preformed hooked wire stiffeners may be used.

2. For thinner gabion cells:

a. Internal connecting wires are not required except when 18 inch baskets are used to build exposed vertical surfaces.

b. In this case, the procedures under Subparagraph 1. above shall be followed, except that the internal connecting wires shall be placed at 9 inches from the base.

610.03.07 PARTIALLY GROUTED RIPRAP

A. When grouted riprap is specified, the stone shall be laid as set forth above for riprap.

B. The spaces between the stones shall then be filled with grout as directed, and in accordance with ***Subsection 706.03.05, "Riprap Grout."***

C. Sufficient grout shall be used to fill 1/3 to 1/2 of the void spaces, and in accordance with Subsection 706.03.05, "Riprap Grout". The target distribution of grout within the riprap matrix is such that about two-thirds of the grout should reside in the upper half of the riprap layer, with one-third of the grout penetrating into the lower half.

D. No grout should penetrate deep enough to come in contact with any underlying filter.

E. The grout shall "glue" individual stones to neighboring stones at their contact points, but leaves relatively large voids between the stones.

F. Conglomerate-like elements should be present in the riprap after partial grouting.

G. After grouting is completed, the surface shall be cured as specified in Section 502, "Concrete Structures" for a period of at least 3 days.

END OF SECTION 610

SECTION 611 – CONCRETE SLOPE PAVING

DESCRIPTION

611.01.01 GENERAL

A. This work shall consist of constructing concrete slope paving and concrete mortar slope paving including aprons and cutoff walls in connection therewith, to the lines and grades established by the Engineer and in accordance with the design shown on the plans.

MATERIALS

611.02.01 GENERAL

A. Materials shall conform to the following sections:

Materials	Section
Portland Cement Concrete	***501***
Reinforcing Steel	***505***

B. Concrete mortar slope paving shall consist of a mixture of 1 part Portland cement to 4 parts sand, thoroughly mixed in a dry state prior to mixing with water.

1. Measurement may be either by volume or weight.
2. Before placing, all lumps 3/8 inch and over shall be removed by screening.
3. Sand shall conform to ***Subsection 706.03.03, "Fine Aggregate."***
4. An air-entraining admixture shall be added to the concrete mortar at a rate of 4 percent to 7 percent.

C. Reinforcing for the slope paving and cutoff walls shall be reinforcing steel in accordance with the Contract Drawings and ***Section 505, "Reinforcing Steel."***

D. Header boards consisting of 2-inch by 4-inch redwood lumber furnished and placed in the concrete or mortar slope paving shall be as shown on the plans. Lumber used in the construction of header boards shall be commercial grade heart redwood, S4S.

E. Nails used in construction of header boards shall be commercial quality galvanized nails.

F. Concrete for the concrete slope paving and cutoff walls shall be modified Class A or AA using Type V cement (6.0 sack minimum, 0.53 water/cement ratio), having a minimum twenty-eight (28) day compressive strength of 3000 psi having a slump not to exceed 4-inches.

CONSTRUCTION

611.03.01 EARTHWORK

A. The subgrade for paved ditches and slope paving shall be formed by excavating to the required depth below the prepared finish surface grade in accordance with dimensions and design indicated on the plans or as directed by the Engineer.

B. The subgrade shall be thoroughly compacted.

1. Any soft, spongy, or other unsuitable material shall be removed to the depth directed by the Engineer, backfilled with suitable material, and thoroughly compacted.

2. Water shall be sprinkled on the subgrade during compaction.

3. The subgrade shall be sufficiently moist prior to placing concrete or mortar to prevent absorption.

C. Excavations for trenches, footings, cutoff walls, and so forth shall conform to ***Section 206, "Structure Excavation."*** Gradation and compaction requirements on structure backfill will not apply.

611.03.02 GENERAL

A. Concrete, after placing, shall be tamped until it is thoroughly consolidated and mortar flushes to the surface.

1. If the slope is too steep to permit the use of concrete sufficiently wet to flush with tamping, the concrete may be tamped until consolidated and a mortar surface 1/4-inch thick troweled on immediately.

2. The mortar shall consist of 1 part Portland cement and 3 parts clean, sharp sand.

3. The mortar surface shall be considered as a part of the concrete and no additional allowance will be made therefor.

B. After striking off to grade, the concrete shall be hand floated with wooden floats not less than 4 inches in width and not less than 30 inches in length.

1. Care shall be taken to prevent rotary marks of the hand floats.

2. The entire surface shall be broomed with a fine texture hair push broom to produce a uniform surface and eliminate float marks.

3. Brooming shall be done when the surface is sufficiently set to prevent deep scarring and shall be accomplished by drawing the broom down the slope leaving the marks parallel to the edges of the panel.

4. Joints shall be edged with a 1/4 inch radius edger prior to the brooming.

C. Materials for mortar that have been mixed for more than 45 minutes and have not been incorporated in the work shall not be used unless otherwise permitted by the Engineer.

D. Concrete or mortar shall not be placed against frosted or frozen surface. If concrete or mortar is placed during cold weather, it shall be heated and protected during placing and curing as set forth in ***Section 501, "Portland Cement Concrete,"*** except concrete or mortar shall be maintained at a temperature of not less than 50 degrees F for 72 hours after placing and at not less than 40 degrees F for an additional 4 days.

E. The slope paving shall be constructed without expansion joints.

F. The mesh reinforcing shall be placed in the approximate center of the concrete mortar.

G. All joints shall be lapped 6 inches and run continuously throughout paving or between headers.

H. Concrete slope paving, aprons, and cutoff walls shall be cured as specified in **Section 502, "Concrete Structures."**

END OF SECTION 611

SECTION 614 – PAINTING

DESCRIPTION

614.01.01 GENERAL

A. This work shall consist of the preparation of surfaces to be painted and the application, protection, and drying of the required number of coats of paint of the kinds and at the points specified or ordered by the Engineer.

MATERIALS

614.02.01 GENERAL

A. Materials shall meet or exceed the minimum standards hereinafter set forth.

B. **Materials:**

1. The raw materials for use in the various paint formulas shall conform to the specifications designated by Federal or Military serial number or paint material code number under the various paint classifications hereinafter specified.
2. Subsequent amendments to the specifications quoted shall apply to all raw materials and finished products.
3. No "or equal" substitutions for any specified material shall be made without written consent of the Engineer.

C. **Manufacturing and Packaging:**

1. All manufactured paint shall be prepared at the factory ready for application.
2. The addition of thinner or other material to the paint after the paint has been shipped will not be permitted, unless so specified.
3. The finished paint shall be furnished in new, round steel containers of not more than 6-gallon capacity and of metal not thinner than 0.024-inch nominal thickness.
    a. The containers shall have lug type crimp lids with ring seals and be equipped with ears and bails.
    b. The containers shall meet U.S. Department of Transportation Hazardous Material Shipping Regulations.
    c. The containers shall be lined if necessary to prevent attack by the paint.
    d. The lining shall not come off the can as skins.
4. No finished paint shall be used until at least 7 days have elapsed from the date of its manufacture.
5. All containers of paint shall be labeled showing the exact title of the paint specification, California State specifications number, manufacturer's name, date of manufacture, and manufacturer's batch number.
6. Precautions concerning the handling and the application of paint shall be shown on the label of paint and solvent containers.

614.02.02 NUMBER OF COATS

A. Unless otherwise required in the contract documents, the number and kinds of coats of paint shall be as set forth in ***Section 714, "Paint and Pavement Markings."***

CONSTRUCTION

614.03.01 WEATHER CONDITIONS

A. Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather.

1. Except as provided below, painting will not be permitted when weather conditions during applications are such that the atmospheric temperature is at or below 40 degrees F or when freshly painted surfaces may become damaged by rain, wind, dust, or condensation, or when it can be anticipated that the atmospheric temperature will drop below 40 degrees F during the drying period.

2. If fresh paint is damaged by the elements, the paint shall be replaced by the Contractor at no additional cost to the Contracting Agency.

B. Subject to the approval of the Engineer in writing, the Contractor may provide suitable enclosures to permit painting during inclement weather.

1. Provisions shall be made to control atmospheric conditions artificially inside the enclosures within the limits suitable for painting throughout the painting operation.

2. The cost of providing and maintaining such enclosures shall be considered as included in the prices paid for the various contract items of work and no additional payment will be made therefore.

614.03.02 APPLICATION – GENERAL

A. Painting shall be done in a neat and workmanlike manner.

B. Unless otherwise specified, paint shall be applied by brush, roller, or spray methods.

1. Brushes shall have sufficient body and length of bristle to spread the paint in a uniform coat.

2. In general, the primary movement of the brush shall be such as to fill thoroughly all irregularities in the surface, after which the coating shall be smoothed by a series of parallel strokes.

3. Paint shall be evenly spread and thoroughly brushed out.

4. If a considerable amount of brush marks appear, it will be considered that the paint has been improperly applied.

5. Rollers shall be of a type that do not leave a stippled texture in the paint film.

C. Work that is defective shall be refinished or repainted as directed at no additional cost to the Contracting Agency.

D. On surfaces that are inaccessible for brushing, the paint shall be applied by sheepskin daubers or by other means approved by the Engineer.

E. If spray methods are used, the operator shall be experienced. Runs, sags, thin areas in the paint coat, or skips and holidays shall be considered as evidence that the work is unsatisfactory and the Contractor may be required to apply the remainder of the paint by brush.

F. Mechanical mixers shall be used to mix the paint.

1. The paint shall be mixed to thoroughly blend the pigment and vehicle together.

2. Paint shall be kept mixed while being applied.

G. Paint specified or formulated shall be ready for application and thinning will be allowed only on direction of the Engineer.

H. The Contractor shall protect all parts of the structure being painted against disfigurement by spots of paint or paint materials.

1. When paint is being applied on structures carrying public traffic, the Contractor shall be responsible for damage caused by Contractor's operations to passing vehicles or persons.

2. The Contractor shall use shields or other protective means to guard against such damage.

I. Paint stains that result in unsightly appearance shall immediately be removed by the Contractor at no additional cost to the Contracting Agency.

614.03.03 SURFACE PREPARATION OF STEEL

A. The following methods of surface preparation apply to steel surfaces. Unless otherwise specified, the sand blasting method shall be used.

B. **Sand Blasting:**

1. Dirt, mill scale, rust, stain, old paint, and other foreign material shall be removed from steel surfaces by an approved blast cleaning apparatus.

2. Blast cleaning shall be sufficient to give the surface the appearance of unpolished cast aluminum.

3. Abrasives used for blast cleaning shall be clean dry sand, mineral grit, steel shot, or steel grit, at the option of the Contractor, and shall be of a grading suitable to produce satisfactory results.

4. The use of abrasives other than those specified herein will not be permitted unless approved in writing by the Engineer.

5. When sand blasting is being performed on structures open to traffic, the Contractor shall provide suitable protective devices to prevent damage to traffic.

6. When sand blasting is being performed near machinery, all journals, bearings, motors, and moving parts shall be sealed against entry of sand dust before sand blasting begins.

7. Unless otherwise authorized by the Engineer, sand blasted surfaces shall be primed or treated the same day sand blasting is done.

8. If cleaned surfaces rust before painting is accomplished, the surfaces shall be recleaned by the Contractor.

C. **Washes:**

1. Rust-inhibitor chemical washes shall be applied to freshly sand blasted steel surfaces prior to the application of the first undercoat of paint, except when the first undercoat of paint is applied to the cleaned surfaces within a 4-hour period after cleaning, washes will not be required.
2. Washes shall be applied in not more than 4-hour intervals.
3. If, in the opinion of the Engineer, atmospheric conditions are such that corrosion forms on freshly sand blasted surfaces in less than 4 hours, treatment may be required at more frequent intervals.
4. Rust-inhibitor chemical washes may be applied by brush or spray, and the washes shall be applied in a careful manner to ensure that all surfaces are covered.
5. During the application of the rust-inhibitor chemical wash, no sand blasting will be permitted in the areas being treated.
6. No paint shall be applied until the treated surfaces have dried.
7. The first undercoat of paint shall be applied to the treated surfaces the same day that cleaning and washing have been done.

D. **Steam Cleaning:**

1. Dirt, grease, loose chalky paint, and other foreign material that has accumulated on the previously painted surfaces shall be removed with an approved steam cleaning apparatus which shall precede all other phases of cleaning.
2. It is not intended that sound paint be removed by this process.
3. Subsequent painting shall not be performed until the cleaned surfaces are thoroughly dry and in no case in less than 24 hours after cleaning.
4. A detergent soap consisting of 45 percent sodium metasilicate, 43 percent sodium sesquisilicate, 10 percent sodium tetraphosphate, and 2 percent Naccanol shall be added to the feed water of the steam generator at the approximate rate of 1 pound of detergent per 200 pounds of water.
5. Any residue that may accumulate on cleaned surfaces shall be removed by flushing with fresh water, but washing down the cleaned surfaces will not otherwise be required.

E. **Hand Cleaning:**

1. Dirt, loose rusts, mill scale, dead paint, or paint that is not firmly bonded to the metal surfaces shall be removed by hand or powered wire brushes, hand scraping tools, or sandpaper.
2. Pneumatic chipping hammers will not be allowed unless authorized in writing by the Engineer.
3. Hand cleaning shall be sufficient to remove all loose material that would prevent the bond of succeeding coats of paint.

F. If the amount of steel to be painted exceeds 100 tons, the surface shall be prepared by method B, "Sand Blasting"; however, if the amount to be painted is 100 tons or less, the surface may be prepared by method E, "Hand Cleaning."

614.03.04 PAINTING STRUCTURAL STEEL

A. **Paint:**

1. Unless otherwise required in the contract documents, the paints to be applied to steel surfaces shall conform to ***Section 714, "Paint and Pavement Markings."***
2. The undercoats shall consist of a minimum dry film thickness of 1 mil per coat.
3. The finish coat shall consist of a minimum dry film thickness of 1 mil.
4. The total thickness of all coats shall be not less than 3 mils.
5. Excessively thick coats of paint will not be permitted.
6. The thickness of each coat shall be limited to that which will result in uniform drying throughout the paint film.

B. **Field Cleaning:**

1. Unless otherwise specified in the contract documents, after erection and riveting or welding, all surfaces of unpainted structural steel that will be exposed to air shall be sand blasted in accordance with ***Subsection 614.03.03, "Surface Preparation of Steel."***
2. Any damage to sound paint, on areas not designated for treatment, resulting from the Contractor's operations shall be repaired to the satisfaction of the Engineer.

C. **Painting:**

1. Painting of structural steel prior to erection will be limited to surface preparation and one undercoat of paint.
2. Any deficiencies in the first coat of paint shall be corrected to the satisfaction of the Engineer, prior to the application of succeeding coats of paint.
3. Surfaces exposed to the atmosphere that would be inaccessible for painting after erection shall be painted the full number of coats prior to erection.
4. The surface of the paint coat being covered shall be free from moisture, dust, grease, or any other deleterious material that would prevent the bond of the succeeding paint coats.
5. In spot painting, any old paint that lifts after application of the first spot coat shall be removed by scraping and the area repainted before application of the next coat.
6. The application of the finish coat will be permitted until the required total film thickness of the undercoats of paint, as described in A, above, is obtained.
7. Open seams at contact surfaces of built-up members that would retain moisture shall be caulked with red lead paste before applying the second undercoat of paint.
8. Metal surfaces embedded in concrete need not be painted.

D. **Machine Finished Surfaces:**

1. With the exception of abutting chord and column splices and column and truss shoe bases, machine finished surfaces shall be coated with a rust inhibitor that can be easily removed.

2. Surfaces of iron and steel castings that have been machine finished shall be painted with a coat of shop paint.

E. **Frames and Grates:**

1. Prior to installation, all surfaces of frames and grates exposed to the atmosphere shall be painted with 2 coats of paint.

2. Unless otherwise specified in the contract documents, the exposed surfaces shall be painted after installation with 1 finish coat as specified for structural steel.

614.03.05 PAINTING TIMBER

A. **Paint:**

1. New timber requiring painting shall be painted with 3 coats of paint.

2. The paint used for various coats will be as specified in these specifications or in the contract documents.

B. **Preparation of Surfaces:**

1. Cracked or peeled paint, loose chalky paint, dirt, and other foreign matter shall be removed by wire brushing, scraping, or other approved means immediately prior to painting.

2. Unpainted timber shall be thoroughly dry before paint is applied.

C. **Painting:**

1. When permitted in writing by the Engineer, the first coat of paint may be applied prior to erection.

2. After the first coat has dried and the timber is in place, cracks, checks, nail holes, and so forth shall be puttied flush with the surface and allowed to dry before the second coat is applied.

3. Skips, holidays, thin areas, or other deficiencies in any coat of paint shall be corrected to the satisfaction of the Engineer before the succeeding coat is applied.

4. The surface of the paint coat being covered shall be free of any deleterious material before any additional paint is applied.

END OF SECTION 614

SECTION 619 – OBJECT MARKERS AND GUIDE POSTS

DESCRIPTION

619.01.01 GENERAL

A. This work shall consist of furnishing and installing object markers and guide posts of the design and at locations shown on the plans or established by the Engineer.

MATERIALS

619.02.01 GENERAL

A. Materials shall conform to ***Section 721, "Object Markers and Guide Posts."***

CONSTRUCTION

619.03.01 GENERAL

A. Target members, object markers, and reflectors appropriate to the color involved shall be assembled, fastened, set, and aligned in accordance with the details and dimensions shown on the plans.

B. All fastenings shall be tight.

619.03.02 RESET

A. Reset object markers and guide posts shall be erected, using salvaged materials, and shall be similar in type to the original construction.

B. Any new materials necessary to rebuild the markers shall be furnished by the Contractor, shall be the same as those in the original, if available, and the cost thereof shall be included in the contract price for the work.

C. The Contracting Agency reserves the right to furnish the Contractor with such new materials as the Contracting Agency deems advisable, and these materials shall be used in the resetting of the markers in lieu of salvage materials which the materials replaced.

END OF SECTION 619

SECTION 621 – MONUMENTS

DESCRIPTION

621.01.01 GENERAL

A. This work shall consist of furnishing and installing permanent survey monuments, constructed in accordance with the design and drawings shown on the plans or ordered by the Engineer.

B. All monuments destroyed and/or damaged shall be installed by the Contractor in accordance with the Uniform Standard Drawings, and under the direct supervision of the Engineer. The Contractor shall coordinate his work with the Engineer.

C. The Contractor shall coordinate Contractor's work with the Registered Land Surveyor.

MATERIALS

621.02.01 GENERAL

A. Monuments shall be constructed of Portland cement concrete, and shall be of Type I, Type II, Type III, or Type IV as shown in the Standard Drawings.

CONSTRUCTION

621.03.01 INSTALLATION

A. The monuments shall be set to assist in reestablishment of the center line for future use and shall be set at the beginning and end of each project, at the beginning and end of each curve, at any angle point, at street intersections, and to replace or reference Section Corners or other Government Land Corners.

B. The monuments may perpetuate a point or reference a point.

C. An as-built set of plans for the project, showing the exact location of all monuments set, shall be prepared by a Registered Land Surveyor and filed with the County Surveyor prior to acceptance of the project.

END OF SECTION 621

SECTION 622 – CONSTRUCTION SURVEYING BY THE CONTRACTOR

DESCRIPTION

622.01.01 GENERAL

A. The Contractor shall, under supervision of a Professional Land Surveyor, registered in the state of Nevada, furnish and set construction stakes establishing locations, lines, and slope stakes for roadway, storm drain, drainage structures, sewer, laterals, and for all other improvements for project necessary to ensure conformance of work to lines, elevations, locations, and grades as shown on the Plans and in these Special Provisions. Any horizontal or vertical discrepancies shall be reported to Engineer prior to commencement of construction. Any revisions or changes approved by Engineer that affect lines, grades, elevations or locations of any improvement shall be indicated on As-Built (Record) Drawings.

B. If necessary, the Contractor shall also perform and provide to the Engineer those items described in subsection 203.04.01 of the USS. Any revisions or changes approved by the Engineer that affect the lines, grades, elevations or locations of any improvement shall be indicated on the As-Built (Record) Drawings.

C. Contractor shall preserve property line and corner survey points. If their destruction is determined by Engineer to be unavoidable, and their replacement is not called for on the plans, Owner shall replace or pay for their replacement under this contract as determined by Engineer. Markers that are disturbed or destroyed by Contractor's operations without prior approval by the Engineer shall be replaced by Contractor at no additional cost to the Owner. Replacement shall be done only by a Nevada Professional Land Surveyor and in accordance with the USS. A monument tie sheet for replacement of permanent survey monuments shall be submitted to Engineer for approval.

D. When a permanent survey marker and/or monument is located within the construction area of any roadway, storm drain, drainage structures, sewer line or channel improvement, the Contractor shall adjust the cover or replace the monument as noted on the plans. The cost of replacement or adjustment of said monuments shall be included in the lump sum bid for Construction Survey. If monuments are to be installed as part of the work, they shall be placed in accordance with the USD numbers 239 through 243 and Section 621 of the USS.

E. The Contractor shall, under the supervision of a Professional Land Surveyor, prepare and provide GPS location and mapping of as-built conditions for all proposed sanitary sewer and storm drainage facilities as described on the Project Drawings and in this Section.

MATERIALS

622.02.01 BLANK

CONSTRUCTION

622.03.01 GENERAL

A. Prior to all work in this section, the Contractor shall carefully inspect all installed work and verify that all such work is complete to a point where this installation may properly commence.

B. The Contractor shall verify that all work can be installed in accordance with all pertinent codes and regulations, Contract Drawings and referenced standards.

C. The Contractor shall verify that there are no conflicts with existing utilities prior to the start of work.

D. In event of a discrepancy, the Contractor shall immediately notify the Engineer in writing.

E. Installation of work in areas of discrepancy shall not proceed until all such discrepancies have been fully resolved.

F. After stakes and marks have been set, it shall be the responsibility of the Contractor to protect the stakes and marks. Should any of the stakes or marks be destroyed or disturbed by the Contractor's operations or otherwise, the costs of replacing said stakes or marks shall be paid by the Contractor.

G. The Engineer, at his discretion, may periodically have survey work performed to verify conformance to the construction plans. Any nonconformity found to be the fault of the Contractor, or the Professional Land Surveyor, shall be corrected at no additional cost to the Owner.

H. Upon completion of the project and as a condition for final payment authorization, the Contractor shall furnish to the Engineer a Record of Survey/monument tie map and a certification attested to by the Professional Land Surveyor that the work performed for this contract has been constructed to the lines and grades as described in the As-built (Record) Drawings. When requested, the Contractor shall also provide the Engineer with copies of all field notes, computations, and other related work performed by the Professional Land Surveyor.

622.03.02 FINAL ACCURACY

A. Surface Drainage Structures (including all concrete or asphalt gutters and drains) shall be installed within 0.05 feet horizontally and 0.05 feet vertically from the location taken from the project plans, and shall not vary more than 10 percent of the gradient shown on the plans.

B. Monument Cases and Brass Caps shall be centered to within 0.01 feet horizontally of the position as called for on the plans, and the ties to that monument.

C. Sanitary and Storm Drainage Sewer Systems shall be installed within 0.05 feet horizontally and 0.05 feet vertically of the exact location taken from the project plans. In

addition, the gradient of any 10-foot section of pipe shall not vary by more than 10 percent of the gradient shown the project plans

622.03.03 INSTALLED/EXPOSED UTILITY SURVEYING

A. All measurements are to be made by the Surveyor who will be certifying the project as constructed.

B. The contractor is responsible for coordinating with the Surveyor during construction and shall provide access to all utilities prior to being buried; allowing accurate horizontal and vertical measurements to be acquired by the Surveyor. In the event of any discrepancies identified by CLV and at no cost to CLV, the Contractor shall verify the location and measurements of any buried utilities.

C. After construction of the approved plans and before backfilling, survey shall be conducted indicating the size, horizontal and vertical location, and configuration of any utility constructed with this project or utility exposed during construction, and utility encasement if applicable. Utility final location information shall be described by coordinates which shall be based on the official horizontal and vertical control networks of the City of Las Vegas and be certified by a Nevada professional land surveyor to have positional certainties within +/- 0.3-ft.

D. Survey measurements for utilities constructed or exposed during the course of construction including but not limited to pipes, manholes, drop inlets, conduits, cables, encasements, boxes, vaults and appurtenances shall be located to the extent possible within the excavation area. Measurements shall be taken at a minimum of 100-ft intervals, at all exposed angle points, deflections of the utility exceeding +/- 0.5-ft, at all exposed points that enter/exit the excavation or the public right-of-way, and sufficient measurements to accurately define curving layout.

E. Potholes performed by the contractor prior to or during construction shall be surveyed indicating the size, location, burial depth, and configuration of the utility. Pothole location information shall be tied to the official horizontal and vertical control networks of the City of Las Vegas and be certified by a Nevada professional land surveyor.

F. Utility final location information shall be submitted on paper and in electronic form, on a form specified by the City Surveyor. Submittal requirements and examples are included in Appendix E.

G. Interim and final survey progress reports shall be submitted to the Engineer certifying sufficient survey measurements have been performed prior to backfilling as required by this section on a weekly basis or as directed.

END OF SECTION 622

SECTION 624 - ACCOMMODATIONS FOR PUBLIC TRAFFIC

DESCRIPTION

624.01.01 GENERAL

A. The work shall consist of providing safe and effective work areas and to warn, control, protect and expedite vehicular and pedestrian traffic through the construction zone. It shall be the sole responsibility of the Contractor to provide for the safety of the traveling public within the limits of the project.

B. The work shall be performed in accordance with the MUTCD Latest Edition and as specified in these Special Provisions.

624.01.70 SPECIAL TRAFFIC CONTROL, LANE RESTRICTIONS OR ACCESS ISSUES:

A. Refer to ***Section 107.07, "Traffic and Access"*** for traffic and access requirements.

MATERIALS

624.02.01 GENERAL

A. The materials used for the construction and maintenance of facilities required for the free flow of public traffic and for protection of the work shall be those prescribed for the several items which constitute the finished work and shall conform to all the requirements for such materials as set forth herein.

CONSTRUCTION

624.03.01 SPECIAL DETOURS

A. Special detours shall be constructed as shown on the Traffic Control Plan prepared by the Contractor. Detour locations indicated on the Traffic Control Plan may be approximate only; the exact location shall be staked by the Contractor's surveyor.

B. Grading for special detours shall consist of motor grader work, supplemented where necessary by other mechanical equipment, to provide the specified roadbed width and a grade line free from breaks or rolls of sufficient magnitude to be hazardous to traffic. This work shall conform to ***Subsection 107.21, "Dust Control."***

C. When grading of special detours has been completed and approved by the Engineer and, if required on the plans or in the Special Provisions, the special detours shall receive surfacing materials of the kind and type specified, and the detours shall be placed and constructed in accordance with the requirements for the particular materials used.

D. Water shall be applied to detours in amounts necessary to attain the compaction of graded sections and of surfacing materials.

E. Maintenance on special detours shall consist of performing any work necessary to maintain the detour satisfactorily, as ordered by the Engineer.

F. Eradication of special detours shall consist of blade grader and scraper work supplemented by other equipment if needed. Eradication shall be performed to the extent

that the ground will be restored as nearly as feasible to the original, and material disposed of, all as directed by the Engineer.

G. It is the City of Las Vegas's policy that under no circumstances will travel on a temporary gravel surface be permitted for longer than fifteen (15) calendar days. Temporary gravel surfaces shall be graded, watered and maintained at all times to provide a smooth dust free traveled surface.

H. All temporary detours and/or bypasses that are expected to be in service for more than fifteen (15) calendar days shall be hard surfaced with a minimum of 1-1/2 inches of AC pavement and maintained in a smooth and usable condition at all times for the duration of the detour and/or bypass.

624.03.02 FLAGGERS

A. If, in the opinion of the Engineer, controlled traffic is necessary for protection of the work or for safety of public traffic, flaggers shall be employed by the Contractor.

B. Flaggers shall have completed an approved instructional course in flagging procedures.

C. A prospective flagger shall possess a valid flagger card attesting satisfactory completion of said instructional course conducted by the Nevada Department of Transportation or some other approved course given by another governmental agency.

D. Proper advance warning signs shall be in place when flaggers are working and removed when work requiring flaggers is completed.

E. Flaggers shall be used to assist trucks for safe ingress and egress whenever truck movements may interfere with safe passage through the work zone. The flaggers' first priority shall be to maintain the safe and efficient movement of the public traffic. In the event that a flagger is to flag at an intersection controlled by a stop sign they must bag the sign(s) prior to taking control of traffic. If a flagger is to flag at an intersection controlled by a traffic signal the traffic signal must be turned off prior to taking control of traffic. Any changes to regulatory signs or changes to a traffic signal shall be reversed at the end of every workday, unless approved by the traffic engineer. Failure to do so could result in an order to stop work.

F. The "Flagger Method" as outlined in Part VI of the MUTCD shall be used for all one lane, two-way traffic control.

624.03.03 PILOT CARS

A. If, in the opinion of the Engineer, it is necessary to afford additional protection to the work, workers, or public traffic, a pilot car and driver shall be used as the Engineer directs. This provision shall be in effect even though the pilot car and driver are not indicated on the plans or provided for in these specifications.

B. Pilot cars shall be suitable vehicles in good mechanical condition and shall carry a sign which shall comply with the design and mountings as shown on the standard drawings appended to the Special Provisions, or shown on the plans.

624.03.04 MAINTAIN BASE

A. When the proposal contains an item of "Maintain Base," the provisions of ***Subsection 109.03, "Extra and Force Account Work,"*** shall apply.

624.03.05 EQUIPMENT RENTAL

A. When the proposal contains an item of equipment rental, the use of such equipment shall be as directed by the Engineer or as indicated on the plans.

624.03.70 TEMPORARY STRIPING

A. The temporary traffic striping tape material shall conform to subsection 635.02.01 of the NDOT Standards. Placement of temporary pavement striping shall be by pilot line method and its use limited to fourteen (14) calendar days. The tape shall be four (4) inches wide and four (4) feet long and spaced every forty- (40) feet. The color of the tape shall match the color of the existing line. The double yellow line shall have two pieces of tape side by side with a four (4) inch space between, and spaced to the above increments.

B. Painted temporary striping shall be 4-inches wide and shall be continuous or intermittent in accordance with the MUTCD. Painted temporary striping shall not be used on the final wearing course of the pavement.

C. Existing pavement markings, either painted or raised pavement markers, which are not applicable and are within the transverse limits of the temporary travel lanes shall be removed to the satisfaction of the Engineer. Painting over existing markings will not be allowed.

624.03.71 TEMPORARY BRIDGES FOR VEHICULAR ACCESS

A. Where necessary or required for the convenience of the traveling public or individual residents, businesses or schools, The Contractor shall provide temporary bridges over all unfilled excavations at all street, driveway and alleyway, crossings unless otherwise directed by the Engineer. The bridges shall remain in place until the excavations have been properly backfilled to the satisfaction of the Engineer.

D. Temporary bridges for street crossings shall conform to the requirements of the authority having jurisdiction in each case, and the Contractor shall adopt designs furnished by said authority for such bridges or shall submit designs for approval by said authority as may be required. If plates are used, they must be capable of carrying the heaviest anticipated loads using the roadway, be properly anchored so as to prevent any transverse and/or any longitudinal shifting of the plate and must be certified by a structural engineer registered in the State of Nevada. Refer to the City of Las Vegas Trench Plate Requirements detail in Appendix “B”.

624.03.72 PIPE LAYING OPERATIONS

A. Pipe stored in the street rights of way within a barricaded work zone, with the approval of or at the direction of the Engineer, which is to remain one night or more shall be protected by Barrier Rail. Type B high intensity warning lights will be installed on the barrier rail at intervals not exceeding 25 feet.

E. During working hours, the Contractor shall have no more than three hundred (300) feet of open trench and/or structure excavation nor more than one half (1/2) of an intersection closed to vehicular traffic, except with specific written permission by the Engineer. During non-working hours, the Contractor shall have no more than one hundred (100) feet of open trench and/or structure excavation barricaded in accordance with these supplemental specifications. Pedestrian access crossings suitably equipped with handrails shall be

provided as directed by the Engineer. The cost of such crossings shall be included as a part of the traffic control bid item.

624.03.73 TRAFFIC CONTROL DEVICES

A. Trained and knowledgeable traffic control personnel shall be utilized to insure proper set-up and maintenance of traffic control devices and to assist in the safe movement of vehicles through the traffic control zone.

F. The Contractor from the public right-of-way shall remove all traffic control devices that are not in use or will not be used for a period greater than 24 hours. All traffic control devices that are determined by the Engineer to be unnecessary, confusing, or causing an unsafe condition, shall be removed by the Contractor from the public right-of-way immediately upon written notification by the Engineer. The Contractor shall not, at any time, use the sidewalk area to store unused barricades unless the sidewalk is closed and an approved barricade plan is provided for rerouting the pedestrians.

G. The Contractor shall maintain all barricades and other traffic control devices in clean and effective condition. The Contractor shall replace poorly maintained devices immediately upon notification by the Engineer.

H. The Contractor shall begin placing the barricades in the direction of traffic. The Contractor shall remove the barricades in a direction opposing traffic.

I. **Temporary Stop Signs**: All temporary stop signs shall be installed in a semi-permanent manner in the ground or pavement surface in accordance with Standard Drawing Number 249 of the USD.

624.03.74 TRAFFIC CONTROL SUPERVISOR

A. The Contractor shall designate a Traffic Control Supervisor who shall be responsible for initiating, installing and maintaining all traffic control devices as shown on the traffic and plans, as specified in the MUTCD, and revisions thereto, the USS, these supplemental specifications or as directed by the Engineer. When traffic control devices are on the project site the designated Traffic Control Supervisor shall be available to the Engineer twenty-four (24) hours a day for the duration of the contract. The Traffic Control Supervisor shall be an employee of the Contractor and under the supervision of the Superintendent. The person so designated shall be certified as a worksite traffic control supervisor by the ATSSA.

J. The Traffic Control Supervisor shall be capable of being on-site within thirty- (30) minutes of notification.

K. The traffic control supervisor shall make at least four (4) inspections of all traffic control devices each calendar day as follows:

1. Before beginning work
2. At mid shift
3. Half an hour after the end of the shift
4. Once during the period of non working hours

L. The Traffic Control Supervisor shall make a daily record of traffic control activities including a reference to the barricading in effect that day. The Project superintendent

shall sign the daily record each day attesting to its accuracy. The Contractor shall submit these records to the Engineer on a weekly basis.

624.03.75 REQUIRED PROTECTION FOR OPEN EXCAVATION DURING WORKING AND NON-WORKING HOURS

A. The following requirements apply to any open excavations where the difference in elevation between the pavement and the excavated area is greater than 6":

1. Any open excavations, in the roadway or within eighteen (18) feet of the roadway, which does not provide a 4:1 (horizontal: vertical) slope between the edge of pavement and the bottom of the excavation, shall be protected with portable precast concrete traffic barrier rails and six (6) feet high non-climb fence. All portable precast concrete traffic barrier rails shall be butted tight and pinned in accordance with the requirements of the Nevada Department of Transportation's Standard Drawing R-8.3.3, entitled "Portable Precast Concrete Barrier Rail", which is hereby incorporated into the plans.

2. Any open excavation further than eighteen (18) feet and less than three hundred (300) feet from any building or roadway, shall be, as a minimum, completely fenced with a six (6) foot high non-climb fence.

3. Any open excavation beyond three hundred (300) feet of any building or roadway shall be protected with a three (3) foot high earth berm completely around the excavation. Type II Barricades with Type B high intensity warning lights shall be spotted around the top of the berm after daylight hours.

4. Barrier rails and fencing may be required, during working hours, when determined by the Engineer, to be in the interest of public safety.

M. The following requirements apply to any open excavations adjacent to a sidewalk where the difference in elevation between the back of the sidewalk and the excavated area is greater than 6 inches:

1. The open excavation shall be protected, as a minimum, with a six (6) foot high non-climb fence.

END OF SECTION 624

SECTION 625 – CONSTRUCTION SIGNS

DESCRIPTION

625.01.01 GENERAL

A. This work shall consist of furnishing, erecting, maintaining, relocating, and removing work zone traffic control devices, including signs, channelizing devices, and lighting devices at locations set forth in the contract documents, or as directed by the Engineer, for the protection of the work, workers, and guidance and safety of the motoring and pedestrian public.

B. All work zone traffic control devices shall remain the property of the Contractor upon completion of the contract and shall be removed from the project by the Contractor.

C. All work zone traffic control devices shall conform to the latest edition of the *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD), published by the U.S. Department of Transportation, Federal Highway Administration, as well as the current edition of the Traffic Control Plans for Highway Work Zones for the Clark County Area, unless otherwise indicated on the plans or by the Special Provisions.

D. Regulatory signs shall be mounted so that the bottom of the sign will be a minimum of 5 feet above the ground surface or the pavement.

MATERIALS

625.02.01 GENERAL

A. It is expressly intended that a broad selection of material be granted the Contractor since work zone traffic control devices are in temporary use and new products become commercially available regularly.

1. Sign panels may be constructed of steel, aluminum, wood, or other approved material and be of a sound, durable nature.

2. The materials shall be of such quality to do the job for which they are intended and are subject to approval by the Engineer.

3. Signs and channelizing devices that have become dull, have flaking or peeling paint, are dirty or discolored, or are otherwise marred shall be repaired or replaced with acceptable units.

B. Reflective sheeting for all signs and channelizing devices shall conform to ***Subsection 716.03.01, "Reflective Sheeting."***

C. Reflective sheeting shall be used on all work zone signs and channelizing devices.

625.02.02 SIGN DIMENSIONS

A. Sign dimensions shown in the MUTCD are minimum standard.

1. Increases above this minimum are permissible and desirable where investigation has shown a larger sign is needed for adequate emphasis.

2. In the enlarging of signs, standard shapes and colors shall be used, and standard proportions shall be retained so far as practicable.

CONSTRUCTION

625.03.01 GENERAL

A. Before any detour, temporary route, or work zone is opened to traffic or imposed upon existing traffic, all necessary signs shall be in place.

B. Signs required by road conditions or restrictions shall be removed immediately when those conditions cease to exist or the restrictions are withdrawn.

C. Guide signs directing traffic to and on temporary routes or detours shall be removed when no longer applicable.

D. Signs and barricades shall be maintained in operable condition.

1. Care shall be exercised to keep the sign faces free of dust and splashed mud.

2. Any signs and barricades that become scarred, damaged, or destroyed shall be repaired immediately or replaced, at no additional cost to Contracting Agency and as directed by the Engineer.

E. The responsibility for the protection of the work, workmen, and public traffic will rest with the Contractor and the Contractor shall be liable for damages and injury suffered by reason of the Contractor's operations or any circumstances, conditions, actions, or negligence in connection therewith.

625.03.02 SIGN PLACEMENT

A. Signs shall be placed in conformance with the MUTCD.

B. All temporary stop signs shall be mounted on a post that is embedded in the ground a minimum of 18 inches or to a depth sufficient to prevent overturning by wind loadings and easy removal by vandals as approved by the Engineer with the following possible exceptions:

1. A flagger is used to supplement temporary stop signs. The temporary stop signs shall be post-mounted and embedded in the ground when no flagger is present.

2. Temporary stop signs may be used with a moving construction operation with frequent lane shifts only when construction is in progress and the flagger is present. When no construction is in progress and no flagger is present, the temporary stop signs shall be post-mounted and embedded in the ground.

625.03.03 SIGN SUPPORTS

A. Signs, posts, pole mountings, and sign foundations shall be constructed to hold signs rigidly in a proper and permanent position, and prevent the signs from swaying in the wind, or from being turned or otherwise displaced.

B. A portable or removable type of mounting may be used for signs required intermittently or that are frequently moved. Such a mounting shall be heavy enough not to turn over in the wind, and the base shall not be appreciably wider than the sign.

C. A portable or removable type of mounting for temporary stop signs may only be used in a moving operation during the time when construction personnel are present.

1. Such a mounting shall be heavy enough not to turn over in the wind.

2. Temporary stop signs shall be post-mounted and embedded in the ground after working hours when no flagger is present.

625.03.04 CHANNELIZING DEVICES

A. Projects closed to traffic shall be protected by appropriate channelizing devices, as approved by the Engineer, in conjunction with appropriate work zone warning signs.

B. If weighting of channelizing devices is necessary, sand bags may be used as long as a low center of gravity is maintained as approved by the Engineer.

625.03.05 PORTABLE CHANGEABLE MESSAGE SIGN

A. Portable Changeable Message Signs (PCMS) conforming to the MUTCD, Part 6, Section 6F.60 shall be used to advise the driver of road closures on streets with an 80-foot or greater right-of-way.

B. The PCMS shall be placed far enough in advance of the closed street to allow traffic ample opportunity to detour around the disrupted area.

C. The location and number of PCMS will be determined by the Engineer.

D. Solar powered panels shall be used in residential areas**.**

625.03.06 ARROW DISPLAYS

A. Arrow Displays conforming to the MUTCD, Part 6, Section 6F.61, Type B, shall be used to advise the driver of lane closures when so directed by the Engineer.

B. The Arrow Displays shall be required at the beginning of the taper and placed behind the barricades in the closed lanes, as required by the approved traffic control plan and as directed by the Engineer.

C. Solar powered panels shall be used in residential areas.

END OF SECTION 625

SECTION 626 – FINAL CLEANUP

DESCRIPTION

626.01.01 GENERAL

A. Before final acceptance, the Contractor shall remove or obliterate, insofar as feasible, all objects or disturbances of the ground which mar the landscape and were caused by Contractor's operations, whether or not part of the improvement.

B. This shall be required on all areas used or occupied by the Contractor within or outside the right-of-way limits.

CONSTRUCTION

626.03.01 FINAL CLEANUP

A. Rubbish, excess material, temporary structures, and discarded equipment shall be collected and disposed of as directed by the Engineer.

1. Burning is prohibited.
2. Pits or trenches for equipment setups or camp sites shall be filled and the ground restored, insofar as feasible, to its original conditions, within or outside of the right-of-way limits.
3. Temporary haul roads within the right-of-way limits shall be scarified and bladed to blend with surroundings.
4. Pits from which materials have been obtained shall be dressed and shaped to conform with the surrounding ground.
5. Waste shall be removed from the tops of banks and placed in the bottom of pit.
6. Unless otherwise specified or directed by the Engineer, banks of pits shall be cut to not steeper than 2:1 slopes to blend with the natural contours.
7. Bottoms of pits shall be reasonably smooth.
8. All other disturbances shall be removed or corrected as directed by the Engineer with particular attention to the abatement of any dust hazard.

B. Working areas and backslopes pertaining to the improvement shall be hand raked and loose objects including rocks and clods in excess of 2 inches in any dimension shall be removed from the site.

C. Pavement, curb and gutter, sidewalks, and driveways shall be swept or flushed and presented to the Contracting Agency in condition for maintenance without further work.

END OF SECTION 626

SECTION 627 – PERMANENT SIGNS

DESCRIPTION

627.01.01 GENERAL

A. This work shall consist of furnishing, erecting, relocating, and installing signs, sign supports, and other materials required for highway signs in accordance with the current edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) and these specifications, as shown on the plans, and as directed by the Engineer.

B. This item does not include street name signs or construction signs used for traffic control during construction.

C. The work shall generally consist of:

1. Overhead signs, including concrete foundations, steel sign posts and frames, and aluminum sign panels with reflective sheeting.

2. Ground mounted signs consisting of concrete foundations, steel sign posts, pole mounted signs, aluminum sign panels with reflective sheeting, and appurtenances.

D. This work does not include sign illumination systems.

627.01.02 SHOP DRAWINGS

A. When overhead sign structures are to be furnished, the Contractor shall submit to the Engineer 5 sets of shop drawings for each overhead sign structure for approval.

B. Fabrication of the overhead sign structures shall not commence until the shop drawings have been approved by the Contracting Agency.

C. Shop drawings for other than overhead signs will not be required; however, all signs shall conform to the plans and the MUTCD.

1. For signs which are shown on the Sign Summary Sheets and are not included in the MUTCD, special sign design sheets shall be furnished by the Contracting Agency to the bidders of the project.

2. The special design sheets shall include such information as letter heights, spacing between letters and words, borders, sign radii, and so forth.

3. These signs shall conform to the special design sheets as well as the drawings noted in the plans.

MATERIALS

627.02.01 GENERAL

A. Materials shall conform to ***Section 716, "Sign Materials."***

627.02.02 REFLECTORIZATION

A. All signs shall utilize Type XI retroreflective sheeting for sign background, letters, numerals, symbols, borders, and accessories.

B. All letters, numerals, symbols, borders, and accessories shall be directly applied to the sign background.

627.02.03 LETTERS, NUMERALS, SYMBOLS, AND ACCESSORIES FOR GUIDE SIGNS

A. All names of places and highways on guide signs shall be composed of lower case letters with initial capital letters.

1. The initial capital letters shall be 1-1/3 times the loop height of the lower case letters.

2. Other legends on guide signs shall be in capital letters.

B. The initial capital letters and numerals used shall be Series E, modified by widening the stroke-width to approximately 1/5 the letter or numeral height.

C. Tables of recommended letter spacing can be obtained from the FHWA.

D. Arrows that are used for large directional guides shall be in direct proportion to the arrows shown in the MUTCD.

CONSTRUCTION

627.03.01 PANEL FASTINGS

A. The panel sections shall be provided with suitable fastenings, as shown on the plans, to permit easy attachment to the supporting frames.

1. The fastenings shall be so designed as to carry the full design load with a factor of safety of not less than 1.5.

2. Panel sections shall be provided with closure strips at the joints.

B. Panel fastenings for use on sign panels covered with sign sheeting shall utilize nylon washers for contact between the sheeting and the metal washer.

627.03.02 CLOSURE STRIPS

A. Closure strip shall be anchored by aluminum rivets as shown on the plans.

B. Rivets shall be the same color as the sign face.

C. Closure strips are required only on aluminum sign panels.

627.03.03 INSTALLATION

A. Sign locations indicated on the plans are approximate only. Final determination of sign locations will be made in the field by the Engineer.

B. Signs and sign islands shall be constructed to the lines and grades given by the Engineer and in accordance with the design and locations shown on the plans.

C. All signs shall be erected as specified before, during, or immediately after the completion of bituminous plantmix surface operations.

D. The date of installation, consisting of month and year, shall be permanently stamped on the back of each sign with metal dies and shall be visible only on close inspection. The stamp shall be placed on the lower right hand corner when facing the rear of the sign.

E. Each sign face shall be thoroughly cleaned according to the reflective material manufacturer's recommendations.

1. All undesirable material that is visible on the face of the sign shall be removed.

2. The use of abrasives or other cleaning material that will scratch or otherwise deface the sign shall not be permitted.

F. Sign islands shall be constructed as roadway embankment in conformity with ***Section 203, "Excavation and Embankment."***

1. Structure excavation and backfill shall conform to ***Section 206, "Structure Excavation,"*** and ***Section 207, "Structure Backfill."***

2. Anchor bolts shall be set true to line and grade.

3. Posts shall be plumb.

G. Sign faces of all directional signs facing public traffic and directing such traffic to a portion of the project not yet open to public traffic shall have the message covered.

H. Care shall be exercised at all times in the handling, storing, transporting, and erecting of the signs. Signs that are damaged shall be repaired or replaced at no additional cost to the Contracting Agency.

I. Pipe sign posts may be field cut and drilled to adjust for local conditions when approved by the Engineer.

1. Flame cutting will not be permitted.

2. All field cuts and abraded areas on steel posts shall be thoroughly cleaned and given 2 coats of paint having a high-zinc dust content conforming to Federal Specification MIL-P-21035.

J. Extending the lengths of sign posts to adjust for local conditions by splicing or welding will not be permitted.

627.03.04 TESTS

A. The Contractor shall verify that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency.

B. The Contractor shall furnish the Contracting Agency with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

627.03.05 RELOCATION

A. This work shall consist of temporary or permanent relocation of existing permanent sign panels, posts, and footings as shown on the plans and as directed by the Engineer.

B. Existing sign panels and posts that are removed for relocation shall be stockpiled on the jobsite at locations determined by the Engineer and shall remain the property of the Contracting Agency.

C. The Contractor shall remove and dispose of all concrete from sign posts prior to stockpiling as directed by the Engineer.

D. Temporary relocation of permanent sign panels for public bus or transit stops shall be as indicated on the plans or as directed by the Engineer. Temporary locations for public bus or transit stops shall conform to ***Subsection 107.07, "Traffic and Access."***

E. The Contractor shall exercise care when removing and stockpiling signs for relocation. Signs that are damaged shall be repaired or replaced at no additional cost to the Contracting Agency.

END OF SECTION 627

SECTION 637 - POLLUTION CONTROL

DESCRIPTION

637.01.01 GENERAL

A. This work shall consist of temporary pollution control measures that may be shown on the plans, specified in the Special Provisions, or ordered by the Engineer during the life of the contract.

1. The work shall meet the applicable requirements of the Clark County Department of Air Quality and Environmental Management (DAQEM).

2. The work is intended to provide prevention, control, and abatement of water and air pollution within the limits of the project and to minimize damage to the work, adjacent property, and streams or other bodies of water.

B. The Contractor shall, 7 days prior to the preconstruction conference, submit for acceptance the Contractor's proposed plans and schedules, in duplicate, for accomplishing the prevention of erosion and pollution that may occur due to the Contractor's operations. No work shall be started until the schedules and methods of operations have been accepted by the Engineer.

C. The work shall include furnishing and applying a dust palliative to all completed excavation and embankment grading planes and other disturbed areas within the right-of-way except those areas that are to be paved under the terms of the contract and as directed by the Engineer. The dust palliative item does not include dust control measures required due to construction operations or carrying public traffic through construction or on detours.

D. Dust control work includes creating a Dust Control Mitigation Plan (DCMP), obtaining all necessary approvals for the DCMP, obtaining a Dust Control Permit for Construction Activities, payment of all fees associated with the project dust control, all work necessary to comply with the DCMP, Dust Control Permit, and the requirements of Section 94 of the Clark County Department of Air Quality Regulations, most recently adopted.

E. Any fines or penalties levied by the Clark County Department of Air Quality and Environmental Management due to violations of the project Dust Control Permit requirements are the sole responsibility of the Contractor and shall be paid by the Contactor.

F. The Contractor shall use all necessary Stormwater Runoff Best Management Practices (BMPs) performing the Work so as to not discharge stormwater runoff containing pollutants or sediment into the waters of the United States, including municipal separate storm sewer systems (MS4s) in violation of federal and state laws, rules, and regulations and the City’s water pollution requirements.

G. The Contractor shall:

1. Comply with the provisions of Nevada Revised Statutes, Chapter 445A: Water Pollution Control and City of Las Vegas Municipal Code 14.18; and

2. Adhere to all Federal regulations under 40 CFR 122.26(b)(14).

3. Submit SWPPP Submittal Checklist found in Appendix A of these Specifications to the Owner's Representative. This checklist must be on file prior to the issuance of the Notice to Proceed for construction.

H. All information and forms pertaining to Nevada's Stormwater NPDES Permitting Program can be found on the following website:

http://ndep.nv.gov/bwpc/storm01.htm

I. The City, state and federal regulations identified above are hereby incorporated by reference as preconditions of this Contract. The Contractor shall familiarize itself with these regulations and practices, and is advised that prior to engaging in any construction activities, the Contractor shall submit a Notice Of Intent (NOI) to the Nevada Division of Environmental Protection. A Storm Water Pollution Prevention Plan (SWPPP) must be completed prior to submission of the NOI and must remain on the project site and be updated as necessary for the duration of the project. As applicant, the Contractor is responsible for insuring that all persons on the project site, including contractor and subcontractor personnel, abide by the conditions of the permit. As the applicant, the Contractor is responsible for supplying complete copies of the NOI and SWPPP to all project subcontractors.

J. Upon completion of the project, the Contractor will need to permanently stabilize the construction area and file a Notice Of Termination (NOT) with NDEP to terminate the permit. The Contractor shall provide a copy of the approval letter of termination from NDEP to the Owner. Receipt of this letter will be required prior to acceptance of Contractor's final payment request.

K. Contractor shall apply for, pay for, and gain approval of the required permit from NDEP in a timely manner so as not to affect the project schedule. Contractor shall comply with the requirements of the permit and shall bear all associated costs. If the Owner suffers damages including but not limited to delays and fines as a result of the Contractor's failure to obtain a required permit or for non-compliance with the requirements of the permit, the Contractor shall reimburse the Owner for such damages and the Owner may withhold amounts equal to the damages from the Contractor's payments. Failure of the Contractor to obtain required permits in a timely manner shall not be justification for delay of the issuance of the Notice to Proceed by the Owner.

L. Any fines or penalties levied by the City of Las Vegas, Nevada Division of Environmental Protection, U.S. EPA, or any local, state, or federal agency to violations of the project Stormwater Runoff Management requirements are the sole responsibility of the Contractor and shall be paid by the Contactor.

MATERIALS

637.02.01 GENERAL

A. The binder for dust palliative shall be a resin emulsion that is miscible in water in the proportions hereinafter provided, is noncorrosive, and is effective as a dust palliative.

B. Resin emulsion shall be composed of from 57 percent to 63 percent of semi-liquid petroleum resin and the remainder water to which a suitable emulsifying agent has been added.

1. The binder shall be mixed with additional water at the job site and at the appropriate rate of 4 parts of water to 1 part of binder.
2. The exact rate of mixture shall be determined by the Engineer.
3. The resin emulsion shall be readily miscible with water and when diluted with any hard water in proportions of 1 part emulsion to 10 parts water shall show no signs of breakdown or separation of the petroleum resin base.
4. Resin emulsion that has been stored in closed containers at temperatures above freezing for a period of up to 3 months shall show no signs of separation.
5. Any resin emulsion that has been stored for more than 3 months shall not be used until tested and approved.

CONSTRUCTION

637.03.01 GENERAL

A. The temporary pollution control measures shall be as directed from time to time by the Engineer for the duration of the contract. The Engineer may revise and bring up to date any temporary control measures or instigate any new temporary pollution control measures found necessary as the work progresses.

B. The temporary control measures to prevent pollution of streams or other bodies of water or of the air, and to minimize damage to the work, to adjacent property, and to streams or other bodies of water, as directed by the Engineer and paid for on a force account basis, are in addition to any other measures provided for within the contract that are to be paid for as separate bid items.

C. It is expected that compliance with the requirements will necessitate performance of certain items of work at a different time or in a different manner than originally planned, causing revisions in scheduling of work that may interfere with normal construction practices.

D. Unless otherwise approved by the Engineer, the total area of erodible earth material exposed by the Contractor's operation shall not exceed 750,000 square feet before either temporary pollution control or temporary or permanent erosion control measures are accomplished.

E. Where erosion damage is probably due to the nature of the material or to the season of the year, the Contractor's operations shall be scheduled so that pollution control features will be installed concurrently with or immediately following grading operations.

F. Compliance with this section shall not relieve the Contractor from Contractor's responsibility to comply with the other provisions of the contract, except that the Contractor will be required to replace, at no additional cost to the Contracting Agency, any of the temporary pollution control work that is damaged by action of the elements.

G. All erosion control work required elsewhere in the specifications or on the plans will be paid for under the provisions for the applicable contract items of work therefor.

H. The Contractor shall coordinate temporary pollution control work, as required by the Engineer, with erosion control work specified elsewhere in the contract to ensure that

effective and continuous pollution control is maintained during the construction of the project.

I. The Contractor shall conduct operations to minimize the effects of erosion and air pollution due to the Contractor's operations upon areas within the limits of the project, haul roads, material sites, disposal sites, and upon adjacent properties, streams, and other bodies of water.

J. Mixing of the dust palliative material shall be accomplished by simultaneously placing the binder and water in the spreading equipment or by other mixing methods that will produce equivalent results.

1. The resulting mixture shall be applied with pressure type water distributor trucks equipped with a spray system, or pressure type asphalt distributors.

2. The mixture shall be applied at a total rate of approximately 1/2 gallon per square yard in 2 applications of 1/4 gallon per square yard.

3. The exact rate of application will be determined by the Engineer.

637.03.70 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) PERMIT FOR CONTRACTOR'S STAGING AREAS

A. The following applies to the Contractor's staging areas:

NDEP, Bureau of Water Pollution Control, has issued general permit NVR100000 that covers construction activities within the state of Nevada. The Contractor shall comply with the requirements of the general permit at no extra cost to the Owner. In order to be covered by the permit, the Contractor shall submit, at no extra cost to Owner, a Notice of Intent (NOI) and the required filing fee on the Internet at http://www.ndep.nv.gov/bwpc/storm_cont03.htm.

B. Upon the completion of the construction, Contractor is responsible for permanently stabilizing the staging area, filing Notice of Termination (NOT), and obtaining approval of NOT with NDEP to terminate the permit.

637.03.71 ROCK MULCH

A. Rock mulch, granite based non-organic ground cover, shall be placed 4 inches thick on all disturbed areas [outside of the detention basin] as required by NDEP final stabilization requirements for the purpose of dust control. Unless otherwise specified, rock mulch shall be one inch (1") minus from a local quarry. The Contractor shall provide with a sample of the proposed rock mulch a minimum of forty-eight (48) hours prior to start of work with any relative manufacturer's comprehensive product description, including specifications and installation instructions.

B. Final approval of product samples shall be made by the Owner and Engineer. No work shall proceed until Contractor has coordinated and received approval of the material from NDEP and provided a copy of the written approval to the Owner. Contractor shall then receive written approval from the Owner prior to proceeding with work.

C. All areas to receive rock mulch [outside of the detention basin] shall be treated with pre-emergent herbicide in accordance with the manufacturer's recommendations and approved by the Engineer.

END OF SECTION 637

DIVISION III

MATERIALS DETAILS

NOTE: Where pertinent, a "Manufacturer's Certificate of Compliance" covering materials as specified in this Division may be required and shall be furnished by the Contractor, when requested by the Engineer, at no cost to the Contracting Agency.

SECTION 701 – HYDRAULIC CEMENT

SCOPE

701.01.01 MATERIALS COVERED

A. This specification covers the types of Hydraulic cement as defined by ASTM C150, ASTM C595, and ASTM C1157. Unless otherwise provided, the cement will be used for all Hydraulic cement concrete, mortar, cement treated base, and cement treated subgrade. The type of cement used shall be as listed in Table 1 with the minimum sack requirements in ***Section 501, "Portland Cement Concrete."***

Table 6 - Types of Cement

Type of Cement Permitted
Type II & Fly Ash
Type MS & Fly Ash
Type IP (MS)
Type V
Type HS
Type V & Fly Ash
Type HS & Fly Ash

MATERIALS

701.02.01 GENERAL

A. Unless otherwise specified, the type of cement used shall be at the Contractor's option based on availability, and no additional compensation will be allowed for substitution of any type of cement for another.

B. Cement to be removed and replaced with fly ash shall be a minimum of 20 percent of the weight of cement. Fly ash added at the mixer shall be in an equal proportion to the weight of cement removed.

C. Class F fly ash conforming to the requirements of ***Section 729, "Fly Ash,"*** shall be used.

PHYSICAL PROPERTIES AND TESTS

701.03.01 REQUIREMENTS

D. Type II and Type V Portland cements shall conform to ASTM C150 except as hereinafter provided.

E. Type IP blended hydraulic cement shall conform to ASTM C595 except as hereinafter provided.

F. Pozzolan shall conform to ***Subsection 702.03.04, "Pozzolans (Fly Ash)."***

G. Additionally, Type II, Type V, and Type IP cements shall conform to ASTM C150 with the following requirements:

1. The cement shall not contain more than 0.60 percent by mass of alkalis calculated as Na20 plus 0.658 K20.

2. Type IP, MS, and HS cements that exceed the allowable alkali content may be used if mortar bars made and tested according to Subparagraph 1 above, using the proposed cement and a selected highly alkali-reactive aggregate, show no more than 0.05 percent expansion at 6 months.

END OF SECTION 701

SECTION 702 – CONCRETE CURING MATERIALS AND MIXTURES

SCOPE

702.01.01 MATERIALS COVERED

A. This specification covers concrete curing materials, air-entraining admixtures, water retardants, pozzolans, and hydrated lime. Comply with ***Section 722, "Water"*** for mixing and curing. The Contractor shall submit a request to use any one of the following for approval by the Engineer as prescribed in ***Subsection 702.03.06 "Submittal."***

PHYSICAL PROPERTIES AND TESTS

702.03.01 CURING MATERIALS

A. Curing materials shall conform to the requirements of the following tests, except the curing compound shall not react harmfully with the components of concrete or contain oils, waxes, or other materials which would prevent bonding of traffic marking paints. The film of curing compound shall be continuous, uniform, and free from pinholes, bubbles, or blisters.:

1. Burlap Cloth made from Jute or Kenaf: AASHTO M182.
2. Waterproof Paper for Curing Concrete: AASHTO M171.
3. Liquid Membrane-Forming Compounds for Curing Concrete: ASTM C309.
4. Pigmented Curing Compound for Portland Cement Concrete pavement: ASTM C309, except the loss of water from the surface in the water retention test shall not exceed 1.50 ounces per square foot in 72 hours.
5. White Pigmented Curing Compound for Bridge Decks: ASTM C309. Type 2 Class B resin type and shall be poly-alpha-methyl-styrene with the loss of water from the surface in the water retention test shall not exceed 0.50 ounce per square foot in 24 hours or more nor 1.50 ounces per square foot in 72 hours.
6. Plastic Sheeting: ASTM C171.
7. White Polyethylene Sheeting (film) for Curing Concrete: ASTM C171.

702.03.02 AIR-ENTRAINING ADMIXTURES

A. Air-entraining admixtures shall conform to ASTM C260.

702.03.03 ADMIXTURES OTHER THAN AIR-ENTRAINING

A. These admixtures shall comply with ASTM C494 and shall be clearly marked as to Type A, B, C, D, E, F, or G.

702.03.04 POZZOLANS (FLY ASH)

A. Fly Ash admixture shall conform to ***Section 729, "Fly Ash."***

702.03.05 HYDRATED LIME

A. Hydrated lime shall conform to ASTM C207, Type N.

702.03.06 SUBMITTAL

A. Curing compounds and admixtures shall be tested and certified in accordance with the Table 1 frequency.

1. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and requirements.

2. A test certificate shall be included with the certifying document.

B. The material supplier for Portland cement concrete materials, plantmix bituminous materials, or any material production that requires the use of admixtures shall attach the certificate to the mix design submittal as indicated in Table 1. All subsequent certificates shall be on file and accessible to the Engineer for audit purposes.

C. The Statute of Limitations duration for the record storage shall be as required by the Nevada Revised Statutes.

Table 1 - Quality Control Testing

Material	Certificate	Frequency
All curing materials	Sample and certification	1 per project
All admixture material	Certificate with copy of test for lot used	1 per lot

END OF SECTION 702

SECTION 704 – BASE AGGREGATES

SCOPE

704.01.01 MATERIALS COVERED

A. This specification covers the quality and size of mineral materials used in base courses, trench backfill, or other construction locations.

B. The term Source shall mean any of the following:

1. A permanent commercial location.
2. Contractor manufactured material either commercial or on-site.

704.01.02 REFERENCE CODES AND STANDARDS:

A. Related Interagency Quality Assurance Committee (IQAC) procedures at:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

(IQAC website)

REQUIREMENTS

704.02.01 GENERAL

A. The mineral aggregate shall be the crushed and screened product from approved aggregate deposits, except that Type I aggregate base need not be crushed. The Engineer reserves the right to prohibit the use of aggregates from any source when:

1. The character of the material is such, in the opinion of the Engineer, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.
2. The character of the material is such, in the opinion of the Engineer, that undue additional costs may be accrued by the Contracting Agency.

B. The mineral aggregate shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful adherent coatings. Crushed Portland cement concrete and asphaltic concrete pavement will be permitted, subject to the requirements of these specifications. No materials subject to regulation as hazardous wastes as defined in the Nevada Administrative Code 444.8565 shall be allowed.

704.02.02 IQAC SOURCE QUALIFICATION

A. For expediting of material source and type approvals, a listing of qualified materials has been provided on the IQAC website.

B. Any listed material is considered qualified for use without a material testing submittal. However, this does not relieve the Contractor of project testing of the material as required in these specifications.

C. The IQAC posted materials indicated in Table 1 are subject to reapproval annually for continued posting on the IQAC website. The procedure is annotated in ***Subsection 704.04.02, "IQAC Annual Material Prequalification."***

Table 1 – IQAC Materials that Require Annual Qualification

Type II Aggregate Base
Type II Controlled Low Strength Material (CLSM)

Table 2 – Materials that Require 6-Month Qualification

Type II blended with recycled Portland Cement Concrete

704.02.03 DEFICIENCIES

A. If the product of a deposit is deficient in material passing the No. 16 sieve, filler from other approved deposits may be added at the crushing and screening plants. This is not to be construed as a waiver of any of the requirements contained herein.

PHYSICAL PROPERTIES AND TESTS

704.03.01 PLASTIC LIMITS

A. When specified, aggregates shall conform to the applicable requirements of the following table:

Table 3 – Plastic Limits

Percentage by Weight Passing 200 Sieve	Plasticity Index Maximum
0.1 to 3.0	15
3.1 to 4.0	12
4.1 to 5.0	9
5.1 to 8.0	6
8.1 to 11.0	4
11.1 to 15.0	3

704.03.02 DRAIN BACKFILL

A. This aggregate shall conform to the following requirements:

Table 4 – Drain Rock Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve		
	3-Inch Size	2-Inch Size	3/4-Inch Size
3-Inch	100	--	--
2-Inch	90-100	100	--
1-1/2-Inch	70-100	95-100	--
3/4-Inch	0-50	50-100	100
1/2-Inch	--	--	95-100
3/8-Inch	0-10	0-55	70-100
No. 4	--	0-25	0-70
No. 8	0-5	0-15	--
No. 200	0-3	0-3	0-3

B. Unless otherwise specified in the contract documents, the Contractor may use any of the sizes.

Table 5 – Drain Backfill Durability Acceptance Limits

Source Requirement Test	3-Inch Size	2-Inch Size	3/4-Inch Size
Percentage of Wear (500 Rev.)	45% Maximum	45% Maximum	45% Maximum

704.03.03 TYPE I AGGREGATE BASE

A. This aggregate shall conform to the following requirements:

Table 6 – Type I Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve	
	3-Inch Size	2-Inch Size
3-Inch	100	--
2-Inch	90-100	100
1-1/2-Inch	--	95-100
1-Inch	--	70-90
No. 4	30-65	30-65
No. 16	15-40	15-40
No. 200	2-12	2-12

Table 7 – Type I Acceptance Limits

Project Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 6
Sampling Aggregate from Calibrated Conveyor stream or belt cut[1]	AASHTO T2	--
Plasticity Index	AASHTO T90[2]	Table 3
Liquid Limit	AASHTO T89	35 Maximum
Resistance (R Value)	ASTM D2844	60 Minimum
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum

704.03.04 TYPE II AGGREGATE BASE

A. This aggregate shall conform to the following requirements:

Table 8 – Type II Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	90-100
No. 4	35-65

[1] Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.

[2] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

Table 8 – Type II Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
No. 16	15-40
No. 200	2-10

Table 9 – Type II Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream or belt cut[3]	AASHTO T2	--
Fractured Faces	Nev. T230	70% Minimum
Plasticity Index	AASHTO T90[4]	Table 3
Liquid Limit	AASHTO T89	35 Maximum
Resistance (R Value) or Resilient Modulus	ASTM D2844	78 Minimum for road base
	AASHTO T307	35,000 psi minimum for road base
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum
Total Available Water Soluble Sulfates[5]	ASTM D2791 AWWA 4550 E	Less than 0.3% by dry weight of soil.

B. BLANK

704.03.05 TYPE III AGGREGATE

A. The soluble sulfate content shall not exceed 0.3 percent by dry weight of soil. The mineral shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful coatings. In addition thereto, the material shall conform to the gradation requirements of Type II aggregate base in accordance with ***Subsection 704.03.04, "Type II Aggregate Base,"*** with the following property testing:

Table 10 – Type III Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream of belt cut[6]	AASHTO T2	--
Plasticity Index	AASHTO T 90[7]	Table 3
Liquid Limit	AASHTO T 89	35 Maximum

[3] Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.
[4] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.
[5] Required only for placement around waterline pipe.
[6] Sampling from a stockpile permitted only after approval of the Engineer.
[7] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

Table 10 – Type III Acceptance Limits

Quality Control Test	Test Method	Requirements
No. 200 Sieve	AASHTO T 27	2-15%
Total Available Water Soluble Sulfates[8]	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

704.03.06 CRUSHED ROCK

A. Crushed rock shall be the product from approved aggregate deposits and shall only be used as directed by the Contracting Agency. The mineral aggregate shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful coatings. In addition thereto, the material shall conform to the following gradation requirements:

Table 11 – Crushed Rock Gradation Acceptance Limits

Sieve Sizes	Percentage of Weight Passing
3/8-Inch	100
No. 4	20-80
No. 200	0-15

Table 12 – Crushed Rock Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T 27	Table 11
Sampling Aggregate From Calibrated Conveyor stream of belt cut[9]	AASHTO T 2	----------
Fractured Faces	Nev. T 230	90% Minimum
Plasticity Index	AASHTO T 90[10]	Table 3
Liquid Limit	AASHTO T 89	35 Maximum
Percentage of Wear (500 Rev.)	AASHTO T 96	45% Maximum
Total Available Water Soluble Sulfates[11]	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

704.03.07 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. CLSM shall consist of a low-strength, self-leveling concrete material composed of various combinations of cement, fly ash, aggregate, water, and chemical admixtures. CLSM shall have a design compressive strength at an age of 28 days within the ranges required below for the specified class:

1. Class I - (20 to 150 psi): Specified where the maximum strength is of primary concern due to the desire to have material that can be excavated in the future with relative ease.

---

[8] Required only for placement around waterline pipe.
[9] Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.
[10] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.
[11] Required only for placement around waterline pipe.

2. Class II – (100 to 300 psi): Specified where the minimum strength is of primary concern for pipe support.

3. Class Special (as shown in project specifications or drawings): Specified where project unique criteria, such as erosion control, are the primary concern.

4. Class I and Class II CLSM:

   a. The mix shall result in a product having a slump in the range of 6 to 10 inches at the time of placement in the pipe zone. Above the pipe zone, a lesser slump is acceptable.

   b. The Source of Contractor shall submit a mix design for approval by the Engineer prior to placement.

   c. The mix design shall be supported by laboratory test data verifying the potential of the mix to comply with the requirements for these specifications.

5. Class III – Bonded Aggregate Fill (BAF) (20 to 150 psi): Specified where the maximum strength is of primary concern due to the desire to have material that can be excavated in the future with relative ease, and where reduced concrete cure time is desired.

B. CLSM Class I and Class II shall be proportioned in general compliance with the methods outlined in ACI 211.1-91, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete." The product shall be proportioned and mixed in a central plant or mobile mixer. The following materials shall be used:

1. Cement shall meet the requirements of ***Section 701, "Hydraulic Cement."*** Type V cement shall be used unless otherwise specified.

2. Fly ash shall meet the requirements of ***Section 729, "Fly Ash."*** Fly ash not meeting the requirements of **Section 729, "Fly Ash,"** may be used if prior testing indicates to the satisfaction of the Engineer the ability of the CLSM with this fly ash to meet these specifications.

3. Water shall meet the requirements of ***Section 722, "Water."***

4. Aggregates shall be well graded, having 100 percent by total weight passing the 1 inch screen and no less than 6 percent passing the No. 200 sieve. The aggregate shall meet the plastic limits requirements of ***Subsection 704.03.01, "Plastic Limits."***

5. Chemical admixtures shall meet the requirements of ***Subsection 702.03.02, "Air-Entraining Admixtures,"*** and ***Subsection 702.03.03, "Admixtures Other Than Air-Entraining."***

   a. Other admixtures specifically approved for CLSM may be used.

   b. All materials proportions shall be measured and the CLSM mixed in accordance with ***Section 501, "Portland Cement Concrete."***

   c. Other proportion measuring and CLSM mixing systems are acceptable, if control can be demonstrated to be satisfactory to the Engineer.

   d. These other methods include continuous feed, volumetric measurement of proportions, and pug mill and continuous mixing plants.

C. If the CLSM Class I and Class II mixes do not produce a flowable consistency or exhibits excessive bleeding, the mix shall be adjusted.

1. Excessive bleeding is considered to occur when water flows from the CLSM in a manner that causes disturbance or displacement of the exposed surface of the CLSM.

2. Mix adjustments shall include, but not be limited to: aggregate gradation, cementitious material content, admixtures, water content, or a combination of adjustments.

D. The testing procedures of CLSM Class I and Class II for acceptance testing and mix design approval by the IQAC, or if required in the contract special provisions shall be as follows:

1. The material Source, which may be the Contractor, shall cast specimen molds using ASTM D4832 “Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM Test Cylinders.” The type of molds shall be as stated below.

a. Section 6.1 other sizes and type

1) Grout Sample Box must meet ASTM C1019, Note 6 and the following:

a) A Grout Sample Box that has a minimum absorption rate of 1.30% or that both the QA and QC laboratories have the same absorption with a tolerance of 0.2.

b) Creates four specimens with nominal dimension of 3”x3”x6”.

2) The QA and QC must agree in a pre-activity meeting which vendor of grout sample box will be used for the casting mold to comply with Note 6 in ASTM C1019 for proper comparisons.

2. Sampling shall be in accordance with ASTM D4832.

3. The cast specimens shall not be laboratory-cured in a concrete cure room (cure tanks shall not be used). The samples must be cured at the ambient temperature of the laboratory at a range between 65º and 85º degrees F.

4. Compressive strength testing shall be performed in accordance with AASHTO T22 and T23 with samples from each set at the ages of 14and 28 days.

5. A report of the results shall be submitted to the Engineer.

E. Class Special: The compressive strength testing procedures shall be as specified in the project specifications or on the project drawings.

F. **Class III - Bonded Aggregate Fill (BAF):**

1. The material Source shall have it designed under the responsible charge of a Nevada PE, and the mix shall consist of a gap-graded 1/2-inch maximum nominal size crushed gravel. The cementitious material shall be Type V cement and/or fly ash and water for a flowable type consistency.

2. The material shall be plant mixed and placed from a truck or may be placed directly from a continuous feed mobile mixer approved by the Engineer.

3. Due to the gap-graded nature of the material, it shall not be used where water drainage is an issue unless wrapped in an approved geotechnical filter fabric, and in all trench installations shall conform to ***Subsection 208.03.16, "Drain Backfill."***

4. This material does not require concrete cylinder break testing; however, it does require a visual inspection and shall be documented in a report to the Engineer summarizing the inspection to be performed as follows:

   a. After the first batch is placed and initially cured, excavate to the bottom of the pipe or structure.

   b. If a self-supporting vertical face is maintained, the material is functioning properly.

704.03.08 AGGREGATE FOR PORTLAND CEMENT TREATED BASE

A. This aggregate shall conform to the following requirements:

Table 13 – Portland Cement Treated Base Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
3-Inch	100
2-Inch	90-100
No. 4	35-75
No. 200	20

Table 14 – Portland Cement Treated Base Acceptance Limits

Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 13
Sampling Aggregate from Calibrated Conveyor stream or belt cut[12]	AASHTO T2	1/1000 Tons per day or portion thereof
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum

B. Aggregate for cement or lime treated bases will be sampled as follows:

1. Where the material is being mixed at a stationary plant, samples will be taken from the conveyors just prior to delivery to the mixer and prior to adding lime or cement.

2. Where material is being mixed on the roadbed, samples will be taken after the material has been placed on the roadbed and processed and prior to adding cement or lime.

704.03.09 SHOULDERING MATERIAL

A. This aggregate shall conform to the following requirements:

Table 15 – Shouldering Material Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	90-100

[12] Sampling from a stockpile permitted only after approval of the Engineer. The conveyor device shall be calibrated every 3 months and record attached to sample document.

No. 4	35-65
No. 16	15-40
No. 200	2-6

704.03.10 AGGREGATE BASE MATERIAL WITH RECYCLED ASPHALT PAVEMENT (RAP) AND CONCRETE

A. The use of recycled asphalt pavement or recycled concrete for Type II Aggregate Base is permitted with the following requirements:

1. The material must conform to the requirements of ***Subsection 704.03.04 "Type II Aggregate Base***

2. The maximum ratio of crushed concrete to Type II Aggregate Base is 50%. Recycled materials must be substantially free of foreign matter including but not limited to asphalt, base, dirt, reinforcing steel, and have at most 1.5% deleterious material.

3. The maximum ratio of the crushed recycled asphalt concrete pavement (RAP) to Type II Aggregate Base is 30%. The mean oil content shall be 1.2% with a +0.3% tolerance. The Total Oil Content of the blended material (virgin aggregate and RAP) shall not exceed 1.5%.

B. The maximum qualification period is six (6) months for aggregate base materials blended with recycled aggregates. The entire qualification process must be completed prior to the first day of April and the first day of October of each calendar year. The report format, as outlined in ***Subsection 704.04.05 "Report Format"*** shall include the sieve analysis for RAP or recycled concrete stockpile, Blended aggregated, the RAP binder content and blended binder content.

SOURCE QUALITY CONTROL TESTING

704.04.01 GENERAL

A. There are 2 testing aspects to Source material acceptance.

1. Testing by the Source for annual posting on the IQAC website of qualified materials.

2. Contractor project quality control Source testing for non-qualified materials.

B. The acceptance of the Source material shall be at the production plant while the acceptance of the Contractor-placed material is at the project site.

C. Any laboratory submitting to an agency shall be R-18 AASHTO accredited in the appropriate test method in accordance with Table 16, "Source Quality Control Testing Requirements," where applicable and testing reviewed and stamped by a Nevada professional engineer who has responsible charge of the work. The use of a professional engineer by the Source could be the Source staff engineer or third party, but the professional engineer must have responsible charge of the testing and/or inspection.

704.04.02 IQAC ANNUAL MATERIAL PREQUALIFICATION

A. Each individual location or "pit" shall be referred to as a "Source." The responsibility for testing and inspection is the material Source. Material shall be tested, inspected, and

certified in accordance with Table 16 "Source Quality Control Testing Requirements." The Source shall submit to the IQAC agency engineer assigned for that Source. The reviewing agency is listed on the IQAC website page next to the Source material.

B. Test data shall be included with the certifying document.

C. The maximum qualification period is 1 year, or 6 months for aggregate blended with crushed concrete. The entire qualification process shall be completed, in accordance with the sections above, prior to the first day of April, or for aggregates blended with crushed concrete, the first day of April and the first day of October of each year. This includes, but is not limited to, submittal, agency review, all required retesting, and qualification from the IQAC member.

704.04.03 NON-PREQUALIFIED MATERIALS

A. If the material is not posted on the IQAC web page, the Source may elect to submit non-prequalified material to the Engineer for approval prior to use that complies with the above noted specification and shall have been tested within 60 days of the intended use.

704.04.04 SUBMITTAL

A. All tests specified in this section shall be performed.

1. The report(s) shall include any graphical representation of plotted data such as the R-value or the Proctor value(s) along with the pit name and location.

2. The most current ASTM, AASHTO, NDOT, and AWWA methods shall be used when performing the tests.

B. All samples shall be "cut" from the "belt." When circumstances do not allow for sampling during production, the Source shall coordinate with the Engineer to identify an alternative plan for sampling.

C. <u>IQAC Annual Submittal</u>

1. For the purposes of IQAC submittal, the Engineer is the IQAC reviewing agency as noted on the IQAC web page.

2. For the annual submittal by the supplier, the material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.

3. The Engineer shall be notified a minimum of 48 hours prior to obtaining the sample.

4. If the Engineer is not present during the sampling of the material, the results for that sample will not be accepted.

5. Sampling shall be performed during normal working hours for the Engineer.

6. If the Source laboratory results are in compliance with the above noted specifications, Source shall submit the test report to the Engineer within 21 days of sampling requesting the review and approval of the materials for the proposed use of the material.

7. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required. Samples without notification or a

qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.

8. The agency Engineer for a particular pit may accommodate minor adjustments for "tuning" of an operation. This courtesy shall not be extended during the qualification process.

D. Non-prequalified materials (materials not posted on the IQAC list)

1. The material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.

a. The Engineer shall be notified a minimum of 48 hours prior to obtaining the sample.

b. If the Engineer is not present during the sampling of the material, the results for that sample will not be accepted.

c. Sampling shall be performed during normal working hours for the Engineer.

d. If the Source laboratory results are in compliance with the above noted specifications, the Source shall submit the test report to the Engineer within 21 days of sampling with a letter requesting the review and approval of the materials report for the proposed use of the material.

2. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required.

a. Samples without notification or a qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.

b. The Source shall submit the material test report to the Engineer no earlier than 60 days and no later than 14 days prior to use.

3. The qualification is for one project only.

704.04.05 REPORT FORMAT

A. The report shall be prepared and stamped by, or under the direction of, a professional engineer registered in the state of Nevada. The report shall be on the standard IQAC[13] form and shall include the pit name and location. The report shall include the following:

1. Recommendation by the Source Professional Engineer.

2. The testing results in accordance with the appropriate Table 16, "Source Quality Control Testing Requirements," test methods and reporting requirements, along with any graphs and charts.

B. When "no exceptions" are taken, a conditional posting on the web site will be provided by the IQAC within 10 days of the receipt of the submittal.

[13] The form is on the IQAC website, or use an Agency approved form.

C. Discrepancies between test results will be reviewed on a case-by-case basis. The Engineer will notify the aggregate producer of substantial test variations within 10 days of receipt of the qualification submittal.

704.04.06 SAMPLING AND TESTING

A. When the Contractor/Material Source or Engineer acquires aggregate samples at an aggregate production plant, the plant shall provide a calibrated mechanical means for obtaining samples.

1. If a mechanical means is not provided, a belt cut from a stopped conveyor will be required.
2. Any mechanical sampling device shall be approved by the Engineer prior to starting the respective phase of the project, or shall have been approved as part of a prior plant inspection by the Engineer or the Engineer's representative.
3. The sampling device shall be so constructed to provide for simultaneous "cutting" of the entire section of material being discharged or conveyed, and so constructed that small representative samples may be taken frequently and these samples combined to form the complete sample.
4. The reference method for the mechanical procedure shall be a "belt cut" sample taken from a stopped conveyor belt.
5. Samples of the finished product of the plant shall be obtained prior to or as the material leaves the conveyor belt for the bin or stockpile.

B. Test results run from samples taken will be furnished to the Engineer by the Contractor or the Contractor's representative. The results of such tests shall not be the basis for final acceptance of the material.

C. Sampling for final acceptance of materials will be as required in the appropriate USS sections and in general shall comply with the AASHTO requirements, where applicable, and with any exception to the method(s) listed on the IQAC website.

Table 16 – Source Quality Control Testing Requirements[14]

Spec Section	Description	Item	Reference Specification and/or Test Procedure	Frequency
704.03.02, 704.03.03, 704.03.04, 704.03.08	Drain Rock	Submittal	IQAC and/or Agency Requirements	Annually for IQAC Source Approval OR per project
	Type I, Type II Aggregate	Sampling from calibrated conveyor stream or belt cut	AASHTO T2	1/day at plant
	Cement treated base	Sieve Analysis	AASHTO T11 & T27	1/day at plant
		Percentage of Wear (500 Rev.)	AASHTO T96	Annually for Source Approval OR per project

[14] Review the IQAC website for any exceptions to the listed test methods.

Table 16 – Source Quality Control Testing Requirements[14]

Spec Section	Description	Item	Reference Specification and/or Test Procedure	Frequency
704.03.04*, *704.03.05*, *704.03.06	Drain rock, Type II, and Type III aggregate around water pipe	Total Available Water Soluble Sulfates[15]	AWWA 3500-NaD AWWA 4550 E	1/month at plant
704.03.03*, *704.03.04	Type I and Type II Aggregate	Plasticity Index	AASHTO T90[16]	1/day at plant
		Liquid Limit	AASHTO T89	1/day at plant
		Resistance (R Value) or Resilient Modulus	ASTM D2844	Annually for IQAC Source Qualification OR per project
			AASHTO T307	Annually for IQAC Source Qualification OR per project
704.03.07	CLSM Class I & II	Mix Design	***USS* *704.03.07***	Annually for IQAC Source Qualification OR per project
		Compressive Strength	***USS* *208.02.07*** & AASHTO T22, T23	Annually for IQAC Source Qualification OR per project
	CLSM Class III-BAF	Visual Inspection Report	**USS 208.02.07 Split cylinders**	Annually for IQAC Source Qualification OR per project

END OF SECTION 704

[15] Required only for placement around waterline pipe.
[16] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

SECTION 706 – AGGREGATES FOR PORTLAND CEMENT PRODUCTS

SCOPE

706.01.01 MATERIALS COVERED

A. This specification covers the quality and size of aggregates used in Portland cement products.

REQUIREMENTS

706.02.01 GENERAL

A. The mineral aggregate shall be the product of approved deposits. The Engineer reserves the right to prohibit the use of aggregates from any source when:

1. The character of the material is such, in the opinion of the Engineer, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.
2. The character of the material is such that, in the opinion of the Engineer, undue additional costs may be accrued by the Contracting Agency.
3. The mobile mixer shall use aggregate from an approved source. Each mixer shall not change source product without a new mix design. The certificate of the source shall include the appropriate test data.
4. The testing type and frequency shall conform to the tables on the Clark County IQAC website page: http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

B. For mix design approval, the proposed proportions of coarse, intermediate, and fine aggregate, combined mathematically by volume or mass, shall produce a mixture within the grading limits for combined aggregates as shown in Table 1 (not applicable to lightweight concrete):

Table 7 - Grading Limits of Combined Aggregates

Sieve Size	Percentage Passing				
	1-1/2-inch Max.	1-inch Max	3/4-inch Max.	1/2-inch Max	3/8-inch Max.
2-inch	100	--	--	-	-
1-1/2-inch	87-100	100	--	-	-
1-inch	65-90	97-100	100	-	-
3/4-inch	48-82	70-100	80-100	100	-
1/2-inch	--	--	--	90-100	100
3/8-inch	39-57	43-70	46-70	70-90	70-100
No. 4	30-45	32-48	34-50	45-60	47-70
No. 8	23-38	23-42	24-42	38-56	34-55
No. 16	15-33	15-34	17-34	24-38	23-43
No. 30	8-24	8-25	10-25	13-27	15-33
No. 50	4-13	4-15	5-15	7-17	7-20

Table 7 - Grading Limits of Combined Aggregates

Sieve Size	Percentage Passing				
	1-1/2-inch Max.	1-inch Max	3/4-inch Max.	1/2-inch Max	3/8-inch Max.
No. 100	1-5	2-7	2-7	0-6	2-8
No. 200	0-5	0-5	0-5	0-5	0-5

C. If the Contractor prefers a finer gradation for the purpose of slip-form operations, the following gradation is permitted with approval of the Engineer.

Table 8 - Gradation for Slip-Form Operations

Sieve Size	Percentage Passing	
	1-1/2-inch Max.	3/4-inch Max.
2-inch	100	--
1 1/2-inch	87-100	--
1-inch	65-97	100
3/4-inch	48-91	80-100
1/2-inch	--	--
3/8-inch	39-70	46-74
No. 4	30-54	34-54
No. 8	23-38	24-50
No. 16	15-33	17-38
No. 30	8-24	10-29
No. 50	4-13	5-19
No. 100	1-5	2-9
No. 200	0-5	0-5

D. If the Contractor proposes to use an admixture other than an air-entraining agent, Contractor shall state the complete brand name and the quantity proposed to be used per sack of cement.

E. Should the Contractor change Contractor's source of supply, Contractor shall submit in writing to the Engineer the new gradation before their intended use.

F. In addition to the coarse, intermediate, and fine aggregates meeting the individual source requirements, the combined gradation shall meet the following source requirement:

Table 9 - Alkali-Silica Reaction

Source Requirement Test, Combined Aggregates	Test Method	Requirement
Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction	AASHTO T303	0.10% Max. Expansion[1]

G. Previous AASHTO T303 qualified aggregates for concrete mix designs will not automatically qualify for approval. Submit new AASHTO T303 test results with concrete mix design.

[1] This requirement applies to all aggregate used in the concrete bridge structures, including approach slabs, reinforced concrete boxes, walkways, or sidewalks on the bridge structure itself, and all concrete bridge rail.

H. Perform this test on the coarse, intermediate, and fine aggregates together, combined in the same proportions as the proposed mix design.

1. The test may be performed on each size separately and the results combined mathematically.

2. Perform the test using the proposed sources together with proposed job cement and job pozzolan or other admixture, if used.

3. The pozzolan and silica fume quantities will be considered as cement in meeting the requirements of cement in Table 2 of ***Subsection 501.03.04, "Classification and Proportions."***

I. Prior to mix design approval, the Contracting Agency reserves the right to verify the AASHTO T303 test results, using the sources and proportions of materials as indicated by the mix design.

J. Conduct another test upon changes in source of cementitious materials, including fly ash, or changes in cement type or mitigating admixture suppliers.

PHYSICAL PROPERTIES AND TESTS

706.03.01 COARSE AGGREGATE

A. The aggregate shall conform to the following table requirements:

Table 4 - Percentage by Weight Passing Sieve

Sieve Size	Size No. 3 2-inch to 1-inch	Size No. 4 1-1/2-inch to 3/4-inch	Size No. 7 1/2-inch to No. 4	Size No. 57 1-inch to No. 4	Size No. 67 3/4-inch to No. 4	Size No. 357 2-inch to No. 4	Size No. 467 1-1/2-inch to No. 4
2-1/2-inch	100	--	--	--	--	100	--
2-inch	95-100	100	--	--	--	95-100	100
1-1/2-inch	35-70	90-100	--	100	--	--	95-100
1-inch	0-15	20-55	--	95-100	100	35-70	--
3/4-inch	--	0-15	100	--	90-100	--	35-70
1/2-inch	0-5	--	90-100	25-60	--	10-30	--
3/8-inch	--	0-5	40-70	--	20-55	--	10-30
No. 4	--	--	0-15*	0-10*	0-10*	0-5	0-5

*Not more than 5 percent shall pass No. 8 Sieve.

NOTE: Sizes No. 357 and No. 467 shall each be split into 2 sizes. Size No. 357 shall be furnished in stockpile or bunker in Sizes No. 3 (2-inch to 1-inch) and Size No. 57 (1-inch to No. 4.) Size No. 467 shall be furnished in stockpile or bunker in Size No. 4 (1-1/2-inch to 3/4-inch) and Size No. 67 (3/4-inch to No. 4). The two sizes shall be uniformly combined at the mixing plant to comply with the grading requirements of Sizes No. 357 and No. 467 respectively.

Table 5 - Coarse Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	--
Material Passing 200 Sieve	AASHTO T27	1% Maximum

Table 5 - Coarse Aggregate Properties

Tests	Test Method	Requirements
Percentage of Wear (100 Rev.)	ASTM C131	10% Maximum
Percentage of Wear (500 Rev.)	ASTM C131	50% Maximum
Soundness (5 Alternations) (sodium sulfate)	AASHTO T104	9% Maximum Loss
Cleanness Value min.	CALIF 227	71 ***706.03.01.B.1***
Clay Lumps	AASHTO T112	1% Maximum
Potential Reactivity	AASHTO T303	Innocuous ***706.03.01.B.2***

B. Thin or elongated pieces (length greater than 5 times maximum thickness) shall not exceed 15 percent by weight.

1. When 2 or more stockpiles are to be combined, each stockpile shall have a cleanness value of at least 65 with a minimum combined cleanness value of 71 calculated by the percent of material used from each stockpile.

2. If the material from a proposed source fails this test requirement, the material may still be used for concrete aggregate provided that it is incorporated in an approved mix design with an approved Type F or Type N Pozzolan, or with a Type IP cement.

C. If a pozzolan is used for this purpose, use 1 part pozzolan to 4 parts of cement by mass. The pozzolan quantity shall be considered as cement in meeting the required minimum cement content. If a Type IP cement is used for this purpose, the use of pozzolan is not required.

706.03.02 LIGHTWEIGHT AGGREGATES

A. These aggregates shall conform to the following requirements:

Table 6 - Lightweight Aggregate Gradation

	Percentage of Weight Passing Sieve			
Sieve Size	**Fine Natural**	**Fine Lightweight**	**1-inch Size Coarse**	**3/4-inch Size Coarse**
1-inch	--	--	95-100	100
3/4-inch	--	--	--	90-100
1/2-inch	--	--	25-60	--
3/8-inch	100	100	--	20-60
No. 4	95-100	85-100	0-10	0-10
No. 16	45-80	40-80	--	--
No. 50	10-35	10-35	--	--
No. 100	2-12	5-25	--	--
No. 200	0-5	--	--	--

Table 7 - Lightweight Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above ***706.03.02.A.1*** below
Sampling	ASTM D75	--
Unit Weight (loose oven dry) Fine Aggregate 70 lb/ft^3	Nev. T487	Maximum ***706.03.02.A.2*** below
Unit Weight (loose oven dry) Coarse Aggregate 55 lb/ft^3		
Unit Weight (loose oven dry) Combined Fine and Coarse Aggregate 65 lb/ft^3		
Organic Impurities	ASTM C40	Satisfactory ***706.03.02.A.3*** below
Clay Lumps	AASHTO T112	2.0% Maximum
Test for Staining Materials	ASTM D330	Satisfactory ***706.03.02.A.4*** below
Mortar Making Properties of Sand	ASTM C87	95% Minimum ***706.03.02.A.5*** below

1. With the following exceptions: The weight of the test sample for the fine lightweight aggregate shall be in accordance with Table 8, and the aggregate when mechanically sieved shall be sieved for only 5 minutes. The test sample for coarse aggregate shall consist of no less than 0.1 cubic foot of the material used for the determination of unit weight.

Table 8 - Weight of Sieve Test Sample for Fine Lightweight Aggregates

Nominal Weight of Aggregate		Weight of Test Sample	
(lbs/ft^3)	kg/m^3	Grams	Oz.
25-35	401-561	150	5.3
35-45	561-721	200	7.0
45-55	721-881	250	8.8
55-65	881-1042	300	10.6
65-70	1042-1122	350	12.3

2. The unit weight of successive shipments of lightweight aggregate shall not differ by more than 10 percent from that of the sample submitted for acceptance tests.

3. Aggregates tested and showing color darker than the standard shall be rejected unless it can be demonstrated that the discoloration is due to small quantities of materials not harmful to the concrete.

4. Aggregates tested and showing stain darker than "heavy stain" (stain index of 80) shall be tested by chemical procedure, and aggregates that contain 1.5 mg or more of ferric oxide (Fe_2O_3) per 200 gram sample shall be rejected for use.

5. Fine Aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

706.03.03 FINE AGGREGATE

A. This aggregate shall conform to the following requirements:

Table 9 - Fine Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
3/8-inch	100
No. 4	95-100
No. 16	45-80
No. 50	10-35
No. 100	2-12
No. 200	0-5

Table 10 - Fine Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	--
Soundness (5 alternations) (sodium sulfate)	AASHTO T104	10% Maximum Loss
Clay Lumps	AASHTO T112	1.0% Maximum
Lightweight Pieces in Aggregate (less than 2.0 sp. gr.)	AASHTO T113	1.0% Maximum
Organic Impurities	ASTM C40	Satisfactory ***706.03.03.A.2*** below
Mortar Making Properties	ASTM C87	95% Minimum ***706.03.03.A.1*** below

1. Aggregates tested and showing color darker than the standard shall be rejected unless they pass the mortar making properties test in accordance with ASTM C87.

2. Fine aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength of 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

3. If the material from a proposed source fails this test requirement, the material may still be used for concrete aggregate provided that it is incorporated in an approved mix design with an approved Type F or Type N Pozzolan, or with a Type IP cement.

    a. If a pozzolan is used for this purpose, use 1 part pozzolan to 4 parts of cement by mass.

    b. The pozzolan quantity shall be considered as cement in meeting the required minimum cement content.

    c. The limitation on replacement of cement with pozzolans at a minimum of 20 percent in ***Subsection 501.02.03, "Admixtures,"*** is hereby waived to meet this requirement.

    d. If a Type IP cement is used for this purpose, the use of pozzolan is not required.

706.03.04 GROUT AND MORTAR SAND

A. This aggregate shall conform to the following requirements:

B. Sand for grout and mortar shall conform to the size requirements of ***Subsection 706.03.03, "Fine Aggregate,"*** except if the Contractor elects, Contractor may screen the sand over a No. 8 screen to produce the following:

Table 11 - Grout Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
No. 8	100
No. 50	15-40
No. 100	0-10
No. 200	0-5

Table 12 - Grout Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	-----
Organic Impurities	ASTM C40	Satisfactory ***706.03.04.B.2***
Mortar Making Properties	ASTM C87	95% Minimum ***706.03.04.B.1***

1. Aggregates tested and showing color darker than the standard shall be rejected unless they pass the mortar making properties test in accordance with ASTM C87.

2. Fine aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

706.03.05 RIPRAP GROUT

A. The mix design for the placing requirements addresses 2 placement methods:

1. Direct discharge from the transit mixer.

2. Placement by small diameter line pumping methods.

B. Two typical mixtures that would meet the above minimum requirements are as follows:

Table 13 - Proportions for 1.0 Cubic Yard of Grout

	Pump Method Approx. Volume (Cu. Ft.)	Transit Mixer Discharge Approx. Volume (Cu. Ft.)
Pea Gravel	3.5	7.6
Washed Concrete Sand	10.6	7.6
Water	6.5	5.9
Type V cement	3.5	3.1

Table 13 - Proportions for 1.0 Cubic Yard of Grout

	Pump Method Approx. Volume (Cu. Ft.)	Transit Mixer Discharge Approx. Volume (Cu. Ft.)
Fly Ash class F	1.6	1.4
Balance Air	1.3	1.4

C. Factors which shall be considered for a given grout mix are:

1. Fine and coarse aggregates.
2. Consistency.
3. Elapse time between placement and initial set.
4. Length of time between batching and placement during which continuous or intermittent mixing is required.

D. Materials used in the production of riprap grout shall meet the minimum following material standards:

1. Fine and Coarse Aggregate: ASTM C33; ***Section 206, "Structure Excavation."***
2. Portland Cement: ASTM C150, Type V; ***Section 701, "Hydraulic Cement."***
3. Fly Ash: ASTM C618; ***Section 729, "Fly Ash."***
4. Water: ***Section 722, "Water."***
5. Air Entraining Admixture: ASTM C260; ***Section 702, "Concrete Curing Materials and Admixtures."***

E. A trial batch shall be placed for review by the Engineer for final approval for the project.

F. The Engineer shall be provided with a legible ticket with each load of grout delivered to the project site which shall contain the following information:

1. Name of Vendor.
2. Name of Contractor.
3. Number of Cubic Yards in the Load.
4. Actual Weights of Cement and of each Size of Aggregate.
5. Amount of Water Added at the Plant.
6. Amount of Water in the Aggregate.
7. Brand and Type of Cement.
8. Brand and Amount of Admixture.
9. Time and Date of Batching.

END OF SECTION 706

SECTION 707 – JOINT MATERIAL

SCOPE

707.01.01 MATERIALS COVERED

A. This specification covers the quality requirements for poured filler, preformed fillers, and resilient and rubber type gaskets used in the construction of bridges, culverts, sidewalks, and so forth.

PHYSICAL PROPERTIES AND TESTS

707.03.01 JOINTS

A. Materials for joints in concrete structures shall comply with provisions specified below.

707.03.02 POURABLE JOINT SEALER

A. The materials specified in this subsection shall be supplied and installed in weakened plane joints, contraction joints, and construction joints when required by the Engineer and as shown on the drawings.

B. Joint Sealant:

1. 2-component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV).
2. Sealant shall be able to expand and compress plus or minus 25 percent movement as the joint opens and closes.
3. Sealant shall be self-leveling for flat surfaces and non-sagging for sloped and vertical joints.
4. Sealant shall meet or exceed requirements of Table 1 below.

Table 1 - Minimum Requirements for Pourable Joint Sealer

Material Characteristics	Self-Leveling	Non-Sagging
Application Temperature	40 to 100 degrees F	40 to 100 degrees F
Service Range	-40 to 170 degrees F	-40 to 170 degrees F
Curing Rate	Tack-free Time: 1-2 hours Final Cure: 3-5 days	Tack-free Time: 6-8 hours Final Cure: 3 days
Tear Strength (ASTM D624)	--	45 lbs/in
Shore A Hardness (ASTM D2240)	45 ±5 (21-day)	25 ±5
Tensile Properties (ASTM D412):		
Tensile Strength	550 psi (21-day)	120 psi (at break)
Elongation	700% (at break)	500%
Modulus of Elasticity (100%)	150 psi	70 psi
Adhesion in Peel, Concrete Substrate (Fed Spec TT-00227E):		
Peel Strength	>30 pounds	25 pounds
% Adhesion Loss	0%	0%

C. No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

D. Each container shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use.

E. The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the 2 components and extrudes the mixed material into the joint.

1. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed.

2. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

F. Primer:

1. Special material furnished by the manufacturer of the sealant to improve bond of polyurethane sealant to concrete.

2. Primer shall be applied to the sides of the groove and to all exposed vertical surfaces in the joint prior to placing the polyurethane sealant.

3. The primer shall be dry prior to placing the sealant.

4. Contaminated primer shall be removed and replaced.

707.03.03 CHANNEL EXPANSION JOINT (1-INCH OR LESS)

A. The materials specified in this subsection shall be supplied and installed in expansion joints with widths 1-inch or less designed for channels included in Clark County Regional Flood Control District's Master Plan.

B. Joint Sealant:

1. 2-component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV).

2. Sealant shall be able to withstand up to plus or minus 25 percent movement.

3. Sealant shall be self-leveling for flat surfaces and non-sagging for slopes.

4. The sealant shall meet or exceed requirements of Table 1 in ***Subsection 707.03.02, "Pourable Joint Sealer."***

C. No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

D. Each container shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use.

E. The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the 2 components and extrudes the mixed material into the joint.

1. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed.

2. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

F. Joint Filler: Preformed, ASTM D1752, Type I (sponge rubber) or inert, preformed, closed cell, polypropylene material.

G. Bond Breaker Tape:

1. Adhesive backed polyethylene tape meeting or exceeding the following:

a. Adhesive Strength: 35 ounces/inch width.

b. Tensile Strength: 20 pounds./inch width.

c. Mil thickness: 14.

2. Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs.

3. In joints that have considerable width variation, 1 tape may be lapped over another to accomplish total backside coverage.

4. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

H. Backer Rod:

1. Non-absorbent expanded, closed cell polyethylene foam.

2. The backer rod shall be approximately 25 percent larger in diameter than the width of the joint to be sealed.

3. Other back-up materials (paper, rope and open cell foam) are unacceptable.

4. The backer rod shall be compatible with the sealant, and no bond or reaction shall occur between the backer rod and sealant.

707.03.04 EXPANSION JOINT (1-INCH OR LESS)

A. The materials specified in this subsection shall be supplied and installed in expansion joints with widths 1-inch or less designed for structures other than those listed in ***Subsection 707.03.03, "Channel Expansion Joint (1-Inch or Less)."***

B. Joint Sealant:

1. 2-component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV).

2. Sealant shall be able to withstand up to plus or minus 25 percent movement.

3. Sealant shall be self-leveling for flat surfaces and non-sagging for slopes.

4. The sealant shall meet or exceed requirements of Table 1 above.

C. No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

D. Each container shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use

E. The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the 2 components and extrudes the mixed material into the joint.

1. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed.

2. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

F. Joint Filler:

1. Preformed filler conforming to AASHTO M213 or ASTM D1751 (fiber type).

2. Filler material shall be punched or drilled to admit dowels where called for on the plans.

3. Filler for each joint shall be furnished in a single piece for the full depth and width required for the joint unless otherwise specified by the Engineer.

4. When the use of more than 1 piece is authorized for a joint, the abutting ends shall be fastened securely and held in place, by stapling or other positive fastening satisfactory to the Engineer.

G. Bond Breaker Tape:

1. Adhesive backed polyethylene tape meeting or exceeding the following:

a. Adhesive Strength: 35 ounces/inch width.

b. Tensile Strength: 20 pounds./inch width.

c. Mil thickness: 14.

2. Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs.

3. In joints that have considerable width variation, 1 tape may be lapped over another to accomplish total backside coverage

4. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

H. Backer rod:

1. Non-absorbent expanded, closed cell polyethylene foam.

2. The backer rod shall be approximately 25 percent larger in diameter than the width of the joint to be sealed.

3. Other backer materials (paper, rope and open cell foam) are unacceptable.

4. The backer rod shall be compatible with the sealant and no bond or reaction shall occur between the backer rod and sealant.

707.03.05 EXPANSION JOINT (GREATER THAN 1-INCH)

A. The materials specified in this subsection shall be supplied and installed in expansion joints with widths greater than 1-inch.

B. Joint Sealant:

1. Impermeable closed-cell, cross-linked, ethylene vinyl acetate, low density polyethylene copolymer, nitrogen blown foam material.
2. Joint sealant shall have a minimum working movement range of 60 percent compression and 30 percent tension.
3. The sealant shall meet or exceed the requirements listed in Table 2 below.
4. Joint sealant shall have 1/8-inch" deep by 1/8-inch wide grooves spaced at 1/4 inch to 1/2 inch along both sides of the joint and running the entire length of the joint to increase bond surface area.
5. Joint sealant material shall be resistant to degradation due to ultraviolet radiation or shall be coated with a material that provides adequate protection.
6. The joint sealant shall be installed with a width 25 percent greater than width of joint opening at a near neutral condition.
7. All direction changes in joint sealant shall be done using heat welding method.
8. Joint sealant shall be installed using all of manufacturer's recommendations.
9. Joint sealant shall be installed prior to significant joint movement after concrete placement.

C. Contractor shall prevent construction equipment from traversing joint after sealant has been placed or adequate steps shall be taken to protect sealant from construction traffic.

Table 2 - Minimum Requirements for Preformed Joint Sealer

Material Characteristics	Physical Requirements
Service Range	-94 degrees F to 160 degrees F
Tensile Strength	115 lb/in^2
Elongation at break	255%
Tear Resistance (ASTM D624)	16 lb/in^2
Water Absorption (ASTM D3575, Suffix L)	0.2 lb/ft^2
Density	2.8–3.4 lb/ft^3

D. Joint Filler: Inert, preformed, closed cell, polypropylene material.

E. Bond Breaker Tape:

1. Adhesive backed polyethylene tape meeting or exceeding the following:
   a. Adhesive Strength: 35 ounces/inch width.
   b. Tensile Strength: 20 pounds./inch width.
   c. Mil thickness: 14.
2. Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs.
3. In joints that have considerable width variation, 1 tape may be lapped over another to accomplish total backside coverage.
4. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

F. Bonder: 2-component, 100 percent solid epoxy adhesive designed to bond joint material to steel, cured concrete, or wood.

707.03.06 RUBBER GASKETS

A. The ring gaskets shall conform to AASHTO M198.

707.03.07 WATERSTOPS

A. Waterstops shall conform to the following requirements:

1. Natural rubber waterstops shall be manufactured from a stock composed of a high grade compound made exclusively from new plantation rubber, reinforced carbon black, zinc oxide, accelerators, antioxidants, and softeners.

2. This compound shall contain not less than 72 percent by volume of new plantation rubber.

NATURAL RUBBER

Test	Test Method	Requirements
Tension Testing of Vulcanized Rubber	ASTM D412	Tensile strength: 3,500 psi minimum Elongation at breaking: 550 percent Unit stress (300 percent): 1,100 psi minimum Unit stress (500 percent): 2,800 psi minimum
Test for Accelerated aging of Vulcanized Rubber by the Oxygen Pressure Method	ASTM D572	After 7 days in air at 158 degrees F (±2 degrees F) or after 48 hours in oxygen at 158 degrees F (±2 degrees F) and 300 psi, the tensile strength and elongation shall not be less than 65 percent of the original.
Test for Indentation of Rubber by Means of a Durometer	ASTM D2240	55 to 65 hardness

SYNTHETIC RUBBER

Test	Test Method	Requirements
Tension Testing of Vulcanized Rubber	ASTM D412	Tensile strength 2,500 psi minimum Elongation at breaking of 425 percent.
Test for Accelerated aging of Vulcanized Rubber by the Oxygen Pressure Method	ASTM D572	After 7 days in air at 158 degrees F (±2 degrees F) or after 48 hours in oxygen at 158 degrees F (±1 degree F) and 300 psi, the tensile strength and elongation shall not be less than 65 percent of the original.
Test for Indentation of Rubber By Means of a Durometer	ASTM D2240	50 to 70 hardness

POLYVINYL CHLORIDE

Test	Test Method	Requirements
Polyvinyl Chloride Waterstops	Corps of Engr CRD-C 572	Compliance with paragraph 6

707.03.08 ASPHALT PLANK

A. Asphalt plank shall conform to ASTM D517 for Plain Asphalt Plank.

707.03.09 PREFORMED ELASTIC JOINT SEALER

A. Preformed elastic joint sealer and lubricant adhesive shall conform to AASHTO M220.

B. The lubricant adhesive shall be homogeneous and shall remain workable from 5 degrees F to 120 degrees F.

1. Each lot of the adhesive shall be in containers with the manufacturer's name or trademark and the date of manufacture plainly marked.

2. Adhesive shall be stored at a temperature of 50 degrees F to 80 degrees F and shall be used within 270 days after the date of its manufacture.

C. The lubricant adhesive shall conform to the following requirements:

1. Average new weight per gallon, pounds: 7.84 ±5%.

2. Solids content by weight, percent: 22 - 28.

D. Each lot of the preformed elastic joint sealer and lubricant adhesive furnished under these specifications shall be identified as specified herein and shall be products that have been tested by a reputable testing laboratory, recognized by the Contracting Agency.

1. The testing laboratory shall certify that the materials meet these specifications and requirements.

2. The Contractor shall furnish the Contracting Agency with these certifications prior to using the material.

707.03.10 SUBMITTAL

A. Material shall be tested and certified in accordance with the Table 3 frequencies.

1. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and requirements.

2. The test shall be performed in an accredited laboratory such as the American Association for Laboratory Accreditation (A2LA) or other as approved by the Engineer.

3. A test certificate shall be included with the certifying document.

4. Subsequent submittals shall be reviewed by the Contractor for compliance then transmitted to the Engineer.

B. The Statute of Limitations duration for the record storage shall be as required by the Nevada Revised Statutes.

Table 3 - Quality Control Inspection and Testing

Product	Subsection	Reference	Submittal	Frequency
Joint Sealant	***707.03.02*** ***707.03.03***	Table 1 requirements	Certification with copy of tests	1 per lot
	707.03.04	ACI 504R, Table 1, Type IV		
	707.03.05	Table 2 requirements		
Joint Filler	***707.03.03***	Tested per ASTM D1752 Type I	Certification	1 per lot

	707.03.04	AASHTO M213	with copy of tests	
	707.03.05	Inert, preformed, closed cell, polypropylene material	Certification	1 per lot
Backer Rod	707.03.03 707.03.04	Non-absorbent expanded, closed cell polyethylene	Certification	1 per lot
Bond Breaker Tape	707.03.03 707.03.04 707.03.05	Adhesive strength 35 ounces/in width Tensile Strength 20 lb/in width Thickness 14 mil minimum	Certification with copy of tests	1 per lot
Rubber Gaskets	707.03.06	AASTHO M198		
Waterstops Natural and Rubber	707.03.07	ASTM D412 ASTM D572 ASTM D2240		
Waterstops Polyvinyl Chloride	707.03.07	Corps of Engr CRD-C 572		
Asphalt Plank	707.03.08	ASTM D517		
Preformed Elastic Joint Sealer	707.03.09	AASHTO M220		

END OF SECTION 707

SECTION 708 – CONCRETE AND CLAY PIPE AND DRAINS

SCOPE

708.01.01 MATERIALS COVERED

A. This specification covers the quality of clay pipe, nonreinforced concrete pipe, and reinforced concrete pipe used for culverts, siphons, pressure conduits, and storm drains and also the quality of perforated pipe used in underdrains.

1. BLANK

2. Quality control testing and inspection requirements are in ***Subsection 708.04.01, "Production Quality Control Inspection and Testing."***

B. Concrete pipe that is precast shall be manufactured in an annually certified plant.

1. Certification shall be by the American Concrete Pipe Association (ACPA).

2. The quality program from the certification process and this specification shall be initially submitted to the Regional Transportation Commission Specification Subcommittee for approval.

3. Once approved, the facility is considered "Authorized" and submittals of the QC program will not be required on a per-project basis unless required in the project specifications.

C. Design in accordance with AASHTO LRFD Bridge Design Specifications, Section 12, and to withstand a backfill dead load of 120 pounds per cubic foot and an HS-20 live load, unless otherwise shown in the contract or approved by the Engineer. The minimum cover over a pipe shall be placed on the plans and/or specifications being submitted for plan review.

D. The design shall consider any flotation effects with the use of controlled low strength material for backfill.

E. For storm drain application, the design shall consider the abrasion effects of parameters outlined in the Clark County Regional Flood Control District design manual or Federal Highway Administration (FHWA) publication FHWA-DF-88-003, "Federal Lands Highway Project Development and Design Manual."

F. The trench section installation configuration as demonstrated in Figure 1 in ***Section 208, "Trench Excavation and Backfill,"*** shall only be permitted when approved by the Engineer.

G. The designing engineer shall comply with the intent of the pipe material as defined as either rigid or flexible in conformance with the AASHTO LRFD Bridge Design and Construction Specifications and this section.

1. Special attention shall be given to the sidewall material properties as this section assumes a minimum AASHTO A1 or A3 material.

2. Other sidewall material type shall be given special consideration for minimum trench widths, the use of CLSM, or other critical processes that would affect the pipe ability to withstand the load and shall also be noted on the plans and specifications for the project.

H. The type of pipe and applicable installation requirement (trench and embankment) to be used as demonstrated by the design and approved by the Engineer shall be clearly noted on the drawings and specifications along with installation procedures that may differ from this section.

I. The design shall include definition of either rigid or flexible pipe as defined by the South African Standard SABS 0102 as outlined on the Clark County QAQC web page:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

J. The minimum design life before first maintenance on all pipes shall be 50 years. The definition of first maintenance is as follows:

1. **Rigid Pipe or Box - Reinforced Concrete:** Point of exposed reinforcement from normal designed use

2. **Rigid Pipe – Nonreinforced:** The least value of the thickness from designed use by a reduction of 25 percent or 1 inch.

K. Joints shall be specified in accordance with the following:

Table 10- Joint Types

Pipe Type	Joint Type	Description	Test Pressure	Application
Non-pressure	Silt Tight	Mastic or Rubber Gasketed	2.0 psi	Storm
Pressure	Water Tight (pressure)	Rubber Gasketed	10.8 psi	Storm

708.01.02 BASIS OF MANUFACTURED LOT ACCEPTANCE

A. Unless otherwise specified or designated by the Engineer, pipe shall be accepted based on manufacture's tests and inspection as indicated in ***Subsection 708.04.01, "Production Quality Control Inspection and Testing,"*** Table 1.

B. The Contractor shall submit to Engineer manufacturer's Certificate of Compliance for each type of pipe furnished, in accordance with the provisions of ***Subsection 106.05, "Certificate of Compliance,"*** and these specifications.

1. The certificate shall certify that the pipe complies with the specifications and shall include the pipe classification, diameter, and the date of manufacture.

2. The batch test results of each material lot delivered to the project shall be attached to the certificate.

PHYSICAL PROPERTIES AND TESTS

708.03.01 REINFORCED CONCRETE PIPE

A. Reinforced concrete pipe shall conform to the following requirements:

1. **Circular Pipe:** ASTM C76, ASTM C1417.

2. **Elliptical Pipe:** ASTM C507.

B. The above ASTM specifications are clarified and amended as follows:

1. Reinforced Concrete Pipe (RCP) ASTM C76, Basis of Manufactured Lot Acceptance. Unless otherwise specified or designated by the Engineer, pipe shall be accepted based on the authorized status of the facility and visual defects or imperfections as delivered to the site.

2. Reinforced Concrete Arch Pipe (RCAP) ASTM C507, Reinforced Concrete Elliptical Pipe (RCEP) Basis of Manufactured Lot Acceptance. Unless otherwise specified or designated by the Engineer, pipe shall be accepted based on the authorized status of the facility and visual defects or imperfections as delivered to the site.

C. **Materials:**

1. Cement and Fly Ash:

a. Unless otherwise specified, cement shall be Type V, Type IP, or Type V and fly ash, and shall conform to ***Section 701, "Hydraulic Cement."***

b. Fly ash shall be Class F and conform to ***Section 729, "Fly Ash."***

2. Concrete: Unless otherwise specified, Portland cement concrete shall be as specified in ***Section 501, "Portland Cement Concrete."***

3. Synthetic Fibers**:**

a. Polypropylene fibers may be used, with the approval of the Engineer, as a nonstructural manufacturing material.

b. Only Type III synthetic fibers designed and manufactured specifically for use in concrete and conforming to ASTM C1116 shall be accepted.

4. Admixtures: Unless otherwise specified or approved by the Engineer, admixtures conforming to ***Section 702, "Concrete Curing Materials and Admixtures,"*** shall be acceptable for use.

D. All D-load and/or compressive strength requirements shall be met prior to shipment.

708.03.02 NONREINFORCED CONCRETE PIPE

A. This pipe shall conform to ASTM C14 for the specified diameters and strength classes.

708.03.03 PERFORATED CONCRETE PIPE

A. This pipe shall conform to ASTM C444 for the specified diameters and strength classes.

708.03.04 CLAY PIPE

A. This pipe shall conform to AASHTO M65 for pipe with full circular cross section, for the specified diameter and strength class.

B. When specified, the bell shall have integral spacer lugs to provide for an annular opening and self-centering feature.

708.03.09 REINFORCED CONCRETE PRESSURE PIPE

A. This pipe shall conform to AWWA C300, AWWA C301, AWWA C302, and ASTM C361.

TESTING AND INSPECTION

708.04.01 PRODUCTION QUALITY CONTROL INSPECTION AND TESTING

A. Material shall be tested, inspected, and certified in compliance with the Table 2 frequency.

B. The laboratory shall be R-18 AASHTO accredited in the appropriate test method, where applicable, and testing reviewed and stamped by a Nevada professional engineer who has responsible charge of the work.

1. Any structural integrity test shall be reviewed and stamped by a Nevada professional engineer who has responsible charge of the work.

2. Chemical testing does not require a professional engineer's review and stamp.

Review the Clark County web site for any exceptions to the test methods listed below at http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx.

Table 2 – Inspection and Testing

Product/Material	Subsection	Referenced Specification or Test Procedure	Requirement	Frequency
Concrete Pipe				
Plant QC Program	***708.01.01***	ACPA	Certified annually	1 per new plant or revision
Reinforced Concrete Pipe	***708.03.01***	ASTM C76, ASTM C1417	Design submittal	1 per type
		ASTM C76, Section 5.1.2	Basis of manufactured lot acceptance	See Components below
Reinforced Concrete Elliptical Pipe	***708.03.01***	ASTM C507, Section 5.1.1 and ASTM C655, Section 9	Design submittal	1 per type
		ASTM C76, Section 5.1.2	Basis of manufactured lot acceptance	See Components below
Nonreinforced Concrete Pipe	***708.03.02***	AASHTO M315 and ASTM C14	Design submittal	1 per type
		ASTM C14	Basis of manufactured lot acceptance	See Components below
Perforated Concrete Pipe	***708.03.03***	ASTM C444	Design submittal	1 per type
			Basis of manufactured lot acceptance	See Components below
Reinforced Concrete Pressure Pipe (Water)	***708.03.09***	AWWA C300, AWWA C301, and AWWA C302	Design submittal	1 per type
			Basis of manufactured lot acceptance	See Components below

Table 2 – Inspection and Testing				
Product/Material	**Subsection**	**Referenced Specification or Test Procedure**	**Requirement**	**Frequency**
Components				
Cement	***708.03.01***	***Section 701***	Certificate with test of Batch lot	1 per batch or heat lot
Curing Compound and Admixtures	***708.03.01***	***Section 702***		
Fly Ash	***708.03.01***	***Section 729***		
Steel Wire Steel Welded Wire Steel Wire Welded Deformed Steel Wire Welded Wire Deformed		***Section 713***		
Aggregates Coarse and Fine		AASHTO M6 and AASHTO M80	Sieve Analysis	1 per day for QA of External Source
Concrete		***Section 501***	Design submittal	1 per new design and renewal each year
		AASHTO T22	Compressive Strength	1 set per production day per design
Pipe	***708.03.01***	ASTM C655	D-Load testing	Annually per size and class
	708.03.01	Applicable AWWA and ASTM methods	Inspection of diameter, wall thickness, steel area, product marking (size and length), length	Each piece
Pressure Pipe Joint	***708.01.01***	ASTM C497 and ASTM C443	Hydrostatic Test	1 per setup or change

END OF SECTION 708

SECTION 710 – STRUCTURAL AND EYEBAR STEEL

SCOPE

710.01.01 MATERIALS COVERED

A. This specification covers the quality of structural and eyebar steel used in highway structures.

REQUIREMENTS

710.02.01 DEFECTS

A. Finished rolled material shall be free from cracks, flaws, injurious seams, laps, blisters, ragged and imperfect edges, and other defects.

B. Material shall have a smooth, uniform finish, and shall be straightened in the mill before shipment.

C. Material shall be free from loose mill scale, rust pits, and other defects affecting its strength or durability.

D. The Engineer may reject material that Engineer deems unsuitable for the purpose intended even though the material meets the mill tolerances.

710.02.02 CHARPY V-NOTCH TEST

A. All steel used in and designated as main load carrying members subject to tensile stress shall comply with all the requirements specified for Charpy V-notch test in the various AASHTO standards for the steel involved.

B. Sampling and testing procedures shall be in accordance with the applicable AASHTO standards.

PHYSICAL PROPERTIES AND TESTS

710.03.01 CORRUGATED METAL PIPE AND PIPE ARCHES

A. This steel shall conform to AASHTO M270 Grade 36.

710.03.02 HIGH STRENGTH-LOW ALLOY STRUCTURAL MANGANESE VANADIUM STEEL

A. This steel shall conform to AASHTO M270 Grade 50.

710.03.03 HIGH TENSILE STRENGTH BOLTS

A. This steel shall conform to ASTM A325.

710.03.04 STAINLESS STEEL BOLTS

A. This steel shall conform to ASTM A276.

710.03.05 WELDED SEAMLESS STEEL PIPE

A. This steel shall conform to ASTM A53, Grade B.

710.03.06 COLD-FORMED WELDED AND SEAMLESS CARBON STEEL STRUCTURAL TUBING IN ROUNDS AND SHAPES

A. This steel shall conform to ASTM A500, Grade B, except the minimum tensile strength shall be 55,000 psi.

710.03.07 SHEAR STUD CONNECTORS

A. This steel shall conform to ASTM A108, Grade 1015 or Grade 1020.

B. Flux-retaining caps shall be low carbon grade suitable for welding and shall conform to ASTM A109.

710.03.08 PINS AND ROLLERS

A. Pins or rollers 9 inches or less in diameter shall be forged and heat treated cold finished carbon-steel shafting.

B. Pins or rollers more than 9 inches in diameter shall be forged and heat treated in accordance with ASTM A235.

END OF SECTION 710

SECTION 712 – MISCELLANEOUS METAL

SCOPE

712.01.01 MATERIALS COVERED

A. This specification covers the type and quality of miscellaneous metals used on various construction projects.

PHYSICAL PROPERTIES AND TESTS

712.03.01 STEEL CASTINGS

A. This steel shall conform to ASTM A27, Grade 65-35.

712.03.02 GRAY IRON CASTINGS

A. These castings shall conform to ASTM A48, Class 30.

712.03.03 MALLEABLE CASTINGS

A. These castings shall conform to ASTM A47, Grade 32510.

712.03.04 WROUGHT IRON PLATES

A. These plates shall conform to ASTM A42.

712.03.05 BRONZE CASTINGS

A. These castings shall conform to ASTM B22, Copper Alloy No. 863.

712.03.06 WELDING MATERIALS

A. Materials used for welding shall conform to the current Specifications for Welded Highway and Railway Bridges of the American Welding Society and current AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges.

712.03.07 STEEL PILES

A. This steel ("H" piles and sheet piling) shall conform to ASTM A36.

712.03.08 STEEL SHELL FOR PILES

A. This steel shall conform to ASTM A252, Grade 2.

END OF SECTION 712

SECTION 713 – REINFORCEMENT

SCOPE

713.01.01 MATERIALS COVERED

A. This specification covers the quality of bar steel, fabricated reinforcement, and welded steel wire used in the reinforcement of concrete.

PHYSICAL PROPERTIES AND TESTS

713.03.01 BAR STEEL REINFORCEMENT

A. This steel shall conform to the applicable following requirements.

Test	Test Method	Requirements
Deformed Billet-Steel Bars for Concrete Reinforcement	ASTM A615	Grade 40, 60
Axle-Steel Deformed Bars for Concrete Reinforcement	ASTM A996	Grade 40, 60
Spiral Reinforcement	ASTM A615	Grade 60

713.03.02 FABRICATED STEEL BAR OR ROD MATS REINFORCEMENT

A. This steel shall conform to ASTM A184.

713.03.03 WELDED STEEL WIRE FABRIC REINFORCEMENT

A. This steel shall conform to ASTM A185.

713.03.04 PRESTRESSING STEEL

A. Prestressing reinforcement shall be high tensile strength steel wire, high-tensile strength 7-strand wire, or high tensile strength alloy bars as called for on the plans or in the Special Provisions.

B. High-tensile strength steel wire shall conform to ASTM A421, except that steel may be made by the basic oxygen process.

C. High-tensile strength 7-strand wire shall conform to ASTM A416, Grade 270.

D. High-tensile-strength alloy bars shall be stress relieved and then cold stretched to a minimum of 130,000 psi. After cold stretching, the physical properties shall be as follows:

Minimum Ultimate Tensile Strength	145,000 psi
Minimum Yield Strength, Measured by the 0.7 Percent Extension, Under Load Method Shall Be Not Less Than	130,000 psi
Minimum Modulus of Elasticity	25,000,000 psi
Minimum Elongation in 20-bar Diameters After Rupture	4 percent
Diameter Tolerance	+0.03 inch, -0.01 inch

E. Testing Prestressing Reinforcement and Anchorages:

1. All wire, strand, or bars to be shipped to the site shall be assigned a lot number and tagged for identification purposes.

2. Anchorage assemblies to be shipped shall be likewise identified.

F. All samples submitted shall be representative of the lot to be furnished, and, in the case of wire or strand, shall be taken from the same master roll.

G. All of the materials specified for testing shall be furnished free of cost and shall be delivered in time for tests to be made well in advance of anticipated time of use.

H. The Contractor shall furnish for testing the following samples selected from each lot. If ordered by the Engineer, the selection of samples shall be made at the manufacturer's plant by the inspector.

1. **Pretensioning Method.**

   a. For pretensioned strands, samples at lease 5 feet long shall be furnished of each strand size.

   b. A sample shall be taken from each end of every coil.

2. **Post-Tensioning Method.** The following lengths shall be furnished:

   a. For wires requiring heading: 5 feet.

   b. For wires not requiring heading: sufficient length to make up 1 parallel-lay cable 5 feet long consisting of the same number of wires as the cable to be furnished.

   c. For strand to be furnished with fittings: 5 feet between near ends of fittings.

   d. For bars to be furnished with threaded ends and nuts: 5 feet between threads at ends.

3. **Anchorage Assemblies.** 2 anchorage assemblies shall be furnished, complete with distribution plates of each size or type to be used if anchorage assemblies are not attached to reinforcement samples.

713.03.05 COLD-DRAWN STEEL WIRE FOR SPIRAL REINFORCEMENT

A. This steel shall conform to ASTM A82.

END OF SECTION 713

SECTION 714 – PAINT AND PAVEMENT MARKINGS

SCOPE

714.01.01 MATERIALS COVERED

A. This specification covers the quality, color, and number of applications of paint used for painting the various materials of construction.

1. The raw materials for use in the various paint formulas shall conform to the specifications designated by federal or military serial number or paint material code number under the various paint classifications hereinafter specified.
2. Subsequent amendments to the specifications quoted shall apply to all raw materials and finished products.
3. No "or equal" substitutions for any specified material shall be made without written consent of the Engineer.
4. State specification numbers referred to are California State Specifications unless otherwise noted.

B. Comply with ***Section 715, "Galvanizing,"*** for galvanized coatings.

REQUIREMENTS

714.02.01 CERTIFICATES

A. The Contractor shall furnish the Engineer with written certification that all required tests have been satisfactorily completed and that the materials tested comply with all of the requirements. Samples will be taken when required by the Engineer.

B. Prior to using any material, the Contractor shall provide the Engineer with a written "Certification of Compliance" from the manufacturer of the material. The certification shall:

1. Include the manufacturer's name, business address, and location of the manufacturing plant.
2. Identify the specifications and include 1 copy.
3. Show the quantity of materials supplied for each color, batch number, and date of manufacture.

C. Manufacturer's lab test results shall be supplied upon request of the Engineer. No pavement marking material shall be used which is not on the Qualified Products List (QPL) established by the Nevada Department of Transportation (NDOT). The current NDOT QPL is available at http://www.nevadadot.com.

PHYSICAL PROPERTIES AND TESTS

714.03.01 IRON AND STEEL USE ITEM CLASSIFICATIONS

A. **Zinc-Rich Primer, Organic Vehicle Type (State Spec. 8010-61J-36):**

1. This specification covers a 1-package, thermoplastic, organic zinc-rich primer whose mechanism of drying is that of solvent release.

2. This primer is intended for use only on blast cleaned open steel structures exposed to the air.

3. This coating is intended for spray application. Limited application can be made by brushing.

B. **Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27):**

1. This specification covers a wash primer formulated specifically for application prior to painting clean aluminum, galvanized surfaces, or surfaces previously coated with an organic or inorganic zinc-rich primer.

2. This primer is also used on blast cleaned steel when specified and is mandatory as an undercoat under vinyl paint systems.

C. **Vinyl Primer, Red Iron Oxide Type (State Spec. 8010-61J-23):**

1. This specification covers a ready-mixed, vinyl-red oxide paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment Vinyl Wash Primer (State Spec. 8010-61J-27).

2. This paint should be applied alternately with Vinyl Primer, Red Iron Oxide - Titanium Dioxide Type (State Spec. 8010-61J-24) to provide a primer coating which may consist of 1 or more applications of each vinyl primer.

3. Either State Specification 8010-61J-23 or 8010-61J-24 may be used for the initial application.

4. This paint is formulated primarily for spray application.

D. **Aluminum Vehicle Varnish (State Spec. 8010-91B-75):**

1. This specification covers an aluminum vehicle clear varnish and general all purpose phenolic base spar mixing varnish.

2. This varnish should not be used on surfaces and in pigment combinations where yellowing will be objectionable.

E. **Aluminum Paint, Finish Coat, (State Spec. 8010-61J-45):**

1. This specification covers a phenolic resin varnish base aluminum paint, suitable for use as a finish coat.

2. This paint is formulated for use on structural steel and interior and underwater surfaces of steel water tanks and similar exposed surfaces.

3. This paint shall be furnished in 2-compartment containers and shall be mixed fresh each day.

F. **Vinyl Paint, Aluminum Finish Coat (State Spec. 8010-61J-25):**

1. This specification covers a vinyl type aluminum paint for use on properly prepared metal surfaces that have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27) or specified vinyl undercoats.

2. This paint is primarily formulated for spray application.

3. This paint shall be furnished in 2-compartment containers and shall be mixed fresh each day.

G. **Burnt Umber Tint Finish Coat (State Spec. 8010-61J-41):**

1. This specification covers a ready-mixed burnt umber tint paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

H. **Burnt Sienna Finish Coat (State Spec. 8010-61J-53):**

1. This specification covers a ready-mixed burnt sienna paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

I. **Green Finish Coat (State Spec. 8010-61J-47):**

1. This specification covers a ready-mixed green paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

J. **Vinyl Green Finish Coat (State Spec. 8010-61J-40):**

1. This specification covers a ready-mixed green vinyl finish paint for use on properly prepared metal surfaces that have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27), or specified vinyl undercoats.
2. This paint is formulated primarily for spray application.

K. **Vinyl Iridescent Green Finish Coat (State Spec. 8010-91B-43):**

1. This specification covers a ready-mixed iridescent green vinyl finish paint for use on properly prepared metal surfaces that have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27), or specified vinyl undercoats.
2. This paint is formulated primarily for spray application.

L. **Tan Finish Coat (State Spec. 8010-61J-51):**

1. This specification covers a ready-mixed, tan paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

M. **White Tint Base Finish Vinyl Coat (State Spec. 8010-71C-35):**

1. This specification covers a ready-mixed, white tint base, vinyl finish paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).
2. This paint is formulated primarily for spray application.

N. **Enamel; Exterior White, Metal (State Spec. 8010-61J-09):**

1. This specification covers a fast drying, exterior, white enamel, primarily for use on metal, or for other exterior surfaces where gloss and durability are requisite.
2. This paint shall conform to the provisions of Military Specification MIL-E-1115A.

O. **Enamel; Traffic Signal, Lusterless, Black (State Spec. 8010-61J-13):**

1. This specification covers a lusterless, black enamel for use in painting traffic signal hoods, shields, and other surfaces.

2. When used on bare aluminum or zinc, Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27) shall be used first to ensure proper bond.

P. **Enamel; Traffic Signal, Dark Olive Green (State Spec. 8010-41B-A):**

1. This specification covers an enamel for use on signal poles.

2. This paint is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).

Q. **Enamel; Traffic Signal, Yellow (School Bus Yellow):**

1. This specification covers high-gloss enamel for use on signal poles.

2. This paint is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).

3. School bus yellow shall conform to Federal Color No. 13432 as shown in Table V of Federal Standard No. 595a.

R. **Enamel; Traffic Signal, Silver:**

1. This specification covers an enamel for use on signal poles.

2. This paint is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).

3. The silver shall conform to Federal Color No. 17178 as shown in Table IX of Federal Standard No. 595a.

714.03.02 TIMBER USE ITEM CLASSIFICATIONS

A. **Wood Primer Latex Base:**

1. This specification covers a ready-mixed, priming paint for use on unpainted wood or exterior wood work.

2. This paint shall comply, in all respects, with Federal Specification TT-P001984, except that it shall dry hard in not more than 12 hours.

B. **Paint, Latex Base for Exterior Wood, White and Tints:**

1. This specification covers a ready-mixed paint for use on wood surfaces subject to outside exposures.

2. This paint shall comply in all respects with Federal Specification TT-P96D.

3. Unpainted wood shall first be primed with Wood Primer conforming to ***Subsection 714.03.02***, paragraph A, ***"Wood Primer, Latex Base."***

C. **Enamel; Sign Post, Black (State Spec. 8010-61J-08):**

1. This specification covers a gloss black enamel for use on wood or metal.

714.03.03 CONCRETE USE ITEMS

A. Concrete end posts (bridges), raised traffic bars, and miscellaneous concrete specified to receive paint.

Purpose	Number of Coats	Color	General Type	Formulated or Specification
Finish	1	White	Water Thinned	Acrylic Resin or Synthetic Latex Alkyd Emulsion

714.03.04 ALUMINUM USE ITEM

A. Aluminum bridge railing and posts specified to receive paint shall be prepared for painting with a coat of Pre-Treatment, Vinyl Wash Primer conforming to ***Subsection 714.03.01***, paragraph B, "***Pre-Treatment, Vinyl Wash Primer*** (State Spec. 8010-61J-27)."

B. The Contractor may use any of the paint systems specified for use on iron or steel in ***Subsection 714.03.01, "Iron and Steel Use Item Classifications,"*** for painting aluminum, and shall submit to the Engineer for approval a letter indicating Contractor's choice of system as required for iron or steel.

714.03.05 PAINT FOR TRAFFIC STRIPING, PAVEMENT MARKING, AND CURB MARKING - GENERAL

A. These specifications are intended to cover ready-mixed paints of a consistency suitable for use on highway pavements and curbing, either asphaltic or Portland cement concrete type.

B. Reference specifications and standards shall be Federal Specifications, latest revision, as herein noted, or Federal Test Method Standard No. 141, latest revision, as called for and amended in these specifications.

C. Paint shall be homogenous, free of contaminant, and of a consistency suitable for use in the capacity for which it is specified.

1. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint.
2. The dispersion shall be of such nature that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled.
3. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle.
4. Settled pigment shall be easily redispersed, with minimum resistance to the smooth uniform product of the proper consistency.
5. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning, or other requisite qualities of a satisfactory working material.
6. The paint shall possess satisfactory properties, in all respects, that affect its application and curing.

D. All manufactured paint shall be prepared at the factory ready for application. The addition of thinner or other material to the paint after the paint has been shipped will not be permitted unless otherwise specified in the contract Special Provisions.

714.03.06 PAVEMENT MARKINGS

A. **Type 2:**

1. Type 2 pavement marking material shall be a durable retroreflective pavement marking for use on asphalt or concrete pavements transverse markings such as crosswalks and stop bars, and for word/symbol markings, that are subjected to severe wear conditions such as repeated shear action from stop, start, or turn movements.

2. Type 2 materials are as follows:

   a. **Preformed Pavement Marking Tape**: This material shall meet the minimum requirements set forth in ASTM D4505 except as modified below.

   b. Whiteness Index: The daylight color of the white striping shall have a minimum initial whiteness index of sixty (60) as determined in Practice E313. Color shall be determined using 0/45 or 45/0 geometry.

   c. Retroreflectance:

      1) White preformed marking tape shall have the following initial minimum retroreflectance values as measured in accordance with ASTM D4061.

      2) Retroreflectance values shall be expressed as coefficient of retroreflected luminance (R_L) in millicandelas per square foot per footcandle (mcd/ft^2/fc).

Entrance Angle	86.0°	86.5°	88.8°
Observance Angle	0.2°	1.0°	1.05°
***R*$_L$ (mcd/ft^2/fc)**	550	300	250

   d. Skid Resistance: The surface of the retroreflective pavement marking tape shall provide an initial minimum average skid resistance value of 45 BPN when tested in accordance with ASTM E303.

   e. Durability:

      1) The durability of the pavement marking material shall be the percentage of the marking material remaining on the pavement surface in satisfactory working condition.

      2) The initial value shall always be established at 100 percent.

   f. Performance Requirements:

      1) Type 2 pavement marking material, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to the temperature if the pavement surface remains stable.

      2) The material shall be weather resistant and, through normal traffic wear, shall show no fading that will significantly impair the intended use of the marking throughout its useful life.

      3) Pavement marking tape shall show no lifting or shrinkage and shall show no significant tearing, roll back, or other signs of poor adhesion.

      4) Type 2 pavement marking material shall also meet the performance criteria establish in the table below.

Performance Factor*	Heavy Traffic (greater than 6,000 ADT per lane)	Medium and Light Traffic (6,000 ADT or less per lane)
Retained Retroreflectivity	74	40
Durability	90%	75%
Whiteness Index	10	10
Whiteness Index (0.5 million vehicle passes)	20	20

***Values for the performance factors are retained values which shall be determined after the markings have been in place a minimum of one (1) year and subjected to a minimum 4,000,000 vehicle passes per lane.**

g. Installation and Warranty

1) The markings shall be applied in accordance with the manufacturer's instructions.

2) Contractor shall provide to Engineer the manufacturer's written installation instructions and a recommendation for the type of adhesive to be used prior to installation of materials.

3) The marking material and installation shall have a minimum 1-year warranty.

B. **Type 1:**

1. Type 1 pavement marking material shall be a durable retroreflective pliant pavement marking for use on asphalt or concrete pavements for longitudinal markings such as edge lines and lane lines.

2. The color of the marking material shall be white or yellow and conform to standard highway colors.

3. Type 1 materials shall be as follows

a. **Preformed Pavement Marking Tape:** This material shall meet minimum requirements set forth in ASTM D4505 except as modified below:

1) Retroreflectance:

a) White and yellow preformed marking tape shall have the following initial minimum retroreflectance values as measured in accordance with the testing procedures of ASTM D4601.

b) Retroflectance values shall be expressed as coefficient of retroreflected luminance (RL) in millicandelas per square foot per footcandle (mcd/ft2/fc).

	White			Yellow		
Entrance Angle	86.0º	86.5º*	88.8°	86.0º	86.5º*	88.8°
Observance Angle	0.2º	1.0º	1.05°	0.2º	1.0º	1.05°
R_L (mcd/ft^2/fc)	800	600	400	700	500	300

2) Skid Resistance: The surface of the retroreflective pavement marking tape shall provide an initial minimum average skid resistance value of 45 BPN when tested in accordance with ASTM E303.

b. **Preformed Thermoplastic Tape (Yellow Markings Only):**

1) The preformed retroreflective marking material shall consist of a resilient polymer thermoplastic with uniformly distributed retroreflective beads throughout its entire cross section.

2) The markings shall be fusible to asphalt and Portland cement concrete pavements by the normal heat of a propane torch as recommended by the manufacturer.

c. **Paint:**

1) Traffic paint used for pavement markings shall conform to material requirements listed in the following subsections:

a) Subsection 714.03.05, "Paint for Traffic Striping, Pavement Marking, and Curb Marking - General,"

b) Subsection 714.03.07, "Fast Dry Traffic Paint,"

c) Subsection 714.03.09, "Ready-Mixed Traffic Stripe Paints."

2) Requirements for retroreflective beads used with the application of this material are listed in ***Subsection 714.03.12, "Reflective Material."***

d. **Epoxy Paint (Yellow Marking Only):**

1) Epoxy paint marking material shall consist of a 100 percent solid, 2-part system formulated and designed to provide a simple volumetric mixing ration of 2 components.

2) Epoxy paint used for pavement markings shall conform to materials requirements listed in ***Subsection 714.03.10, "Epoxy Paint for Traffic Markings."***

3) Requirements for retroreflective beads used with the application of this material are listed in ***Subsection 714.03.12, "Reflective Material."***

e. **Polyurea Paint:**

1) Polyurea paint marking shall consist of a 100 percent solid, 2-part system formulated and designed to provide a simple volumetric mixing ratio of 2 components.

2) Polyurea paint used for pavement markings shall conform to materials requirements listed in ***Subsection 714.03.10, "Epoxy Paint for Traffic Markings."***

3) Requirements for retroreflective beads and reflective elements used with the application of this material are listed in ***Subsection 714.03.12, "Reflective Material."***

f. Durability:

1) The durability of the pavement marking material shall be the percentage of the marking material remaining on the pavement surface in satisfactory working condition.

2) The initial value shall always be established at 100 percent.

g. Performance Requirements:

1) Type 1 pavement marking material, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to the temperature if the pavement surface remains stable.

2) The material shall be weather resistant and, through normal traffic wear, shall show no fading that will significantly impair the intended use of the marking throughout its useful life.

3) Pavement marking tape shall show no lifting or shrinkage and shall show no significant tearing, roll back, or other signs of poor adhesion.

4) Type 1 pavement marking material shall also meet the performance criteria established in the table below.

Performance Factors	**Heavy Traffic** (greater than 6000 ADT per lane)		**Medium and Light Traffic** (6000 ADT or less per lane)	
	White	**Yellow**	**White**	**Yellow**
Retained Retroreflectivity	200	150	100	100
Durability	98%	95%	93%	93%
Whiteness Index	6	45	6	40

*Values for the performance factors are retained values which shall be determined after the markings have been in place a minimum of one (1) year and subjected to a minimum 4,000,000 vehicle passes per lane.

h. Installation and Warranty:

1) The markings shall be applied in accordance with the manufacturer's instructions.

2) Contractor shall provide to Engineer the manufacturer's written installation instructions and a recommendation for the type of adhesive to be used prior to installation of materials.

3) The marking material and installation shall have a minimum 1-year warranty.

i. Qualified Products List:

1) The Nevada Department of Transportation (NDOT) maintains a Qualified Products List (QPL) of all products available that satisfy the requirements of these specifications and have proven effective in field tests. The current NDOT QPL is available at: http://www.nevadadot.com.

714.03.07 FAST DRY TRAFFIC PAINT

A. Type 2 (Heatable) Fast Dry White, Type 2 (Heatable) Fast Dry Yellow, Type 1 Fast Dry White, and Type 1 Fast Dry Yellow shall comply with any western state specification valid at the time of use in addition to meeting ***Subsection 714.03.05, "Paint for Traffic Striping, Pavement Marking, and Curb Marking – General,"*** and listed on the NDOT QPL.

B. Fast dry traffic paint shall be applied at the film thickness of 15 mils to 20 mils and shall dry to "no traffic pickup" within 3 minutes.

C. The "no traffic pickup" time shall be determined by ASTM D711.

714.03.08 ALL PURPOSE BLACK TRAFFIC PAINT - PAINT FORMULA 235

A. All purpose Black Traffic Paint - Paint Formula 235 shall comply with any western state specification valid at the time of use, and listed on the NDOT QPL.

714.03.09 READY-MIXED TRAFFIC STRIPE PAINTS

A. Where ready-mixed paints are specified, they shall be suitable for use on either asphalt concrete or Portland cement concrete.

714.03.10 EPOXY PAINT FOR TRAFFIC MARKINGS

A. Epoxy traffic paints shall be a 2-component marking material suitable for use on either asphalt concrete or Portland cement concrete.

B. Mixing of 2 components shall be performed as recommended by the manufacturer.

C. Epoxy paint shall only be applied if air temperature is a minimum of 50 degrees F at the time of marking installation.

D. If the manufacturer of the marking material requires a minimum air temperature different than detailed above, the higher temperature shall be used.

E. If material needs heating prior to application, no fumes shall be exuded that are toxic or injurious to persons or property.

F. Epoxy paint shall dry to "no traffic pickup" within 45 minutes.

714.03.11 POLYUREA PAINT FOR TRAFFIC MARKINGS

A. Polyurea traffic paints shall be a 2-component marking material suitable for use on either asphalt concrete or Portland cement concrete.

B. Mixing of 2 components shall be performed as recommended by the manufacturer.

C. Polyurea paint shall be applied if air temperature is a minimum of 40 degrees F at the time of marking application.

D. If the manufacturer of the marking material requires a minimum air temperature different than detailed above, the higher temperature shall be used.

E. If material needs heating prior to application, no fumes shall be exuded that are toxic or injurious to person or property.

F. Polyurea paint shall be dry to “no traffic pickup” within 5 minutes.

714.03.12 REFLECTIVE MATERIAL

A. Reflective material shall consist of retroreflective beads and of the final coat of traffic paint or epoxy paint and polyurea paint prior to setting, so that the beads will have proper adhesion.

B. Special care shall be taken with rapid dry paint and epoxy paint materials.

C. Retroreflective beads shall conform to Federal Specification TT-B-1325B and shall be mechanically applied at a rate recommended by the manufacturer to achieve performance criteria established in ***Section 714.03.06, "Pavement Markings."***

D. Retroreflective beads shall be applied to pavement markings, curbs, and crosswalks by use of a dispensing device developed for this purpose or other methods approved by the Engineer.

E. The Engineer may authorize the use of traffic paint containing pre-mixed retroreflective beads.

1. The type, gradation, quantity, and quality of the pre-mixed retroreflective beads shall be approved prior to the manufacture of the traffic paint.

2. In addition to the specified pre-mixed beads, additional beads may need to be mechanically applied when the traffic paint is applied.

714.03.13 AIR POLLUTION

A. All paint shall meet the requirements of the Clark County Department of Air Quality and Environmental Management (DAQEM).

714.03.14 TEST REPORTS AND CERTIFICATION

A. At the time of delivery of each shipment of material, the Contractor shall, upon request, deliver to the Engineer certified copies of the manufacturer's test report.

B. The test report shall indicate the name of the manufacturer, type of material, date of manufacture, quantity, applicable State Specification Number and specification, manufacturer's lot or batch number, and results of the required tests.

1. The test report shall be signed by an authorized representative of the manufacturer.

2. The certified test reports and the testing required in connection therewith shall be at no cost to the Contracting Agency.

END OF SECTION 714

SECTION 715 – GALVANIZING

SCOPE

715.01.01 MATERIALS COVERED

A. This specification covers the quality and thickness of galvanizing used on various material when called for on the plans or designed in the specifications.

PHYSICAL PROPERTIES AND TESTS

715.03.01 PRODUCTS 1/8-INCH THICK AND THICKER

A. Galvanizing of products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strip shall conform to ASTM A123.

715.03.02 GUARDRAIL ELEMENTS

A. All rail elements shall be galvanized in accordance with AASHTO M180, Type 2.

715.03.03 HARDWARE

A. Bolts, nut, washers, and fastenings shall be galvanized in accordance with ASTM A153.

END OF SECTION 715

SECTION 716 – SIGN MATERIALS

SCOPE

716.01.01 MATERIALS COVERED

A. This specification covers the kind and quality of materials used in the construction and fabrication of traffic control devices used in temporary event zones and for permanent installations.

REQUIREMENTS

716.02.01 GENERAL

A. The following materials shall conform to the requirements as noted:

Material	Section
Portland Cement Concrete	***501***
Reinforcing Steel	***505***

716.02.02 CERTIFICATES

A. The Contractor shall ascertain that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency.

B. The Contractor shall furnish the Engineer with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

716.02.03 SUBMITTALS

A. Before fabrication is started, 5 sets of shop drawings for each overhead sign structure shall be submitted to the Engineer for approval.

PHYSICAL PROPERTIES AND TESTS

716.03.01 REFLECTIVE SHEETING

A. Sheeting for all orange signs and devices shall be Fluorescent Orange with the exception of Type 1, Type 2, and Type 3 barricades, which shall be pre-striped white and non-fluorescent Orange sheeting.

B. Fluorescent Yellow-Green sheeting shall be used on School, Bicycle, and Pedestrian signs, and related supplemental plates, or as directed by the Contracting Agency.

C. Inks and films for symbols, legends and borders on sheeting shall be in accordance with the manufacturer's sheeting specification. Films shall be a durable, transparent, acrylic colored film coated with a transparent pressure-sensitive adhesive.

D. Protective overlay film (anti-graffiti film for non-illuminated signs), shall be a durable, solvent resistant, transparent, fluoropolymer film, coated with a transparent pressure-sensitive adhesive, and applied to the finished sign in accordance with the manufacturer's sheeting specification.

E. **Non-Reboundable Signs and Devices**: Retroreflective sheeting shall conform to ASTM D4956, Type XI. The warranty for the sheeting shall be twelve years for non-fluorescent sheeting, ten years for Fluorescent Yellow and Fluorescent Yellow-Green sheeting, and three years for Fluorescent Orange sheeting,

F. **Reboundable Devices and Delineators**: Retroreflective sheeting shall conform to ASTM D4956, Type IV and Type VI with the following modifications:

1. Minimum Coefficient of Retroreflection (R_A) [cd/fc/ft^2 (cd/lx.m^2)] for both Type IV and Type VI shall conform to the requirements for ASTM D4956, Type VI as shown in Table 716-1

2. Daytime color – the chromaticity coordinates and total luminance factor shall conform to the requirements as described in 23 CFR Part 655 Appendix to Subpart F.

TABLE 716-1 MINIMUM COEFFICIENT OF RETROREFLECTION (R_A)

Observation Angle	Entrance Angle	White	Fluorescent Orange	Fluorescent Yellow	Fluorescent Yellow-Green
0.2°	-4°	500	200	300	400
0.2°	30°	200	80	120	160
0.5°	-4°	225	90	135	180
0.5°	30°	85	34	51	68

G. Fluorescence Luminance Factor (L_F) for all Fluorescent sheeting shall conform to the requirements in Table 716-2.

H. Unless otherwise specified, the Contractor shall use only Type IV, Type VI, and Type XI products listed in the NDOT QPL.

TABLE 716-2 FLUORESCENCE LUMINANCE FACTOR (Y_F)

Color	Y_F Initial Requirement	Y_F Minimum Requirement
Fluorescent Orange	20	15
Fluorescent Yellow	25	20
Fluorescent Yellow-Green	30	20

I. **Field Performance Life Requirement:**

1. The supplier shall warranty that signs supplied shall have an effective retroreflective life of not less than that specified above.
2. The retroreflective sheeting shall be considered unsatisfactory and failing this life requirement if it has deteriorated due to natural causes to the extent that 1 or more of the following is true:
   a. The sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night conditions.
   b. The values for the coefficients of retroreflection for Type IV, Type VI, and Type XI are less than 50 percent of the required values for the same sign when new in accordance with ASTM D4956.
   c. The sign material's integrity or adhesion to the sign substrate has substantially failed.
3. Sheeting which fails the life requirement within the specified required lifetime shall be replaced by the supplier at no cost to the Contracting Agency.
4. Replaced sheeting warranty shall begin at time of replacement and the warranty shall be to the life requirement per sheeting type.
5. All finished signs shall be dated with the month and year of delivery in order to ascertain compliance with the life requirements.

716.03.03 ALUMINUM SIGN PANELS (FOR REFLECTIVE SHEETING)

A. Sheet aluminum for sign panels shall be of 0.100-inch aluminum alloy Alclad 5052-H38 or 6061-T6 and shall conform to ASTM B209.

B. Sign panels for street name signs shall be as required in the Standard Drawings.

C. Sign panel sections shall be fabricated of standard width aluminum sheets not less than 4 feet wide, except that not more than 2 sheets for any 1 sign may be cut not less than 18 inches in width to provide sign widths to nearest 6-inch increments. Panel sections shall run from the top edge to the bottom edge of the sign without horizontal joints.

D. The aluminum shall be free of all corrosion, white rust, and dirt.

1. All sign dimensions, metal gauge, and bolt holes shall conform to the plans and these specifications.
2. Blanks shall be cleaned, degreased, and chromated or otherwise properly prepared according to methods recommended by the sheeting manufacturer.

E. Metal shall not be handled, except by device or clean canvas gloves, between all cleaning operations and the applications of the sign background material. There shall be no opportunity for the aluminum to come in contact with greases, oils, or other contaminants prior to application of the background material.

F. All fabrication, including cutting, shall be completed prior to the cleaning process.

1. Metal panels shall be cut to size and shape and shall be free of defects resulting from fabrication.

2. The surface of all sign panels shall be a plane surface.

716.03.05 OVERHEAD SIGN STRUCTURES AND SIGN FRAMES

N. The materials used in the fabrication of overhead sign structures and footings shall conform to the requirements specified below.

O. **Sign Frames:** Bars, plates, and shapes shall be structural steel conforming to ASTM A36.

P. **Sign Pipe Posts:**

1. Pipe posts shall be welded or seamless steel pipe conforming to ASTM A53, Grade B.

2. At the option of the Contractor, posts may be fabricated from structural steel conforming to ASTM A36 or ASTM A283, Grade D, except that plates more than 1 inch in thickness shall be structural steel conforming to ASTM A373.

Q. **Sign Steel Walkway Gratings:** Steel walkway gratings shall be furnished and installed in accordance with details shown on the plans and the following provisions:

1. Gratings shall be the standard product of an established grating manufacturer.

2. Material for gratings shall be structural steel conforming to ASTM A36.

3. For welded type gratings, each joint shall be full resistance welded under pressure to provide a sound, completely beaded joint.

4. For mechanically locked gratings, the method of fabrication and interlocking of the members shall be approved by the Engineer, and the fabricated grating shall be equal in strength to the welded type.

5. After fabrication, gratings shall be hot-dip galvanized.

6. Gratings shall be free from warps, twists, and other defects affecting their appearance or serviceability.

   a. The tops of the bearing bars and cross members shall be in the same plane.

   b. Gratings distorted by the galvanizing process shall be straightened.

R. **Bolts and Nuts:**

1. Bolts and nuts shall conform to ASTM A307.

2. Bolted connections shall conform to ***Subsection 506.03.07, "Bolts and Bolted Connections."***

S. Bearing plates and gusset or stiffener plates shall be of the sizes and dimensions shown on the plans and shall be galvanized after fabrication.

1. Steel shall conform to ASTM A36.

2. Galvanizing shall conform to ASTM A123.

3. All welding shall conform to ***Subsection 506.03.17, "Welding."***

T. Anchor bolts, nuts, and washers shall be of structural carbon steel conforming ***to Section 710, "Structural and Eyebar Steel,"*** and shall be galvanized in accordance with ASTM A153 or cadmium plated in accordance with ASTM A165, Type TS.

1. The top portion of anchor bolts shall be galvanized or cadmium plated so that the galvanized or cadmium plated portion will extend at least 2 inches into concrete.
2. Anchor bolts shall be of the size, shape, and length shown on the plans.

U. All bolts, nuts, clamps, and metal washers not otherwise noted shall be galvanized or cadmium plated.

1. Cadmium plating shall conform to ASTM A165, minimum thickness as prescribed for grade Type TS.
2. Galvanizing shall conform to ASTM A153.

V. Supporting frame shall be manufactured in accordance with the plans and requirements herein specified.

1. All metal parts shall be galvanized after fabrication, in accordance with ***Section 715, "Galvanizing."***
2. When permission is granted by the Engineer to zinc coat a surface by means other than hot-dip galvanizing, the metalizing process shall be used to place the zinc.
3. Metalizing shall be performed in accordance with AWS specifications and the thickness of the sprayed zinc coat shall be at least 5 mils.

W. Truss frames shall be fabricated to the largest practical sections prior to galvanizing.

1. Splice locations shall be submitted to the Engineer for approval.
2. Contractor shall not commence fabrication until such splice locations are approved.

X. All welding on the fabrication of the structure shall be done by welders qualified in accordance with AWS requirements using the inert-gas shielded-arc method.

1. Welds shall be free from cracks, blow holes, and other irregularities.
2. Welds shall be wire brushed or otherwise cleaned.
3. No field welding on any part of the structural assembly will be permitted.

716.03.06 SIGN HARDWARE, POST, AND RELATED MATERIALS

A. Bearing plates and gusset or stiffener plates shall be of the sizes and dimensions shown on the plans and shall be galvanized after fabrication.

1. Steel shall conform to ASTM A36.
2. Galvanizing shall conform to ASTM A123.
3. All welding shall conform to ***Subsection 506.03.17, "Welding."***

B. Structural I-beam steel shall be galvanized in accordance with ASTM A153 or cadmium plated in accordance with ASTM A165, Type TS.

C. Anchor bolts, nuts, and washers shall be of structural carbon steel conforming to ***Section 710, "Structural and Eyebar Steel."***

1. The top portion of anchor bolts shall be galvanized or cadmium plated so that the galvanized or cadmium plated portion will extend at least 2 inches into the concrete.
2. Anchor bolts shall be of the size, shape, and length shown on the plans.

D. Steel pipe for posts shall conform to ASTM A53, Grade B, and shall be galvanized.

1. Galvanized steel pipe posts shall be of the diameter and length shown on the plans.
2. The top of the posts shall be fitted with a cover.
3. Posts showing damage shall be repaired or rejected.

E. BLANK

F. Aluminum stiffeners, braces, and stringers used as horizontal supporting structural members shall be of aluminum alloy 6061-T6.

1. These extrusions shall have a continuous, inverted "T" slot.
2. The inverted "T" shall accommodate positionable stainless steel clamping devices.
3. The clamping devices shall provide complete freedom of alignment within the slot, forming an interlocking clamp system for fastening the sign to the post.
4. The sign support system described herein shall conform to AASHTO *Standard Specifications for Highway Signs, Luminaires and Traffic Signals*, latest revision, and be rated for minimum wind velocities of 80 mph.
5. All bolts, nuts, clamps, and metal washers in contact with this aluminum channel shall be Stainless Steel Type 304.
6. The system shall be compatible with all I-beam, steel post, and wood post systems.

G. All other bolts, nuts, clamps, and metal washers in contact with other aluminum components shall be galvanized or cadmium plated.

1. Cadmium plating shall conform to ASTM B766, minimum thickness as prescribed for Class 5 Type 3.
2. Galvanizing shall conform to ASTM A153.

H. Cantilever arm brackets shall be used when it is desired to offset the entire length of a sign to 1 side of a post or pole.

1. Cantilever arm brackets shall consist of a stainless steel or aluminum head mounted to an extruded aluminum "TEE" section.
2. The "TEE" section shall have a continuous slot that will accept signs up to 1/8 inch thick.
3. If sign thickness, including aluminum sign panel and reflective sheeting, exceeds the width of the "TEE" section slot, sign panel thickness may be reduced to not less than 0.080 inch, or reflective sheeting may be eliminated in the bracket area, as directed by the Engineer.
4. The heads shall be designed to accept 3/4-inch stainless steel banding.
5. The "TEE"-shaped extrusions shall be made from 6061-T6 aluminum alloy.
6. The cantilever arm brackets shall be used to support the entire length of the sign on both the top and the bottom.
7. The sign shall be attached to the brackets using 1/8-inch rivets spaced according to the hole pattern pre-drilled on the extruded "TEE" section.

8. The cantilever arm brackets shall be compatible with any size and shape of post or pole.
9. The system shall be designed for use on signs up to 72 inches in length with a maximum surface area of 9.5 square feet.
10. Signs with surface area greater than 2 square feet shall be fastened to round posts or poles using 3/4-inch by 0.030-inch stainless steel banding.
11. When mounting to square posts or flat surfaces, compatible stainless steel threaded studs or bolts can be used as well as 3/4-inch by 0.030-inch stainless steel banding.
12. For signs less than 2 square feet in surface area, 5/8-inch banding is acceptable.

END OF SECTION 716

SECTION 721 – OBJECT MARKERS AND GUIDE POSTS

SCOPE

721.01.01 MATERIALS COVERED

A. This specification covers the quality and kind of material used in the construction of object markers and guide posts.

REQUIREMENTS

721.02.01 CERTIFICATES

A. At no additional cost to the Contracting Agency, 2 certificates covering each order of material (plates, reflectors, and posts) shall be furnished by the manufacturer, certifying that the product complies with the specifications.

B. Certificates shall be delivered to the Engineer at the time of, or prior to, delivery of the order.

C. For steel used in posts, the Contractor shall furnish 2 certified copies of mill test reports showing the chemical and physical characteristics from each heat.

PHYSICAL PROPERTIES AND TESTS

721.03.01 METAL POSTS

A. Posts shall be steel conforming to ASTM A570, Grade C.

B. Metal posts shall be galvanized in accordance with ***Section 715, "Galvanizing."***

721.03.02 TARGET PLATES

A. **Base Metal:** Base metal for target plates shall be zinc-coated steel sheet or aluminum sheet.

B. Zinc-Coated Steel Sheet:

1. The zinc-coated steel sheet shall comply with Federal Specification QQ-S-775, Steel Sheet, carbon, zinc-coated Type 1, Classes d and e, except that the zinc-coated surface shall withstand a 180-degree bend on itself at room temperature without flaking the coating.

2. The zinc-coated surface shall be prepared for painting by the application of phosphate coating.

3. Surface preparation shall conform to the following requirements:

   a. The phosphatizing process shall be accomplished without damaging or removing the galvanized coating from the steel base metal.

   b. Any evidence of damage or removal of the zinc coating shall be cause for rejection of the entire lot.

C. Aluminum Sheet:

1. The aluminum shall be prepared for painting with a chemical conversion coating conforming to Federal Specification MIL-C-5541.

2. The coating shall be applied in accordance with the manufacturer's specifications and recommended sequence of operation.

3. Contractor shall furnish 2 copies of certified mill tests of the aluminum sheets to the Engineer.

D. Target plates shall be fabricated from 20 gauge steel sheet or 0.050-inch thick aluminum sheet, alloy 3005-H14.

E. Fabrication of all metal parts shall be accomplished in a uniform and workmanlike manner.

1. Plates shall be cut to size and shape and the holes punched for mounting bolts and reflectors in accordance with the details shown on the plans.

2. Surfaces and edges of the plates shall be free from defects resulting from fabrication.

F. **Paint:**

1. Target plates shall have satisfactory paint adherence.

2. The plates shall be coated with baked enamel conforming to the following provisions:

a. The enamel finish coat for plates shall comply in all respects with Federal Specification TT-E-489, Class B baking type enamel, with the added requirement that the yellowness index of the white enamel shall not exceed 0.08 when tested in accordance with Federal Test Method Standard No. 141, Method 6131.

b. Application of the baking enamel may be by spray, roller, or dip, at the option of the manufacturer. Other methods may be used provided they are approved prior to use.

c. The dry film thickness of the baked enamel coating on the galvanized steel plates shall be not less than 2.0 mils on both front and back surfaces.

d. The dry film thickness on both front and back surfaces of the aluminum plates shall be:

1) Not less than 1.5 mils on each side if enamel is applied by spray or dip method.

2) Not less than 1.0 mil if enamel is applied by continuous roller coat method.

e. The coating shall be uniform throughout and shall be smooth and free from flow lines, streaks, blisters, and other surface imperfections.

G. The finished plates shall be free from dents and defects. The maximum surface deviation from a horizontal plane on which the finished plate lies shall not exceed 0.25 inch.

702.03.03 REFLECTORS

A. **Photometric Requirements:**

1. Each reflective delineator shall have the following minimum brightness values at 2 degrees divergence expressed as candlepower per foot candle.

2. Measurements shall be conducted in accordance with standard photometric testing procedures for reflex reflectors of the Society of Automotive Engineers.

Angle of Incidence	Silver-White		Yellow	
	Divergence Angle			
	0.2	0.5	0.2	0.5
	Brightness (cd/ftcd)			
0 degrees	9.0	3.8	5.3	2.3
15 degrees	8.0	3.4	4.4	2.0
30 degrees	5.4	2.9	2.7	1.2
45 degrees	2.6	1.1	1.0	0.5

3. The brightness of the reflective sheeting, totally wet by rain, shall not be less than 90 percent of the above values.

4. Wet performance measurements shall be conducted in conformance with standard rainfall tests specified in MIL-R-13689A.

B. **Durability.** The delineator surface shall readily be refurbished by cleaning and clear overcoating in accordance with the manufacturer's recommendations.

END OF SECTION 721

SECTION 722 – WATER

SCOPE

722.01.01 MATERIALS COVERED

A. This specification covers the quality of water from non-potable sources for use in preparing cement concrete or soil-cement mixtures, and for wetting embankment, backfill, subgrade, and gravel base and surfacing courses.

REQUIREMENTS

722.02.01 GENERAL

A. All water for embankments, backfill, subgrade, gravel base, landscaping, and surface courses and cement concrete curing shall be free from an excessive amount of acids, alkali, oil, and other substances which, in the opinion of the Engineer, will cause damage to the above mentioned items.

PHYSICAL PROPERTIES AND TESTS

722.02.02 CONCRETE USE

A. Samples submitted for tests shall consist of 2 quarts of water, obtained and shipped in clean glass containers carefully packed and labeled.

B. Tests shall be made in accordance with AASHTO T26.

C. Any indication of unsoundness, marked change in time of setting, or a reduction of more than 10 percent in strength from results obtained with concrete mixtures containing the water of satisfactory quality shall be sufficient cause for rejection of the water under tests.

END OF SECTION 722

SECTION 725 – ELASTOMERIC BEARING PADS

SCOPE

725.01.01 MATERIALS COVERED

A. Elastomeric bearing pads shall be preformed pads formed by casting or extruding natural rubber or neoprene under pressure and heat.

B. The pads shall be cast or extruded in a single, integral layer to the required thickness, unless pads with nonelastic lamination are called for on the plans.

C. All components of a laminated pad shall be molded together into an integral unit and all edges of the laminates shall be covered by a minimum of 1/8 inch of elastomer, except at laminate restraining devices and around holes that will be entirely closed on the finished structure.

D. Laminates shall be of the material and thickness called for on the plans.

REQUIREMENTS

725.02.01 CERTIFICATE OF INSPECTION

A. The material furnished will be evaluated for acceptance on the basis of the manufacturer's Certified Report of Test or Analysis indicating compliance with these special properties, but the Engineer may obtain test specimens on request.

B. Contractor shall furnish to the Engineer 3 copies of the manufacturer's Certified Report of Test or Analysis before use of the material in the work.

C. Test specimens, when required, shall be in accordance with ASTM D15, Part B.

PHYSICAL PROPERTIES AND TESTS

725.03.01 GENERAL

A. The pads shall conform to the following physical properties:

	Natural Rubber	Neoprene
Grade (Durometer)	60	60
Physical Properties:		
Hardness, (ASTM D 2240)	60 ±5	60 ±5
Tensile Strength, min. psi, (ASTM D412)	2,500	2,500
Ultimate elongation, min. percent	400	350
Heat Resistance, 70 hours at 158°F (ASTM D573):		
Hardness, max. points change	10	15
Tensile strength, max. percent change	-25	-15
Ultimate elongation, max. percent change	-25	-40
Compression Set (ASTM D395, Method B):		
22 hours at 158°F, max. percent	25	--
22 hours at 212°F, max. percent	--	35

	Natural Rubber	Neoprene
Ozone (ASTM D1149), 20 percent strain 100°F ±2°F, mounting procedure ASTM D518, Procedure A:		
225 pphm ozone in air by volume, 48 hours	No cracks	---
100 pphm ozone in air by volume, 100 hours	--	No cracks
Adhesion (ASTM D429, Method B):		
Bonds made during vulcanization, pounds per inch	40	40

END OF SECTION 725

SECTION 726 – ROADSIDE MATERIALS

SCOPE

726.01.01 MATERIALS COVERED

A. This specification covers the materials used in erosion control, landscaping, and irrigation systems.

REQUIREMENTS

726.02.01 CERTIFICATES AND SAMPLES

A. **Planting Soil:**

1. Before imported planting soil is brought on the jobsite, a 10-pound sample shall be submitted to the Engineer for approval.
2. The sample shall be accompanied by a current report, furnished by the Contractor, from a recognized testing laboratory indicating the particle size, clay content, the pH factor, electrical conductivity, and analysis of salt concentrate.

B. **Fertilizer:** The fertilizer containers shall have the manufacturer's guaranteed statement of analysis clearly marked, all in accordance with state and federal laws.

C. **Organic Material:**

1. Before bulk organic material is brought to the jobsite, a 10-pound sample shall be submitted to the Engineer for approval.
2. The sample shall be accompanied by a current report, furnished by the Contractor, from a recognized testing laboratory indicating the moisture retention capacity, organic matter (based on dry weight), mineral matter (ash), silica (acid insoluble ash), nitrogen (based on dry weight), pH factor, and the amount of Douglas Fir bark.

D. **Plants:**

1. All plants shall be nursery grown, healthy, vigorous, well-rooted, shall be true to type or name as shown on the plans, and shall conform to ANSI Z60.1, No. 1 grade.
2. Plants shall be tagged in accordance with the most recent standard practice recommended by the American Association of Nurserymen and the latest edition of Standardized Plant Names, American Joint Committee on Horticultural Nomenclature.
3. All plants shall comply with federal and state laws requiring inspection for plant diseases and infestations.
4. Inspection certificates required by law shall accompany each shipment of plants, and all plant shipments shall be inspected and passed by the Nevada Department of Agriculture.
5. All shipments of pine nursery stock shall meet all applicable state and federal quarantine regulations.

E. **Seeds:** The Contractor shall furnish to the Engineer duplicate copies of a statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before the date of delivery on the project.

F. **Irrigation Materials:**

1. The Contractor shall ascertain that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency.

2. The Contractor shall furnish the Engineer with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

G. All materials shall be approved prior to use.

PHYSICAL PROPERTIES AND TESTS

726.03.01 PLANTING SOIL

A. Planting soil shall consist of friable soil of loamy character.

B. The soil shall be obtained from well-drained arable land and shall be free from subsoil, refuse, roots, heavy or stiff clay, stones larger than 1 inch in largest dimension, coarse sand, sticks, brush, litter, and other deleterious substances.

C. Requirements for planting soil shall be as follows:

Organic Matter	0.1 to 1.0% by dry weight of soil
Particle Size	3/8 inch (0.953 centimeters) maximum
Clay Content	20% maximum (by weight)
pH Factor	6.5 to 8.0
Electrical Conductivity	0.5 to 1.0 mmhos. per centimeter of the saturation paste extract

726.03.02 FERTILIZER

A. Fertilizer and agricultural minerals shall be a standard commercial grade of organic or inorganic fertilizer of the kind and quality specified in the contract documents.

1. Fertilizer may be separate or in a mixture containing the percentage of total nitrogen, available phosphoric acid, and water-soluble potash in the amounts specified.

2. All fertilizers and agricultural minerals shall be furnished in standard, unopened containers with weight, name of plant nutrients, and manufacturer's guaranteed statement of analysis clearly marked, all in accordance with state and federal laws.

B. Acceptable commercial fertilizer and agricultural minerals will be specified in 1 of the following forms:

1. A dry, free-flowing, granular material suitable for application by agricultural fertilizer spreaders.

2. A soluble fertilizer and agricultural mineral ground to a fineness that will permit complete suspension of insoluble particles in water, suitable for application by power sprayers.

3. A granular or pelleted fertilizer and agricultural mineral suitable for application by blower equipment.

4. A non-volatile liquid fertilizer or agricultural mineral.

726.03.03 ORGANIC MATERIAL

A. Organic matter shall be processed, composted, fine-ground bark of White Fir, Pine, or Redwood, or a mixture of these in any proportion.

B. Organic matter shall be free of lumps and clods and shall be fine enough so that 100 percent of the material will pass a 1/2-inch screen and 85 percent will pass a No. 6 screen.

C. Requirements for organic material shall be as follows:

Moisture Retention Capacity	35 percent minimum
Organic Matter Based on Dry Weight	95 percent minimum
Mineral Matter (Ash)	5 percent maximum
Silica (Acid Insoluble Ash)	3 percent maximum
Nitrogen Based on Dry Weight	0.8 percent minimum
pH Value Based on 1:5 Solution	4.0 to 6.0 maximum
Douglas Fir Bark	0 percent

726.03.04 MULCH

A. **Hay or Straw:**

1. All hay or straw mulch materials shall be in an air-dried condition free of noxious weeds, weed seeds, and other materials detrimental to plant life.

2. Unless otherwise specified in the contract documents, hay or straw mulch material shall be of approved field grasses or legumes indigenous to the area.

B. Mulch shall also conform to the following requirements:

Moisture Content	12.0% ± 3.0%
Organic Matter (Oven-Dried Basis)	99.6% ± 0.2%
Ash Content	0.8% ± 0.2%
Water Holding Capacity (Grams of Water/ Grams of Fiber)	1,150 minimum

C. **Wood Cellulose Fiber:**

1. Wood cellulose fiber mulch shall be specially processed wood fiber containing no growth or germination inhibiting factors.

2. Mulch shall be dyed a suitable color to facilitate inspection of the placement of the material.

D. **Wood Chips and Shavings:**

1. Wood chips and shavings shall be manufactured from any clean wood free of infestations.

2. Chips from kiln-dried or air-dried material will not be acceptable.
3. Chips shall be produced by machinery equipped with knives or blades which cut rather than shred or break the material.
4. Chips shall be graded so that substantially all chips are from 1/2 inch to 3 inches in length, 1/2 inch to 1-1/2 inches in width, and from 1/8 inch to 1/2 inch in thickness.

E. **Bark:**

1. Bark shall be 100 percent bark derived from the bark of White Fir, Red Fir, or Pine and shall contain no Douglas Fir.
2. The bark shall be granular or chunky in nature with all particles between 1-1/4 inches and 2-1/2 inches in diameter.

726.03.05 JUTE MATTING

A. Jute matting shall be of a uniform, open, plain weave of undyed and unbleached single jute yarn.

B. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than 1/2 its normal diameter.

C. Jute matting shall be furnished in rolled strips as follows:

1. Length shall be approximately 50 yards.
2. Matting width shall be 48 inches with an average weight of 0.92 pounds per square yard. A tolerance of ±1 inch in width and of 5 percent in weight will be allowed.

726.03.06 PLANTS

A. All plants shall be nursery grown, representative specimens of their species, and shall be true to type or name as shown on the plans.

B. All plants shall be uniform in growth, in healthy condition, and free from insects, pests, diseases, and injuries, and without evidence of being or having been in a wilted condition.

726.03.07 SEEDS

A. Grasses, legumes, or cover crop seed shall be furnished in standard containers on which shall be shown the following information:

1. Date of Test.
2. Seed Name.
3. Lot Number.
4. Net Weight.
5. Percentage of Purity.
6. Percentage of Germination (in the case of legumes, percentage of germination shall include hard seed).
7. Percentage of Weed Seed Content and Inert Material, clearly marked for each kind of seed, in accordance with applicable state and federal laws.

8. No noxious weed seed present.

B. Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

C. Seed shall be at least 95 percent pure and shall have a minimum of 85 percent germination.

726.03.08 TREE TIES

A. Tree ties shall be strips of vinyl-coated nylon, durable, non-hardening, long-life material approximately 1 inch wide and approximately 10 mils thick, or other suitable material approved by the Engineer.

B. A 10-gauge galvanized wire encased in at least 1/2-inch rubber hose may be used when permitted by the Engineer.

726.03.09 PIPE AND FITTINGS

A. **Plastic Pipe:**

1. Plastic pipe, shall be PVC 1120 or 1220 pressure pipe as shown in the irrigation system legend on the plans.
2. All PVC pipe shall be extruded from 100 percent virgin material and shall be NSF approved, except plastic pipe for soaker lines shall be flexible PVC conforming to ASTM D2287.
3. Fittings for PVC plastic pipe shall be rigid polyvinyl chloride, standard weight, Schedule 40, and shall be solvent weld type except as shown on the plans.
4. Fittings for PVC pipe shall have higher bursting pressure than the pipe.
5. All plastic pipe shall be continuously and permanently marked with the following information:
    a. Manufacturer's name and trademark.
    b. Pipe size.
    c. Pipe class.
    d. Type of pipe.
    e. Working pressure at 73.4 degrees F.
    f. National Sanitation Foundation (NSF) rating.
6. All PVC plastic pipe shall be homogeneous throughout; smooth inside and outside; and free from cracks, holes, foreign materials, dents, wrinkles, and blisters.

B. **Delivery:** Plastic pipe shall be delivered to the site in unbroken bundles packaged to provide adequate protection for the pipe ends.

726.03.10 CONTROL TUBING

A. Control tubing shall be PVC tubing meeting NSF rating in the size specified on the plans.

726.03.11 GATE VALVES

A. Gate valves, when called for on the plans, shall be heavy-duty bronze conforming to ASTM B62.

726.03.12 QUICK COUPLER VALVES

A. Quick coupler valves shall have a service rating not less than 150 psi for non-shock cold water.

B. Body of the valves shall be a single-piece construction of sand-cast semi-red brass alloy No. 5-A as given in ASTM B584.

726.03.13 MASONRY

A. Hollow load-bearing concrete masonry blocks shall conform to ASTM C90.

B. Hollow non-load-bearing concrete masonry blocks shall conform to ASTM C129.

END OF SECTION 726

SECTION 727 – CONCRETE SURFACE FINISHING MATERIAL

SCOPE

727.01.01 MATERIALS COVERED

A. This specification covers the types and quality of concrete surface finishing materials.

PHYSICAL PROPERTIES AND TESTS

727.02.01 REQUIREMENTS

A. Bonded grout finishing material shall conform to the provisions specified below.

B. Except as noted herein, tests shall be made in accordance with test method indicated. Federal standard test methods are as contained in FED-STD-141, most current edition.

C. Viscosity: 110-115 K.U., using pin paddle. (Federal Standard. Method No. 4281)

D. Total Solids (Federal Standard Test Method No. 4042):

1. By weight: 65% minimum.
2. By volume: 48% minimum.

E. Flexibility (Federal Standard Test Method No. 6221):

1. Pass 1/8-inch mandrel when spread 12 mils wet on a tin panel and air dried 16 hours at 120 degrees F.
2. Panel shall show no mud cracking and no loss in adhesion to the panel when bent.

F. Water Resistance: No softening when tested as follows (ASTM D1647):

1. Spread a 12-mil film on tin panel and allow to air dry 48 hours.
2. Immerse in water for 16 hours and allow to dry for 8 hours.
3. There shall be no effect on the material.

G. Weatherometer Durability (Federal Standard Test Method No. 6152):

1. Expose a 12-mil film applied to asbestos cement board for 500 hours in an Atlas Twin-Arc weatherometer.
2. There shall be no erosion, cracking, softening, or other visible defects in the coating.

END OF SECTION 727

SECTION 728 – EPOXY

SCOPE

728.01.01 MATERIALS COVERED

A. These specifications are intended to specify epoxy that will meet service requirements for street and highway construction.

B. Epoxy shall be furnished as 2 components that shall be mixed together at the site of the work.

REQUIREMENTS

728.02.01 SAMPLING AND TESTING

A. Epoxy shall not be used prior to sampling and testing unless its use is permitted prior to said sampling and testing in accordance with the provisions in ***Subsection 106.05, "Certificate of Compliance."***

B. All tests will be conducted in accordance with the latest test methods of ASTM International and Federal Test Method Standard No. 141.

728.02.02 CERTIFICATES

A. Without expense to the Contracting Agency, 2 certificates covering each order of material shall be furnished by the manufacturer, certifying that the product complies with the specifications.

B. Certificates shall be delivered to the Engineer in charge at the jobsite at the time of, or prior to, delivery of the order.

728.02.03 PACKAGING, LABELING, AND STORING

A. Each component shall be packaged in steel containers not larger than 5 gallons in volume.

B. When the components are to be mixed at a ratio of 2 parts Component A to 1 part Component B, by volume, the container containing Component B shall be 1/2 the volume of the container containing Component A.

C. The containers shall have lug-type crimp lids with ring seals, shall be new, shall be not less than 24 gauge, shall otherwise meet U.S. Department of Transportation Hazardous Materials Shipping Regulations, and shall be well sealed to prevent leakage.

D. If a lining is used in the containers, it shall be of a character to resist any action by the components.

E. Each container shall be clearly labeled with the designation (Component A or Component B), manufacturer's name, date of manufacture, batch number (a batch shall consist of a single charge of all components in a mixing chamber), all directions for use specified elsewhere, and the following warning:

CAUTION

This material will cause dermatitis if it is allowed to come in contact with the skin or eyes. Use gloves and protective creams on the hands. Should this material contact the skin, wash thoroughly with soap and water. Do not attempt to remove this material from the skin with solvents. If any gets in the eyes, flush for 10 minutes with water and secure immediate medical attention.

F. Attention is directed to the characteristics of some epoxy components to crystallize or thicken excessively prior to use when stored at temperatures below 35 degrees F. Any material that shows evidence or crystallization or a permanent increase in viscosity or settling of pigments that cannot be readily redispersed with a paddle shall not be used.

728.02.04 DIRECTIONS FOR USE

A. At the time of mixing, Component A and Component B shall be at a temperature between 60 degrees F and 85 degrees F, unless otherwise specified.

B. Any heating of the adhesive components shall be done by application of indirect heat.

C. Immediately prior to mixing, each component shall be thoroughly mixed with a paddle. Separate paddles shall be used to stir each component.

D. Immediately prior to use, the 2 components shall be thoroughly mixed together in the specified ratios.

1. When mixed, all adhesive, except coal tar modified epoxy, shall have a uniform gray color without black or white streaks.

2. No solvent shall be added to any epoxy.

E. After mixing, all epoxies shall be placed in the work and any overlaying or inserted material that is to be bonded to the work by the epoxy shall also be placed before thickening of the epoxy has begun.

F. Surfaces upon which epoxy is to be placed shall be free of rust, paint, grease, asphalt, and loose and deleterious material.

G. When epoxy is used as a binder to make epoxy concrete or mortar, the 2 components of epoxy shall be thoroughly mixed together before the aggregate is added and, unless otherwise specified, the mix proportions shall consist of 1 part binder to approximately 4 parts aggregate, by volume.

H. Aggregate for use in epoxy concrete and mortar shall be clean and shall have a moisture content of not more than 0.50 percent when tested in accordance with ASTM D2216.

I. All surfaces against which epoxy concrete and mortar are to be placed shall be primed with a coat of the epoxy used just prior to placing the mortar.

PHYSICAL PROPERTIES AND TESTS

728.03.01 BINFER (ADHESIVE), EPOXY RESIN BASE

A. **Classification:**

1. This specification covers a low viscosity, liquid polysulfide extended epoxy formulated primarily for use in making high-strength epoxy concrete and epoxy mortar, in fastening metal anchors in vertical holes in concrete, and in pressure grouting of cracks in concrete.
2. Thick sections of this epoxy are not suitable for use in freeze-thaw environments.
3. Epoxy Resin Base Binder (Adhesive) shall conform to AASHTO M235 or ASTM C881.

B. **Directions for use:**

1. The ingredients in Component A and Component B shall be thoroughly dispersed such that each component forms a fluid mixture.
2. The mixing ratio is 2 parts by volume of Component A to 1 part by volume of Component B.
3. No more material shall be mixed than can be used within 10 minutes from the time mixing operations are started.

728.03.02 COAL TAR MODIFIED EPOXY RESIN

A. **Classification:**

1. This specification covers a low viscosity, liquid coal tar extended epoxy formulated primarily for use with a cover of aggregate as a black seal and skid resistant surfacing for Portland cement concrete and for use in making low strength epoxy concrete and epoxy mortar.
2. This epoxy is suitable for use in freeze-thaw environments.
3. Coal Tar Modified Epoxy Resin shall conform to ASTM C881.

B. **Directions for use:**

1. Equal parts, by weight or volume, of Component A and Component B shall be mechanically batch mixed, or continuously mixed in automatic paving equipment that provides continuous metering, mixing, and application at a controlled rate.
2. If the components are to be batch mixed, mixing shall be performed with a propeller type stirrer, or other power driven agitator attached to a 1/2 inch heavy duty drill.
3. Care shall be exercised to thoroughly incorporate material at the sides and bottom of the mixing container.
4. When mixed in batches, the mixing time shall be 5 minutes at 60 degrees F to 80 degrees F or 3 minutes at 80 degrees F to 100 degrees F and the batch size shall not exceed 5 gallons.
5. The mixed material will set quickly if allowed to remain in large mass, due to the heat generated as the 2 components react.
6. Pot life in large quantities (1 gallon to 5 gallons) is approximately:

Material Temperature	Pot Life (Measured from Beginning of Mixing)
60-70 degrees F	18 minutes
70-80 degrees F	12 minutes
80-90 degrees F	10 minutes
90-100 degrees F	8 minutes

728.03.03 EPOXY RESIN ADHESIVE FOR BONDING NEW CONCRETE TO OLD CONCRETE

A. **Classification:**

1. This specification covers a low viscosity paste polysulfide extended epoxy formulated primarily for use in bonding new Portland cement concrete to old Portland cement concrete and in fastening metal anchors in horizontal holes in concrete.
2. This epoxy is available in 2 types:
   a. Type I for general use.
   b. Type II for use when cure temperatures are below 60 degrees F, or when a faster cure is required.
3. Thick sections of this epoxy are not suitable for use in freeze-thaw environments.
4. Epoxy Resin Adhesive shall conform to AASHTO M235 or ASTM C881.

B. **Directions for use:**

1. The ingredients in Component A and Component B shall be thoroughly agitated so each component forms a uniform paste.
2. The mixing ratio is 2 parts by volume of Component A to 1 part by volume of Component B.
3. When measuring individual Component A and Component B, stir and tap the measuring containers to remove possible air voids.
4. Do not mix more material than can be spread within 8 minutes from the time mixing operations are started.
5. The spreading rate shall be sufficient to thoroughly coat the surface.
6. Spread the mixed adhesive by brush or roller over thoroughly cleaned concrete at a rate not exceeding 40 square feet per gallon.
7. On very rough surfaces, the spreading rate shall be 25 square feet per gallon.
8. The new concrete shall be placed against the adhesive coating on the old concrete within 15 minutes after spreading at temperatures below 90 degrees F or within 10 minutes at temperatures above 90 degrees F.

728.03.06 BINDER (ADHESIVE), EPOXY RESIN BASE, ALKYLBENZENE EXTENDED

A. **Classification:**

1. This specification covers a medium viscosity, liquid alkylbenzene extended epoxy formulated primarily for use with aggregate as a gray seal and skid-resistant surfacing for Portland cement concrete and for preparing low-strength epoxy mortar and epoxy concrete.
2. This epoxy is suitable for use in freeze-thaw environments.
3. Alkylbenzene Extended Epoxy Resin Base Binder (Adhesive) shall conform to ASTM C881.

B. **Directions for use:**

1. The mixing ratio is 1 part by volume of Component A to 1 part by volume of Component B.
2. No more material shall be mixed than can be used within 10 minutes from the time mixing operations are started.

728.03.07 BINDER (ADHESIVE), EPOXY RESIN BASE, FAST SETTING

A. **Classification:**

1. This specification covers a medium viscosity, liquid rapid set epoxy formulated primarily for use in making high-strength epoxy concrete and epoxy mortar where low curing temperatures are expected or when a fast cure is required.
2. This epoxy is not formulated for use in bonding of new Portland cement concrete to old Portland cement concrete.
3. This epoxy is suitable for use in freeze-thaw environments.
4. Fast Setting Epoxy Resin Base Binder (Adhesive) shall conform to ASTM C881.

B. **Directions for use:**

1. The mixing ratio is 2 parts by volume of Component A to 1 part by volume of Component B.
2. Aggregate shall be added immediately after Component A and Component B are thoroughly mixed.
3. The epoxy mortar or concrete shall be placed as soon as possible.
4. The useful work life of the mortar will depend on temperature, but shall be about 10 minutes to 15 minutes at 75 degrees F.
5. All surfaces shall be primed with mixed epoxy.

728.03.08 BINDER (ADHESIVE), EPOXY RESIN BASE, FAST SETTING, ALKYLBENZENE EXTENDED

A. **Classification:**

1. This specification covers a medium viscosity, liquid rapid set, alkylbenzene extended epoxy formulated primarily for use with aggregate as a gray seal and as a skid-resistant surfacing for Portland cement concrete and for use in making low-strength

epoxy concrete and epoxy mortar where low curing temperatures are expected or when a fast cure is required.

2. This epoxy is suitable for use in freeze-thaw environments.

3. Fast Setting Epoxy Resin Base Alkylbenzene Extended Binder (Adhesive) shall conform to ASTM C881.

B. **Directions for use:**

1. The mixing ratio is 1 part by volume of Component A to 1 part by volume of Component B.

2. Do not mix more material than can be used within 10 minutes from the time mixing operations are started.

3. When applying resinous seal, the aggregate shall be sprinkled in the epoxy film not later than 5 minutes after epoxy is applied to the road surface.

728.03.09 EPOXY SEALANT FOR INDUCTIVE LOOPS

A. **Classification:**

1. This specification covers a high viscosity, liquid epoxy formulated primarily for use in sealing inductive wire loops and leads imbedded in asphalt concrete and Portland cement concrete for traffic signal controls and vehicle counters.

2. This epoxy is to be used for repair work on existing spalls, cracks, and other deformations in and around saw cuts and housing inductor loops and leads.

3. The rapid cure allows minimum traffic delay.

4. This sealant is suitable for use in freeze-thaw areas and can be used on grades up to 15 percent without excessive flow of material.

5. Epoxy Sealant for Inductive Loops shall conform to ASTM C881.

B. **Directions for use:**

1. Saw cuts shall be blown clean and dry with compressed air to remove all excessive moisture and debris.

2. For repairing damaged saw cuts, all loose, spalled material shall be cleaned away from saw cut, chipping back to sound asphalt concrete or Portland cement concrete, and all loose material cleaned from loop wires.

3. The mixing ratio is 1 part by volume of Component A to 1 part by volume of Component B. No more material shall be mixed than can be used within 10 minutes from the time mixing operations are started.

728.03.10 EPOXY ADHESIVES FOR PAVEMENT MARKERS

A. **Rapid-Set Epoxy Adhesive:**

1. This specification covers a high viscosity, rapid set epoxy formulated primarily for use in bonding pavement markers to Portland cement concrete and asphalt cement.

2. The epoxy used under this specification shall conform to AASHTO M237, Type I.

3. Tests for requirements for AASHTO M237 shall be performed in accordance with AASHTO T237.

B. **Standard-Set Epoxy Adhesive:**

1. This specification covers a high viscosity, rapid set epoxy formulated primarily for use in bonding pavement markers to Portland cement concrete and asphalt cement.
2. The epoxy used under this specification shall conform to AASHTO M237, Type II.
3. Tests for requirements for AASHTO M237 shall be performed in accordance with AASHTO T237.

728.03.11 BINDER (ADHESIVE), STRUCTURAL EPOXY

A. **Classification:**

1. This specification covers a multipurpose, 2-component, moisture tolerant, structural epoxy adhesive, formulated primarily for bonding new concrete to asphalt cement pavement.
2. This epoxy is formulated for hot weather concrete placements requiring a bonding adhesive and is suitable for minimum substrate and ambient temperature of 40 degrees F.
3. Physical properties shall meet the criteria a minimum of 2,200 psi and heat deflection temperature at 14 days shall be a minimum of 108 degrees F.

B. **Directions for use:**

1. The epoxy shall not be mixed with more material than can be used within 60 minutes at 73 degrees F or 30 minutes at 100 degrees F from the time mixing operations begin.
2. Surface shall be clean and sound.
3. Surface may be dry or damp, but shall be free of standing water, dust, curing compound, and other contaminants.

END OF SECTION 728

SECTION 729 – FLY ASH

SCOPE

729.01.01 MATERIALS COVERED

A. This specification covers the quality of fly ash used in Portland cement products.

REQUIREMENTS

729.02.01 REQUIREMENTS

A. Fly ash shall conform to ASTM C618 for Class F, with the following exceptions:

1. The maximum loss of ignition shall be 6 percent.
2. The sulfate resistance factor, R, shall not exceed 1.5, where

$$R = \frac{(\%\ CaO - 5)}{\%\ Fe_2O_3}$$

B. Certification that the fly ash used in Portland cement concrete conforms to ASTM C618 shall be provided by the supplier of the fly ash.

C. Copies of the certification shall be provided to the Engineer by the supplier of the fly ash or supplier of the Portland cement concrete fly ash upon request.

D. The certification provided is to be a maximum of 30 days old.

END OF SECTION 729

APPENDIX A – SWPPP CHECKLIST

LAS VEGAS VALLEY STORMWATER QUALITY MANAGEMENT PROGRAM
CONSTRUCTION PERMIT SUBMITTAL CHECKLIST

(Applies to all Grading, Site Development, Building, and Encroachment Permits and plans including Final, Parcel, Subdivision, Site Drainage and Erosion and Sediment Control Plans)

Owner / Operator (applicant) Information

Name:_____

Address:_____

City:_____ State:___ Zip Code:_____ Phone:_____

Project Name: _____

Project Address/Location:_____

Signature:_____Date:_____

Total area of land disturbance =_____acres, _____square feet (must match permit application).

If the area of land disturbance is one acre or more, the applicant must submit a copy of their Notice of Intent (NOI) to Nevada Division of Environmental Protection (NDEP) to be regulated under Stormwater General Permit NVR100000 and submit a copy of the receipt for payment of the annual fee or the letter of authorization from NDEP (address attached). Once payment has been received by NDEP, the applicant is immediately covered under the State's permit.

☐ 1. Copy of NOI attached
☐ 2. Copy of receipt **or** letter of authorization attached

By submitting a copy of the NOI and the receipt or authorization from NDEP, the applicant acknowledges that they are aware of the requirements set forth in the State's General Permit and have developed and will implement a site specific Stormwater Pollution Prevention Plan (SWPPP). The applicant further acknowledges that they are aware of the Las Vegas Valley Construction Site BMP Guidance Manual and the required performance standards set forth in Section 3.2 of the manual. To ensure compliance with these performance standards, the applicant shall submit a completed Performance Standards Compliance Checklist, indicating the BMPs that implement standards 1 – 12. It is recommended that the applicant also attach a copy of the checklist to their SWPPP.

☐ Copy of Performance Standards Compliance Checklist completed (see reverse side)

Yes	No	
☐	☐	Were calculations required for sizing of diversion channels and/or sediment retention basins? If the answer is yes, pursuant to NRS 625.565, a Nevada Registered Professional Engineer must review and stamp plans, such as grading plans and reports that require engineering calculations.

In addition to the submittal requirements specified above and in the ordinances, the following shall be included as a set of standard notes to be depicted on all site plans that disturb one acre or larger:

☐ Standard notes from Section 3.5 of the Las Vegas Valley Construction Site BMP Guidance Manual on design plans

To submit a Notice of Intent (NOI), contact:
Nevada Division of Environmental Protection
Bureau of Water Pollution Control
901 South Stewart Street
Suite 4001
Carson City, NV 89701-5249
Phone: (775) 687-9429
Fax: (775) 687-4684
Web: http://ndep.nv.gov/bwpc/index.htm

LAS VEGAS VALLEY STORMWATER QUALITY MANAGEMENT ROGRAM
CONSTRUCTION PERMIT SUBMITTAL CHECKLIST

The checklist that follows identifies the BMPs that can be used at construction sites to meet each of the Performance Standards of the Las Vegas Valley Construction Site BMP Guidance Manual (BMP Guidance Manual). You must select at least one BMP for each performance standard to meet the minimum requirements. Please refer to the BMP Guidance Manual to assist you in selecting BMPs for your site. It is the responsibility of the person who fills out this checklist to ensure that the BMPs selected are included in the contract bid documents and implemented at the site. If your project or site has characteristics that make meeting a performance standard infeasible or inapplicable (e.g. size of site, slope of site), please explain these characteristics at the bottom of the form.

Performance Standard	Check if Selected	BMPs	Comments
1. Schedule construction and minimize clearing and grading	☐	PL-1 Site Design	
	☐	PL-2 Scheduling	
	☐	PL-3 Phased Construction	
	☐	PL-4 Topsoil Reuse	
	☐	EC-3 Protect Trees/Vegetation	
	☐	Other or N/A (explain)	
2. Stabilize disturbed areas	☐	EC-1 Erosion Control Mats	
	☐	EC-2 Mulching	
	☐	EC-7 Dust Control	
	☐	EC-12 Surface Roughening	
	☐	SPC-6 Revegetation	
	☐	Other or N/A (explain)	
3. Protect slopes	☐	EC-9 Diversion Dikes	
	☐	EC-4 Pipe Slope Drains	
	☐	EC-12 Surface Roughening	
	☐	EC-7 Dust Control	
	☐	EC-1 Erosion Control Mats	
	☐	SPC-6 Revegetation	
	☐	SPC-1 Organic Filter Barriers	
	☐	SPC-2 Sand Bag Barrier	
	☐	SPC-3 Gravel Filter Berms	
	☐	Other or N/A (explain)	
4. Design conveyance for non-erosive velocities	☐	EC-9 Diversion Dikes	
	☐	SPC-4 Check Dams	
	☐	EC-11 Outlet Protection	
	☐	Other or N/A (explain)	
5. Protect waterways, natural drainages and storm drains	☐	PL-1 Site Design	
	☐	EC-9 Diversion Dikes	
	☐	EC-3 Protect Trees/Vegetation	
	☐	SPC-1 Organic Filter Barriers	
	☐	SPC-2 Sand Bag Barriers	
	☐	SPC-3 Gravel Filter Berms	
	☐	SPC-5 Silt Fence	
	☐	SPC-8 Temporary Stream Crossing	
	☐	EC-11 Outlet Protection	
	☐	SPC-7 Storm Drain Inlet Protection	
	☐	Other or N/A (explain)	

Performance Standard	Check if Selected	BMPs	Comments
6. Install sediment traps / retain eroded sediments on-site	☐	SPC-4 Check Dams	
	☐	SPC-1 Organic Filter Barrier	
	☐	SPC-2 Sand Bag Barrier	
	☐	SPC-3 Gravel Filter Berm	
	☐	SPC-5 Silt Fence	
	☐	SPC-9 Temporary Sediment Traps	
	☐	SPC-8 Temporary Sediment Basins	
	☐	Other or N/A (explain)	
7. Remove accumulated sediment	☐	Use Standard Note No. 5	
	☐	Other or N/A (explain)	
8. Control site entrances and exits	☐	EC-5 Stabilized Site Entrance	
	☐	EC-6 Construction Road Stabilization	
	☐	SPC-11 Entrance/Exit Tire Wash	
	☐	GH-6 Road Sweeping/Trackout Cleaning	
	☐	Other or N/A (explain)	
9. Manage materials and wastes	☐	GH-2 Solid Waste Management	
	☐	GH-5 Spill Containment Plan	
	☐	Other or N/A (explain)	
10. Manage equipment and vehicles	☐	GH-3 Equipment Maintenance Procedures	
	☐	GH-4 Designated Washdown Area	
	☐	Other or N/A (explain)	
11. Stabilization of inactive disturbed areas	☐	PL-4 Topsoil Reuse	
	☐	EC-2 Mulching	
	☐	EC-7 Dust Control	
	☐	SPC-6 Revegetation	
	☐	Other or N/A (explain)	

Explanation why performance standard(s) cannot be met:

SPECIFICATIONS

May 2018

SKYE CANYON DETENTION BASIN 2

PREPARED FOR:

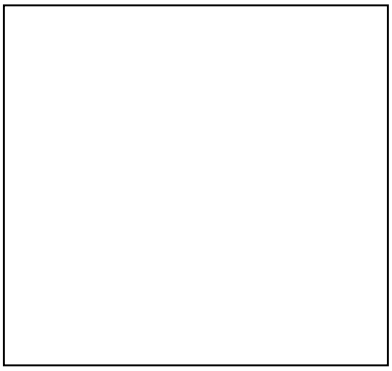
NINETY-FIVE MANAGEMENT LLC

PREPARED BY:

SLATER HANIFAN GROUP

SKYE CANYON DETENTION BASIN 2

SPECIFICATIONS



NOTE: THE ENGINEERS' APPROVAL AND SUBSEQUENT SEAL IS LIMITED TO THE FOLLOWING PORTIONS OF THESE DOCUMENTS AS PREPARED BY OR UNDER THE DIRECT SUPERVISION OF THE ENGINEER:

(1) SPECIFICATIONS, PAGES SP-100-1 THROUGH SP-729-1

ALL OTHER ATTACHMENTS, INCLUSIONS, ENCLOSURES, SCHEDULES, FORMS, GRAPHICS, ETC. WERE PREPARED BY OTHERS AND NOT UNDER THE DIRECT SUPERVISION OF THE ENGINEER.

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SECTION 100 – GENERAL PROJECT REQUIREMENTS

100.01 REFERENCE SPECIFICATIONS AND DRAWINGS

A. Work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications or the applicable codes. Wherever references are made in the contract, standards or codes in accordance with which work under this contract is to be performed or tested, the latest edition or latest revision(s) of the standards or codes shall apply.

B. **"Uniform Standard Drawings for Public Works Construction, Clark County Area, Nevada Volume I and Volume II"**, also referred to as the "Uniform Standard Drawings" or "USD" and shall be adhered to except where otherwise provided herein or otherwise shown on the Contract Drawings. Copies may be obtained from the Regional Transportation Commission of Southern Nevada, 600 S. Grand Central Parkway, Suite 350, Las Vegas, Nevada 89106 or online at www.rtcsouthernnevada.com

C. **"Manual on Uniform Traffic Control Devices"**, also referred to as "MUTCD" and shall be adhered to except where otherwise provided herein or otherwise shown on the Contract Drawings. Copies may be obtained from the U.S. Government Printing Office, Washington, D.C. 20402 or online at mutcd.fhwa.dot.gov

D. **"State of Nevada Department of Transportation Standard Specifications for Road and Bridge Construction"**, also referred to as the "NDOT Standard Specifications" or the "State of Nevada Standard Specifications" and shall be adhered to when specifically referenced herein or as shown on the Contract Drawings. NDOT is located at 123 E. Washington Blvd., Las Vegas, Nevada 89101; Phone (702) 385-6500 or online at www.nevadadot.com/business/contractor/standards/

E. **"State of Nevada Department of Transportation Standard Plans for Road and Bridge Construction"**, also referred to as the "NDOT Standard Drawings" or the "State of Nevada Standard Plans" and shall be adhered to when specifically referenced herein or as shown on the Contract Drawings. NDOT is located at 123 E. Washington Blvd., Las Vegas, Nevada 89101; Phone (702) 385-6500 or online at www.nevadadot.com/business/contractor/standards/.

F. **"Nevada Work Zone Traffic Control Handbook"**, also referred to as the "Work Zone Handbook". Copies may be obtained from Lisa Cody, University of Reno Nevada, (775) 784-1433.

G. **"American Society for Testing and Materials"**, also referred to as the "ASTM". ASTM is located at 100 Barr Harbor Drive, Conshohocken, Pennsylvania, 19428-2959; Phone (610) 832-9585 or online at www.astm.org

H. **"Uniform Design and Construction Standards for Water Distribution Systems"**, also referred to as the "Water District Standards" or "UDACS". Copies may be obtained from the Las Vegas Valley Water District, 1001 South Valley View Boulevard, Las Vegas, Nevada 89153 or online at http://www.lvvwd.com/html/eng_udacs.html

I. **"LVVWD Design Guidance Documents"**, Copies may be obtained from the Las Vegas Valley Water District, 3700 W. Charleston Blvd., Las Vegas, Nevada 89153.

J. **"Design and Construction Standards for Wastewater Collection Systems – Southern Nevada Current Edition"**, also referred to as the "Sewer Specifications" or "DCSWCS". Issued by the Clark County Water Reclamation District, 5857 E. Flamingo Blvd., Las Vegas, Nevada, 89122; Phone (702) 668-8160.

END OF SECTION 100

SECTION 101 – DEFINITIONS AND TERMS

101.01 ABBREVIATIONS

AGA	American Gas Association
AI	The Asphalt Institute
AIEE	American Institute of Electrical Engineers
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ATSSA	American Traffic Safety Services Association
CFR	Code of Federal Regulations
CPM	Critical Path Method
CRSI	Concrete Reinforcement and Steel Institute
EPA	Environmental Protection Agency (USA)
IMSA	International Municipal Signal Association
IPCEA	Insulated Power Cable Engineers' Association
ITB	Instructions to Bidders
NBFU	National Board of Fire Underwriters
NCPI	National Clay Pipe Institute
NDEP	Nevada Department of Environmental Protection
NDOT	Nevada Department of Transportation
NOAA	National Ocean and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRS	Nevada Revised Statutes
OSHA	Occupational Safety and Health Standards
PCA	Portland Cement Association
SSPC	Steel Structures Painting Council
UBC	Uniform Building Code, International Conference of Building Officials
USS	Uniform Standard Specifications for Public Works' Construction Off-Site Improvements, Clark County Area Nevada
USD	Uniform Standard Drawings for Public Works' Construction Off-Site Improvements, Clark County Area Nevada, Volumes I & II

101.02 ADDENDUM

A. A supplemental addition or deletion to the contract documents prior to the advertised bid opening.

101.05 AWARD

A. The acceptance by the Owner of a bid.

101.06 BASE COURSE

A. The layer or layers of specified or selected material of designated thickness on a subgrade to support a surface course.

101.07 BIDDER

A. An individual, partnership, firm, corporation, or any acceptable combination thereof, or joint venture, submitting a bid for the advertised work.

101.12 CHANNEL

A. A natural or artificial water course.

101.16 CONTRACTOR

A. The person, firm, partnership, corporation, permittee, subdivider, or other entity who has entered into a contract or agreement with the Owner. Where work is done under permit issued by the Owner, the permittee shall be construed to be the Contractor. Also,a subdivider who does land development and other work under contract with the Owner.

101.18 CULVERT

A. Any structure not classified as a bridge which provides an opening under the roadway.

101.19 DETOUR

A. A temporary route for traffic around a closed portion of road.

101.22 DRAWINGS

A. That part of the Contract Documents prepared or approved by the Contracting Agency which graphically shows the scope, intent, and character of the Work to be performed by the Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

101.23 EMPLOYEE

A. Any person working on the project mentioned in the contract of which these specifications are a part, and who is under the direction and control, or received compensation from the Contractor or the Contractor's subcontractor.

101.24 ENGINEER

A. The signing engineer on record drawings or other person designated by the Owner acting directly and through the signing engineer’s duly authorized representative.

101.25 EQUIPMENT

A. All machinery and equipment, together with the necessary supplies for upkeep and maintenance, also tools and apparatus necessary for the proper construction and acceptable completion of the work.

101.27 FRONTAGE ROAD OR FRONTAGE STREET

A. A local street or road auxiliary to and located generally on the side of an arterial highway for service to abutting property and adjacent areas and for control of access.

101.31 HYDRAULIC CEMENT

A. An inorganic material or a mixture of inorganic materials that sets and hardens by chemical reaction with water by formation of hydrates, and is capable of doing so under water.

101.32 INSPECTOR

A. The Engineer's or Contracting Agency's authorized representative assigned to make detailed inspections of contract performance.

101.34 LABORATORY

A. The testing laboratory of the Contracting Agency or of any other testing laboratory which may be designated by the Engineer.

101.36 MATERIALS

A. Any substances specified for use in the construction of the project and its appurtenances.

101.41 PAVEMENT STRUCTURE

A. The combination of base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

101.44 PLANS

A. The approved project plans and Standard Drawings, profiles, typical cross sections, and supplemental drawings, or exact reproductions thereof, which show the location, character, dimensions, and details of the work to be performed. All such documents are to be considered as a part of the plans whether or not noted in the Special Provisions.

B. In the above definition, the following terms are defined as follows:

1. Standard Drawings - The Standard Drawings of the Contracting Agency.

2. Project Drawings - The Project Drawings are specific details and dimensions peculiar to the work and are supplemented by the Standard Drawings insofar as the same may apply.

101.45 PROFILE GRADE

A. The trace of a vertical plane intersecting the top surface of the proposed structural section as shown on the plans. Profile grade means either elevation or gradient of such trace according to the context.

101.46 PROJECT

A. The specific improvement to be constructed together with all appurtenances and construction to be performed thereon at the prices quoted.

101.50 QUALITY ASSURANCE (QA)

A. Planned and systematic operations conducted to ensure that the operations and/or product meets specifications. QA encompasses the Engineer's review and oversight of the Contractor's "Quality Control"; verifying the results of "Quality Control"; and inspecting for conformance to plans and specifications. QA is the responsibility of the "Engineer."

101.51 QUALITY CONTROL (QC)

A. Planned and specified operations necessary to construct items that will meet the requirements for quality and performance as specified. QC includes, but should not be limited to controlling the quality of raw materials, produced materials assemblies, components, finished product, and construction process. QC is the responsibility of the "Contractor."

101.52 RIGHT-OF-WAY OR EASEMENT

A. A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to a highway or other improvements.

101.60 SIDEWALK

A. That portion of the roadway primarily constructed for the use of pedestrians.

101.61 SPECIAL PROVISIONS

A. Special Provisions means the written descriptions of the requirements for the Work incorporated as a part of the Contract.

101.62 SPECIFICATIONS

A. The directions, provisions, and requirements contained in the Specifications and supplemental specifications as modified by the Special Provisions. Whenever the term "these specifications" is used in this book, it means the provisions set forth in this book.

101.64 SUBCONTRACTOR

A. Any individual, firm, or corporation to whom the Contractor, with the consent of the Contracting Agency, sublets any part of the contract.

101.66 SUBSTRUCTURE

A. All of that part of the structure below the bearings of simple and continuous spans, skewbacks or arches, and tops of footings or rigid frames, together with backwall, wingwalls, and wing protection railings.

101.67 SUPERINTENDENT

A. The Contractor's authorized representative in responsible charge of the work, present on the work at all times during the progress to supervise and direct the construction, to receive and fulfill instructions from the Engineer, and to accept orders for changed and extra work.

101.68 SUPERSTRUCTURE

A. The entire structure except the substructure.

101.70 SUPPLEMENTAL SPECIFICATIONS

A. Additions and revisions to the Specifications that are approved subsequent to the issuance of the published specifications.

101.72 SURFACE COURSE

A. The top layer of an improvement.

101.75 UNSUITABLE MATERIAL

A. Soils that fail to meet the AASHTO Soil Classification System (AASHTO M145) A-1 through A-7 classifications; are highly organic; or are determined to be contaminated.

101.76 UTILITY

A. Tracks, overhead or underground wires, pipelines, conduits, ducts, or structures, sewers, or storm drains owned, operated, or maintained in or across a public right-of-way or private easement.

101.79 BOARD

A. Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the Contractor is required to submit to the Engineer for approval. Working Drawings are not part of the Contract Documents.

B. In order to avoid cumbersome and confusing repetition of expressions in these specifications, it is provided that whenever anything is, or is to be, done, if, as, or, when, or where "contemplated, required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable suitable, accepted, satisfactory, unsatisfactory, sufficient, insufficient, rejected, or condemned," it shall be understood as if the expression were followed by the words "by the Agency."

101.81 AGENCY

A. The governing body to which a work or facility will be dedicated upon successful completion. Agency may be one or more of the following entities: City of Las Vegas, Nevada; City of North Las Vegas, Nevada; Las Vegas Valley Water District, Las Vegas, Nevada; Clark County Sanitation District, Las Vegas, Nevada; Clark County, Nevada; and state of Nevada Department of Transportation.

101.83 CERTIFIED ENVIRONMENTAL MANAGER (CEM)

A. One who is certified by Nevada Department of Environmental Protection as an Environmental Manager.

101.85 DEWATERING

A. The removal and/or lowering of any surface or subsurface water by a method chosen by the Contractor and acceptable to the Engineer, which results in a ground moisture content which enables construction to be carried out under relatively dry and stable conditions. Unless specifically indicated elsewhere in these specifications, no separate payment will be made for dewatering but shall be included in other items of work.

101.88 NOMINAL DIAMETER

A. The inside diameter of a standard pipe as specified by the manufacturer.

101.91 SERVICE CONNECTION LATERAL

A. All or any portion of a utility, including pipe, conduit, wire, cable or duct, including meters between a utility distribution (or collection) line and an individual customer or customers.

END OF SECTION 101

SECTION 104 – SCOPE OF WORK

104.00 LOCATION AND SCOPE OF WORK

A. LOCATION: Iron Mountain Road and Puli Drive

B. SCOPE OF WORK: The project is located at the intersection of Iron Mountain Road and Puli Drive, with improvements extending approximately 2,630 feet south of Iron Mountain Road along the Puli alignment. The project consists of a 76.3 acre-foot detention basin with a portion of the interior slope soil cement lined, an emergency overflow spillway structure, a debris dewatering tower, a basin outlet structure consisting of 60-inch RCP storm drain pipe, a 750 linear foot concrete collector channel into a 205-foot long by 25-foot min. wide by 4.5-foot high chute and baffle block south stilling basin, a 85-foot long by 25-foot to 60-foot wide by 4.5-foot high chute and baffle block north stilling basin, approximately 800 linear foot of 7-foot wide by 6-inch height concrete low flow u-channels, Type II and concrete access roads/ramps around the entire perimeter and into the detention basin, graded native path for NV Energy access, a flood threat recognition station, riprap erosion control, block and cable fencing around the basin perimeter and flood warning signs.

104.05 RIGHTS IN AND USE OF MATERIALS FOUND ON THE PROJECT

A. The Contractor with the approval of the Engineer, may use on the project such stone, gravel, sand, or other material determined suitable by the Engineer, as may be found in the excavation and will be paid for both the excavation of such materials at the corresponding contract unit price and also at the contract unit price for the pay item for which the excavated material is used. At no additional cost to the Owner, the Contractor shall replace with other acceptable material all of that portion of the excavation material so removed and used which was needed for use in the embankments, backfills, approaches, or otherwise. No charge for the materials so used will be made against the Contractor. The Contractor shall not excavate or remove any material from within the project location which is not within the grading limits, as indicated by the slope and grade lines, without written authorization from the Engineer.

B. Unless otherwise provided, the material from any existing old structure may be used temporarily by the Contractor in the erection of the new structure. Such material shall not be cut or otherwise damaged except with the approval of the Engineer.

END OF SECTION 104

SECTION 105 – CONTROL OF WORK

105.01 AUTHORITY OF THE ENGINEER

A. The Engineer will decide all questions that may arise as to the quality and acceptability of materials furnished and work performed and as to the rate of progress of the work; and all questions that may arise as to the interpretation of the plans and specifications.

B. The Engineer will have the authority to suspend the work wholly or in part due to the failure of the Contractor to correct conditions unsafe for the workmen or the general public; for failure to comply with the technical provisions of the contract; for failure to carry out orders; for such periods as the Engineer may deem necessary due to unsuitable weather; and for conditions considered unsuitable for the prosecution of the work.

C. Whenever the Contractor fails to carry out orders of the Engineer, the Engineer will have executive authority to enforce such orders and the Engineer's decision shall be final.

D. Decisions of the Engineer shall be subject to appeal to the Board, whose decisions shall be final and conclusive.

E. The Engineer shall not direct Contractor’s means, methods, techniques, sequences or procedures of construction, or the safety precautions and program incident thereto and will not be responsible for Contractor’s failure to perform the work in accordance with the Contract.

F. Engineer will not be responsible for the acts or omissions of the Contractor, or any Subcontractor or any of his or their agents or employees or any other persons at the site or otherwise performing any of the work.

105.02 PLANS AND WORKING DRAWINGS

A. The contract plans and drawings do not purport to show all the details of the work. These documents are intended to illustrate the character and extent of the performance desired under the contract; therefore, they may be supplemented or revised from time to time, as the work progresses, by the Engineer or (subject to approval of the Engineer) by the Contractor. The Contractor will keep one set of plans available on the work at all times.

B. The plans may be supplemented by such working drawings as are necessary to adequately control the work. Working drawings for structures shall be furnished by the Contractor. Working Drawings shall include stress sheets, shop drawings, erection plans, fabrication sheets, falsework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data required by the Engineer. Unless otherwise specified, all working drawings shall be submitted in triplicate 10 days prior to start of related work and approved by the Engineer. Such approval shall not relieve the Contractor of any of the Contractor's responsibility under the contract for the successful completion of the work. It is mutually agreed that the Contractor shall be responsible for agreement of dimensions and details as well as for conformity of the Contractor's working drawings with the approved plans and specifications.

D. The Contractor shall make submittals for all materials prior to use. All submittals shall be via electronic communication (pdf at ≥ 300 dpi) unless otherwise approved by the Engineer.
   1. All submittals made and signed by the Contractor shall be accompanied by a submittal coversheet with the Contractor's review stamp and the Contractor's standard transmittal form, containing, at a minimum, the bid item to which the submittal pertains. All submittals are to be numbered by specification section then sequential submittal number (e.g. 203-001, 203-002, etc.).
   2. Any submittals not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for re-submittal.
   3. Items submitted by anyone other than the Contractor will be returned, without action, for resubmission by the Contractor.
   4. All submittals shall be carefully reviewed by an authorized representative of the Contractor prior to submission to the Engineer.
   5. Each submittal shall be dated, signed and certified by the Contractor as being correct and in strict conformance with the Contract Documents.
   6. All non-certified submittals will be returned to the Contractor without action taken by the Engineer and any delays caused thereby shall be the total responsibility of the Contractor.

E. The Contractor shall submit any City of Las Vegas acceptance letters for asphalt concrete, aggregate and Portland Cement Concrete in lieu of test data.
   1. If the asphalt concrete, aggregate or Portland Cement Concrete mix designs are not on the current IQAC list of approved materials, a mix design for asphalt or Portland Cement Concrete or test data must be signed and approved by a Nevada Licensed P.E.
   2. The Contractor shall establish its bid price according to the mix designs that are delineated on the current IQAC list of approved materials.
   3. Any additional costs arising from mix designs submitted by the Contractor that are rejected for not meeting the IQAC criteria for any reason whatsoever shall be borne solely by the Contractor.
   4. All mix designs are to be submitted thirty (30) days prior to anticipated material placement.

F. The Engineer's review of working drawings submitted by the Contractor will cover only general conformity to the drawings, specifications and special provisions, external connections and dimensions which affect the layout. Unless otherwise specified within the Special Provisions, allow Owner fifteen (15) Working Days for each submittal review.
   1. The Engineer's review does not indicate a thorough review of all dimensions, quantities and details of the material, equipment, devices or items shown.
   2. The Engineer's review of submittals shall not relieve Contractor from responsibility for errors, omissions, or deviations, or responsibility for compliance with the Contract Documents.
   3. Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

G. If a submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS AS NOTED", formal revision and resubmission of said submittal will not be required.

H. If a copy of the submittal is returned to the Contractor marked "AMEND – RESUBMIT", or "REJECTED – RESUBMIT" the Contractor shall revise said submittal and shall resubmit to the Engineer.
   1. When corrected copies are submitted, the Contractor shall indicate any revisions not made and any revisions made other than those called for by the Engineer on previous submissions.
   2. Manufacture, fabrications or purchasing of items prior to final acceptance is at the Contractor's own risk.

105.03 CONFORMITY WITH PLANS AND SPECIFICATIONS

A. Work performed and materials furnished shall be in conformity with the lines, grades, cross sections, dimensions, and materials requirements, including tolerances, shown on the plans or indicated in the specifications.

B. In the event the Engineer finds the materials or the finished product in which the materials are used not in conformity with the plans and specifications, but that acceptable work has been produced, the Engineer shall then make a determination if the work shall be accepted and remain in place. In this event, the Engineer will document the basis of acceptance by plans modification concurred in by the Agency.

C. In the event the Engineer finds the materials or the finished product in which the materials are used or the work performed are not in conformity with the plans and specifications and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by the Contractor at no additional cost to the Owner.

D. In the event the Contractor desires to perform work that does not conform with the plans and specifications, the Contractor will make a written request to the Engineer for review and approval.

E. As a minimum, the written request will address the following:
   1. The Contractor will demonstrate that the performed work is of equal or greater value than the work specified in the plans and specifications.
   2. Various requests may require the seal and signature of approval from a licensed Nevada Professional Engineer. Prior to submitting a request, the Contractor shall inquire as to whether the Owner will require the approval of an Engineer, and if so, the Contractor will be responsible for the associated costs of this review.

105.04 COORDINATION OF PLANS, SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS, AND SPECIAL PROVISIONS

A. The specifications, supplemental specifications, plans, special provisions, and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. These documents are intended to be

complementary and to describe and provide for a complete work. In case of discrepancy, the following precedence will govern:

1. Permits from other agencies as may be required by law.
2. Plans.
3. Specifications.

B. Change orders, supplemental agreements, and approved revisions to plans and specifications will take precedence over Items 2 and 3 listed above. Detailed plans shall have precedence over general plans.

C. The Contractor shall take no advantage of any apparent error or omission in the plans or specifications. In the event the Contractor discovers such an error or omission, the Contractor shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications.

105.05 COOPERATION BY CONTRACTOR

A. The Contractor will be supplied with a minimum of 4 sets of approved plans and contract assemblies including specifications, one set of which the Contractor shall keep available on the work at all times. Additional copies of plans and specifications may be obtained by the Contractor upon written request to the Owner.

B. The Contractor shall give the work constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer, the Agency's inspectors, and other contractors in every way possible.

C. The Contractor shall provide his own mobile telephone, capable of making and receiving both local and long distance calls to allow communication with the Engineer and Resident Project Representative at all times. The contractor shall provide his own electronic device capable of receiving and sending e-mails from the field. The Contractor shall also provide his own electric power, potable water, construction water and sanitary facilities required in the performance of the work under the contract. All costs associated with these items shall be the responsibility of the Contactor. :

D. The prime Contractor shall have on the work at all times, as the Contractor's agent, a competent superintendent capable of reading and thoroughly understanding the plans and specifications and thoroughly experienced in the type of work being performed, who shall receive instructions from the Engineer or the Engineer's authorized representatives. Such superintendent shall be designated in writing before starting work. The superintendent shall have full authority to execute orders or directions of the Engineer without delay, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. Such superintendent shall be furnished irrespective of the amount of work sublet.

E. Whenever the Contractor or the Contractor's authorized representative is not present on any particular part of the work where it may be desired to give direction, orders will be given by the Engineer to the Contractor's superintendent, foreman, or other person in

charge of the operation, who is present, and these orders shall have the same force and effect as if given to the Contractor or the Contractor's designated representative.

F. Any order given by the Engineer, not otherwise required by the specifications to be in writing, will on request of the Contractor be given or confirmed by the Engineer in writing.

105.06 COOPERATION WITH UTILITIES

A. The Permittee, in the case of private contract, and the Agency, in the case of cash contract or Special Improvement District contract, will search known substructure records which describe the location of utility substructures, and will indicate on the plans for the project those substructures, except for service connections, which may affect the work.

B. Where underground main distribution conduits such as water, gas, sewer, electric power, telephone, or cable television are shown on the plans, the Contractor, shall assume that every property parcel will be served by a service connection for each type of utility.

C. At least 2 working days before entering on the work, the Contractor shall notify all the utility owners to mark or otherwise indicate the approximate location of their subsurface facilities including, but not limited to, structures, main conduits, and service connections. This requirement will not apply to sewer and storm drain installations where their location and depth are shown on the plans for the project.

D. It shall be the Contractor's responsibility to determine the location and depth of all utilities, including service connections, for which approximate locations have been marked by the respective owners and which the Contractor believes may affect or be affected by the Contractor's operations. If no pay item is provided in the contract for this work, full compensation for such work shall be considered as included in the prices bid for other items of work.

E. The Contractor shall not interrupt the service function or disturb the supporting base of any utility without authority from the owner or an order from the Agency.

F. Where protection is required to ensure support of utilities, the Contractor shall, unless otherwise provided, furnish and place the necessary protection at no additional cost to the Owner.

G. Upon learning of the existence and location of any utility omitted from or shown incorrectly on the plans, or not properly marked, the Contractor shall immediately notify the Engineer in writing.

H. The Contractor shall immediately notify the Owner and the utility owner if the Contractor disturbs or damages any utility. The Contractor shall bear the costs of repair or replacement of any utility damaged if properly located as provided.

I. When placing concrete around or contiguous to any utility installation, the Contractor, at no additional cost to the Contracting Agency, shall (1) furnish and install a 2-inch cushion of expansion joint material or other similar resilient material; or (2) provide a sleeve or other opening which will result in a 2-inch minimum clear annular space between the concrete

and the utility; or (3) provide other acceptable means to prevent embedment in or bonding to the concrete. The standards of the affected utility company shall prevail. Where concrete is used for backfill or for structures which would result in embedment, or partial embedment, of a metallic utility installation, or where the coating, bedding, or other cathodic protection system is exposed or damaged by the Contractor's operations, or as may be required by the work, the Contractor shall notify the Engineer and arrange to secure the advice of the affected utility owner regarding the procedures required to maintain or restore the integrity of the system.

J. Unless otherwise specified, the Contractor shall remove all interfering portions of utilities shown on the plans or indicated in the bid documents as "abandoned" or "to be abandoned in place." Before starting removal operations, the Contractor shall ascertain from the Contracting Agency whether the abandonment is complete, and the costs involved in the removal and disposal shall be absorbed in the bid for the items of work necessitating such removals.

K. When feasible, the owners responsible for utilities within the area affected by the work shall complete their necessary installations, relocations, repairs or replacements before commencement of work by the Contractor. Utilities that are relocated in order to avoid interference with the proposed permanent work shall be protected in their relocated position and the cost of such protection shall be absorbed in the various items of the contract.

L. A utility company installing a new line is responsible for relocation of other utility company facilities if the new line conflicts with existing locations.

M. When the plans or specifications provide for the Contractor to alter, relocate, or reconstruct a utility, all costs for such work shall be included in the bid for the items of work necessitating such work. Temporary or permanent relocation or alteration of utilities requested by the Contractor for the Contractor's own convenience shall be the Contractor's responsibility, and the Contractor shall make all arrangements and bear all costs.

N. The utility owner will relocate service connections as necessary within the limits of the work or within temporary construction or slope easement unless otherwise specified. When directed by the Engineer, the Contractor shall arrange for the relocation of service connections as necessary between the meter and property line, or between a meter and the limits of temporary construction or slope easements. The Contractor may, for the Contractor's own convenience or to expedite the work, agree with the owner of any utility to disconnect and reconnect interfering service connections. The Agency will not be involved in any such agreement.

O. The Contractor shall notify the Agency of the Contractor's construction schedule insofar as it affects the protection, removal, or relocation of utilities.

P. The Contractor will not be entitled to damages attributable to utility relocations or alterations if correctly located, noted, and completed.

Q. When necessary, the Contractor shall so conduct the Contractor's operations as to permit access to the work site and provide time for utility work to be accomplished during the progress of the contract work.

R. The Owner and Engineer do not guarantee that all existing utilities are shown on the contract drawings, or that the utilities are shown in their exact locations. The Owner may or may not have indicated utility service connection laterals on the Contract Drawings. The Contractor shall be responsible for verifying that each utility has responded to each notification.

S. During all time periods when any utility valve, manhole, vault, or pull box may be buried or otherwise rendered inaccessible, the Contractor shall have personnel and equipment on standby (respond within 1 hour) to uncover any valve, manhole, vault or pull box when requested by the Engineer or owning agency.

1. All utility valves, manholes, vaults, or pull-boxes which are buried shall be conspicuously marked in a fashion acceptable to the owner and Engineer by the Contractor to allow their location to be determined by the Engineer or utility personnel under adverse conditions, (inclement weather or darkness).

2. All cost for providing standby personnel and equipment and for uncovering buried facilities shall not be paid for separately but shall be considered incidental to the items of work associated with the burial.

If, during the course of paving operations, the Contractor paves over water and/or gas distribution valves, the Contractor shall have no more than 48 hours to remove the asphalt over the valves and adjust the valves to grade. The Contractor shall be responsible for adequately marking all such valves prior to paving operations so as to readily locate them after paving. Adjustment of valves may require a temporary adjustment to dense grade prior to the permanent final adjustment to the top of finish grade.

T. The Contractor shall pothole to determine the exact vertical and horizontal location of all existing utilities indicated on the Drawings, or marked in the field, crossing or potentially impacting the proposed reinforced concrete box, pipeline, mains, and laterals, at least (10) days in advance of the construction of any underground facility.

1. Contractor shall provide Engineer all pothole information obtained including measurements, dimensions, elevations, types and sizes of utilities within one working day following the potholing.

U. During the performance of contract work, the owner of any utility affected by the work shall have the right to enter, when necessary, upon any portion of the work for the purpose of maintaining service and of making changes in, or repairs to said utility.

W. The Contractor shall not shut off the water supply to a hydrant, nor in any way, prevent access to a fire hydrant until he has secured permission to do so from the proper authorities.

105.07 COOPERATION BETWEEN CONTRACTORS

A. The Agency reserves the right at any time to contract and perform other or additional work on or near the work covered by the contract.

B. When separate contracts are let within the limits of any one project, each Contractor shall conduct Contractor's work so as not to interfere with or hinder the progress or completion of the work being performed by the other Contractors. Contractors working on the same project shall cooperate with each other as directed.

C. Each Contractor involved shall assume all liability, financial or otherwise, in connection with Contractor's contract and shall protect and save harmless the Contracting Agency from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced by Contractor because of the presence and operations of other Contractors working within the limits of the same project.

D. The Contractor shall arrange Contractor's work and shall place and dispose of the materials being used so as not to interfere with the operations of other Contractors within the limits of the same project. Contractor shall join Contractor's work with that of the others in an acceptable manner and shall perform the work in proper sequence to that of the others.

105.08 CONSTRUCTION STAKES, LINES AND GRADES

A. Construction staking work shall be required of the Contractor, as indicated in ***Section 622 "Construction Surveying by the Contractor"*** of these Specifications, and shall conform to all requirements therein.

105.09 RECORD DOCUMENTS

A. General Instructions
   1. Ensure entries are complete and accurate. Current Progress Record Documents shall be available for review by the Owner, Owner's Consulting Engineer and the Owner's Construction Management Consultant (if applicable) at all times during the progress of the work.
   2. Store Progress Record Documents separate from documents used for construction.
   3. Neatly record information concurrent with construction progress. Maintain Progress Record Documents in a clean and orderly manner. The Contractor shall not conceal any work until the required record information has been recorded on the record document set. The Contractor shall bear the cost of uncovering any prematurely concealed work for required record documentation.
   4. Progress Record Documents shall be made available to the Owner, the Owner's Consulting Engineer and the Owner's Construction Management Consultant (if applicable) for review at the site, at progress meetings and during Owner's review of the monthly progress bill requesting payment
   5. Failure of the Contractor to maintain a current record of information on the Progress Record Documents shall entitle the Owner to withhold payment until corrected. The release of payment to the Contractor shall be contingent upon the Contractor's diligent performance as required herein.

B. Progress Record Documents - The Contractor shall maintain the following documents, which constitute the Progress Record Documents, at the job site during construction:
   1. Drawings – Owner shall provide a full size copy of the approved set of drawings on bond paper for use as the Progress Record Document drawings prior to starting the work.
      a. The Contractor will supplement the drawing set with approved drawings submitted as deferred submittals. The Contractor shall insert approved Addenda and revision sheets in front of the original sheet
      b. The Contractor shall legibly mark each sheet to record actual construction including (but not limited to):
         i. Measured horizontal and vertical locations of underground installations, utilities and appurtenances referenced to permanent surface improvements;
         ii. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work;
         iii. Field changes of dimension and detail;
         iv. Details not on original Contract Drawings
   2. Specifications – The Contractor shall legibly mark and record at each product section description of actual products installed, including (but not limited to) the following:
      a. Manufacturer's name and product model and number
      b. Product substitutions or alternates utilized;
      c. Changes made by addenda and modifications.
   3. The Contractor shall keep copies of and maintain a record of all Change Orders and any other modifications to the Contract.
   4. The Contractor shall keep copies of and maintain a record of all reviewed Shop Drawings, Product Data and Samples.
   5. The Contractor shall keep copies of and maintain a record of all Manufacturer's instructions for assembly, installation and adjusting.

C. Final Record Documents - Upon completion of the work, including all punch list items and prior to Release of Retention, the Contractor shall provide to Owner a complete set of Final Record Documents. The Final Record Documents shall include (but not limited to) the following:
   1. Final Drawings
      a. The Contractor will supplement the drawing set with approved drawings submitted as deferred submittals. The Contractor shall insert approved Addenda and revision sheets in front of the original sheet including any revisions required for completion of the punch list
      b. The Contractor shall legibly mark each sheet to record actual construction including, (but not limited to):
         i. Measured horizontal and vertical locations of underground installations, utilities and appurtenances referenced to permanent surface improvements;
         ii. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work;
         iii. Field changes of dimension and detail;
         iv. Details not on original Contract Drawings;
         v. Changes made during completion of the punch list.

c. The Contractor shall mark each sheet as “Record” or “As-Built”

2. Specifications
   a. Manufacturer’s name and product model and number
   b. Product Substitutions or alternates utilized
   c. Changes made by Addenda and modifications
   d. Changes made during completion of the punch list.
3. Contractor shall keep copies of and maintain a record of all Change Orders and any other modifications to the Contract including any changes made during completion of the punch list.
4. The Contractor shall keep copies of and maintain a record of all reviewed Shop Drawings, Product Data and Samples including any additional shop drawings, product data and samples required for completion of the punch list.
5. The Contractor shall keep copies of and maintain a record of all Manufacturer’s instructions for assembly, installation and adjusting and any Manufacturer’s instructions for assembly, installation and adjusting required for completion of the punch list.

105.10 DUTIES OF THE INSPECTOR

A. Inspectors for the Agency will be authorized to inspect all work done and all materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector will not be authorized to issue instructions contrary to the plans and specifications, or to act in any capacity for the Contractor.

105.11 INSPECTION

A. All materials and each part or detail of the work shall be subject to inspection by the Engineer. The Engineer shall be provided acceptable access to all parts of the work and shall be furnished with such information and assistance by the Contractor as required to make a complete and detailed inspection.

B. Any work done or materials used without inspection by an authorized Engineer’s representative may be ordered removed unless the material meets the specifications and shall be replaced at no additional cost to the Owner unless the Engineer representative failed to inspect after having been given notice in writing that the work was to be performed. If the noninspected work or material proves acceptable the work or material may remain, but any expenses entailed in a late inspection shall be the Contractor's.

C. If the Engineer requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing and the replacing of the covering, or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing and replacing of the covering, or making good of the parts removed will be at no additional cost to the Owner.

D. When facilities of any unit of government or political subdivision or of any railroad corporation or public utility corporation are adjusted or constructed as a part of the work covered by this contract, its respective representatives shall have the right to inspect the work. Such inspection shall in no sense make any unit of government or political subdivision or any railroad corporation or public utility corporation a party to this contract, and shall in no way interfere with the rights of either party thereunder.

E. A full time third party special inspector and testing agency shall be hired and provide weekly reports to the City of Las Vegas Building Department – Offsite Inspections and Testing. The special inspector and testing agency is required to be listed on the current Quality Assurance Agency list issued by Clark County Building Department for the applicable work and inspection. City of Las Vegas is required to review and verify the list of special inspectors and agencies hired by the owner, prior to the start of construction. The current Quality Assurance Agency list of approved personnel is found at the below webpage.

http://www.clarkcountynv.gov/building/engineering/Approved%20Listings/qaainsp_list.pdf

105.12 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK

A. All work which does not conform to the requirements of the contract will be considered as unacceptable work, unless otherwise determined acceptable under the provisions in ***Subsection 105.03, "Conformity with Plans and Specifications."***

B. Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause, found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner.

C. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the plans, or as given except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at no additional cost to the Owner.

D. Upon failure on the part of the Contractor to comply forthwith with any order of the Engineer, made under the provisions of this article, the Owner will have authority to cause unacceptable work to be remedied or removed or replaced and unauthorized work to be removed and to withhold the costs from any money due or to become due to the Contractor.

105.13 LOAD AND SPEED RESTRICTIONS

A. The Contractor shall be responsible for all damage to the work caused by Contractor's hauling equipment.

B. In hauling material for incorporation in portions of the project, loads which are in excess of the limits set by the Agency will not be permitted on any existing bridge or new and

existing bituminous base and surface, cement treated base, or Portland cement concrete paving which is to remain in place for vehicular traffic within the project or between the project and the pits or other sources of materials. Load limits established by the Contracting Agency for the project shall be complied with regardless of the source of materials, whether from described pits, approved pits, or commercial sources. Unless otherwise stated in the Special Provisions, the maximum loads shall not exceed the limits set forth in Chapter 484, "Traffic Laws," of the Nevada Revised Statutes and all acts amendatory thereto or supplementary thereto.

C. Construction loads greater than legal loads may be carried over any new bridge structure within the project providing the Contractor complies with all of the following limitations and provisions:

1. Concrete in any such structure shall have attained designed strength as shown on the structure plans.

2. The gross load of the vehicle shall not exceed 108,000 pounds.

3. Gross load on any individual axle shall not exceed 48,000 pounds.

4. The gross load on any individual set of tandem axles spaced not more than 6 feet apart shall not exceed 72,000 pounds.

5. The center to center spacing of individual axles or center to center spacing of pairs of tandem axles shall not be less than 14 feet.

6. No more than one lane of vehicles shall operate over any structure.

7. The speed of any vehicle approaching or traveling on any structure shall not exceed 10 mph.

8. The roadway surface approaching any structure shall be kept smooth and uniformly graded for 150 feet each side of the structure and shall be maintained to provide a uniform transition onto the structure.

9. A cover of 6 inches $\pm$ 1 inch shall be placed and maintained on the decks of all structures. Cover material shall not include rocks of diameter greater than 2 inches.

D. The limitations specified in items 2, 3, 4, 5, 6, 7, 8, and 9 above may be waived for all reinforced concrete box culverts providing that the depth of fill compacted and in place over the reinforced concrete box culvert is equal to or greater than the distance between inside faces of outside walls measured along center line of roadway. Fill may be placed not to exceed profile grade elevation.

E. Construction loads greater than legal loads may be carried over structures within the project which have spans of 10 feet to 20 feet only when the Contractor complies with the above Subparagraph C, numbers 3 through 9, inclusive; however, the limitations as set forth in Subparagraph C, numbers 3 through 5, inclusive, may be waived by the Engineer for reinforced concrete box structures which are adequately supported by shoring. The

Contractor shall submit Contractor's proposed shoring details and the actual loads and axle spacings to the Engineer for review prior to the planned hauling. Approval will be based on a review of the shoring details and a physical inspection of the shoring complete and in place.

F. The Engineer shall make sufficient checks to satisfy Engineer that the Contractor is complying with all limitations, and any violation shall result in denying the Contractor use of the structure until the violation has been corrected to the satisfaction of the Engineer.

G. The provision that the Contractor may haul construction loads greater than legal loads on new structures shall not relieve the Contractor of Contractor's responsibility for all damage caused by Contractor's hauling equipment.

H. The Engineer may, for the protection of the traveling public, establish speed limits on or adjacent to the project. Such limitations of speed shall be strictly observed by the Contractor.

105.14 MAINTENANCE DURING CONSTRUCTION

A. The Contractor shall maintain the work during construction and until the project is accepted, except as provided for in ***Subsection 107.15, "Relief from Maintenance and Responsibility."*** This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that the roadway and structures are at all times, to be kept in a condition satisfactory to the Engineer.

B. In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

C. Except as provided for in ***Subsection 107.15, "Relief from Maintenance and Responsibility,"*** all costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various pay items and the Contractor will not be paid an additional amount for such work.

D. The Contractor shall maintain a temporary AC patch over backfilled pipe trenches, subject to traffic, during the course of the project to the satisfaction of the Engineer.

1. The temporary patch shall be permanently repaired or removed as soon as the Contractor's operations allow. Temporary asphalt patching will not be allowed to remain longer than 30 calendar days before permanent paving is placed.

2. Should areas of temporary pavement fail and become hazardous, the Contractor shall repair at the Engineer's direction and at the Contractor's expense.

105.15 FAILURE TO MAINTAIN ROADWAY OR STRUCTURE

A. If the Contractor, at any time, fails to comply with the provisions of ***Subsection 105.14, "Maintenance During Construction,"*** the Engineer will immediately notify the Contractor in writing of such noncompliance. If the Contractor fails to remedy unsatisfactory

maintenance within 24 hours after receipt of such notice, the Engineer may immediately proceed to maintain the project, and the entire cost of this maintenance will be deducted from money due or to become due the Contractor.

B. If a condition develops that is dangerous to public safety in the opinion of the Engineer, such condition may be immediately remedied with whatever means is available and the cost of this maintenance will be deducted from money due or to become due to the Contractor.

105.16 FINAL ACCEPTANCE

A. Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer will make an inspection. Upon receipt of Record Drawings, and if all construction and final cleanup provided for and contemplated by the contract are found completed to Engineer's satisfaction, the inspection shall constitute the final inspection and the Engineer will so advise the governing body or commission. The Contractor will be notified in writing of the acceptance of the contract as of the date of the final inspection. Such notice will not be given to the board or commission until all work, including required Record Drawings has been completed to the satisfaction of the Engineer.

END OF SECTION 105

SECTION 106 – CONTROL OF MATERIALS

106.01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS

A. The Contractor shall furnish all materials required to complete the work.

B. No materials or supplies under this contract shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage, conditional sale contract or other security interest, or other agreement by which an interest is retained by the seller. The Contractor warrants that Contractor has good title to all materials and supplies used by the Contractor in the work, free from all liens, claims, or encumbrances.

C. Only materials conforming to the requirements of the specifications shall be incorporated in the work except as provided in ***Subsection 105.03, "Conformity with Plans and Specifications."***

D. The materials furnished and used shall be new, except as may be provided elsewhere in these specifications, on the plans or in the Specifications. The materials shall be manufactured, handled, and used in a workmanlike manner to ensure completed work in accordance with the plans and specifications.

E. The Contractor shall furnish the Engineer a list of the Contractor's sources of materials. The list shall be submitted to the Engineer prior to any official "Notice to Proceed" and in sufficient time to permit proper inspecting and testing of materials to be furnished from such listed sources in advance of their use.

F. The listings of materials that are posted on the Interagency Quality Assurance Committee (IQAC) web page are automatically considered a qualified source. However, this does not remove the responsibility of the Contractor to provide inspection and testing on the project as specified herein. The address for the IQAC webpage is:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

G. If it is found after trial that sources of supply for previously approved materials do not produce uniform and satisfactory products, or if the product from any source proves unacceptable at any time, which includes IQAC listed materials, the Contractor shall furnish satisfactory materials from other sources.

H. The Contractor shall furnish without charge such samples as may be required by the Engineer. The primary inspection and testing shall be made by the Contractor or the Contractor's designated representative, with Engineer oversight. However, it is understood that such inspections and tests, if made at any point other than the point of incorporation in the work, in no way shall be considered as a guarantee of acceptance of such materials nor of continued acceptance of material presumed to be similar to that upon which inspections and tests have been made.

I. Manufacturer's warranties, guarantees, instruction sheets, and parts lists, which are furnished with certain articles or materials incorporated in the work, shall be delivered to the Engineer before acceptance of the completed contract.

J. Contractor's reports and records of inspections made and tests performed shall be submitted to the Engineer as required in these specifications. The Engineer's inspection and testing records, when available at the site of the work, may be examined by the Contractor.

106.02 LOCAL MATERIALS

A. Local material is defined as rock, sand, gravel, earth, or other mineral material, other than local borrow or selected material, obtained or produced from sources in the vicinity of the work specifically for use on the project. Local material does not include materials obtained from established commercial sources.

B. Local materials shall be furnished by the Contractor from any source the Contractor may elect, except when a mandatory source is designated in the Special Provisions.

C. Aggregates for base, surface, and concrete may be the products of approved commercial producers, provided they meet specification requirements.

D. The furnishing of local materials from any source is subject to the provisions of ***Subsection 106.03, "Possible Local Material Sources."*** Material deposits shall not be excavated at locations where their resulting scars will present an unsightly appearance from any street or highway, unless such excavation is approved in writing by the Engineer.

E. Generally, local material deposits will not be approved if located within 1,000 feet of right-of-way line. In any case the Contractor's pit operations shall not encroach within 25 feet of the right-of-way. Payment will not be made on material obtained in violation of these provisions.

F. The Contractor shall, at no additional cost to the Contracting Agency, make any and all arrangements necessary for hauling over local, public, or private roads or property from any source. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals; for doing all the work involved in conforming to the provisions in this subsection; and for furnishing and producing materials from any source shall be considered as included in the price paid for the contract item of work involving such material and no additional compensation will be allowed.

G. The Contractor or the Contractor's representative shall attest to the content of the submitted materials that have been reviewed against the Contract Documents, and that the materials are in compliance thereto. Submitted materials that are to be evaluated as “Or Equal” or “Substitution” shall include sufficient information to enable the Engineer to make the determination for approval.

106.03 POSSIBLE LOCAL MATERIAL SOURCES

A. If the Contractor desires to use materials from local sources the Contractor shall, at no additional cost to the Owner, acquire the necessary right to take material and shall obtain all other necessary permits and approvals and shall comply with all the requirements and stipulations in effect by other governing agencies having jurisdiction over the area, and pay all costs involved, including any which may result from an increase in length of haul. All costs of exploring and developing, including inspection and testing such alternate sources shall be borne by the Contractor and the use of material from such sources will not be permitted until representative samples taken by the Engineer have been approved and written authority issued for the use thereof.

B. The Contractor's attention is especially directed to Title 43, "Code of Federal Regulations," Part 23, "Surface Exploration, Mining and Reclamation of Lands," which pertains to all exploration, developing, and obtaining material from said alternate deposits located upon land under the jurisdiction of the Bureau of Land Management.

C. BLANK

D. BLANK

E. BLANK

F. BLANK

G. BLANK

H. BLANK

I. BLANK

J. BLANK

K. Where the Owner has obtained the right to remove materials from lands owned or controlled by the U.S. Government, by withdrawal or otherwise, and these areas are set forth as optional or mandatory local material sources in the Special Provisions, the Contractor on the project may enter and remove materials for use on subject project only without further permission. The Contractor may not enter on or remove materials from any other areas withdrawn or otherwise obtained by the Contracting Agency from the U.S. Government which are not specifically designated for the project without prior written approval from the Contracting Agency.

L. Should the Contractor enter upon any of the areas withdrawn or otherwise obtained by the Contracting Agency from the U.S. Government, it shall be the Contractor's responsibility to determine the rights of others in the area. The Contractor shall not encroach on easements of others without their written permission and shall assume the responsibility for any damages due to the Contractor's entering said area. In addition, the Contractor shall be bound by the terms, conditions, and reservations contained in the approved application for withdrawal.

M. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and producing specified materials from possible local material sources, including the construction of any access roads or fences and any clearing, grubbing, and stripping of material sources, and all processing of whatever nature and extent required, shall be considered as included in the price paid for the contract item of work involving such material and no additional compensation will be allowed.

106.04 SAMPLES AND TESTS

A. Sampling for final acceptance of materials will be as required in the appropriate specifications sections, contract special provisions, and in general shall comply with the AASHTO requirements, where applicable, and with the following sampling criteria:

1. Aggregates for roadmix bituminous mixtures (including base or surface) will be sampled after the material has been placed on the roadbed and processed and prior to adding the bituminous binder.

2. Aggregate for plantmix bituminous open-graded will be sampled from the laydown machine, or by “belt-cut” sample at the production plant at the Engineer’s discretion.

3. Aggregate for screenings will be sampled from the loaded truck just prior to placing, or by “belt-cut” sample at the production plant at the Engineer’s discretion.

4. Aggregate for plantmix bituminous mixtures (base or surface) will be sampled for acceptance behind the paver. Samples for plasticity tests will be taken at the bins.

5. Sampling of bituminous materials, intended for use in prime, tack or seal coats, surface treatments, and base, binder, or surface course mixtures shall be done after the bituminous material has arrived at job destination and before or at the time of unloading the materials.

    a. Two samples shall be taken from each railroad tank car or truck transport of material by the Contractor or the Contractor's designated representative under the observation of and complying with the requirements and in a manner approved by the Engineer. Where delivery is made in smaller hauling units than those cited above such as a distributor, or where the contents of a storage tank are sampled, the required 2 samples shall be taken to represent a maximum of 10,000 gallons. The Contractor shall take the samples during the established job working hours, unless arrangements are made for a representative of the Contracting Agency to witness the taking of the samples at another time.

    b. All sampling devices and sample containers shall be furnished by the Contractor. Immediately after filling the sample container, it shall be tightly sealed, properly marked for identification, and presented to the Engineer.

    c. One of the 2 samples, taken from each load, shall be submitted to the Contractor's Material Source laboratory for testing and the other sample retained by the Engineer. If the first sample tested complies with requirements, the second may be discarded.

    d. Where less than 80 percent of the asphalt deliveries are used on the project, samples shall be taken just prior to delivery to the mixer. Samples shall be taken for every 25 tons of asphalt delivered to the project.

6. Tests for the aforementioned materials produced under conditions other than contemplated herein shall be taken at the time and place deemed by the Engineer to be most appropriate.

7. All field and laboratory testing technicians shall be Nevada Alliance for Quality Transportation Construction (NAQTC) certified, including ACI certification. Information regarding training, examinations and certification is available from the Nevada T2 Center/257, NAQTC, University of Nevada, Reno, 1664 N. Virginia Street, Reno, Nevada, 89557-0179.

106.05 CERTIFICATE OF COMPLIANCE

A. The Engineer may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance stating that the materials involved comply in all respects with the requirements of the specifications. The certificates shall be signed by the manufacturer of the material or the fabricator of assembled materials. A Certificate of Compliance shall be furnished with each lot of material delivered to the work and the lot so certified shall be clearly identified in the certificate with attached applicable test results for that lot in accordance with the specification section.

B. All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance

shall not relieve the Contractor of responsibility for incorporating material in the work which conforms to the requirements of the plans and specifications and any such material not conforming to such requirements will be subject to rejection whether in place or not.

C. The Agency reserves the right to refuse to permit the use of material on the basis of a Certificate of Compliance.

D. The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

106.06 CITED SPECIFICATIONS

A. The Nevada Department of Transportation has developed test methods for testing the quality of materials and work. These test methods are identified by the prefix Nev. followed by the serial number. Copies of individual test methods are available at the Materials Division, Nevada Department of Transportation, Carson City, Nevada.

B. Whenever a reference is made in the specifications to a test method by Nev. or Cal. number, it shall mean the test method in effect on the date of the advertisement for bid.

C. Whenever a reference is made in the specifications to a specification or test designation either of ASTM International, AASHTO, federal specifications, or any other recognized national organization, and the number or other identification accompanying the test designation representing the year of adoption or latest revision of the test is omitted, it shall mean the test method in effect on the date of advertisement for bid.

D. When requested by the Engineer, the Contractor shall furnish, without charge, samples of all materials entering into the work, and no material shall be used prior to approval by the Engineer, except as provided in ***Subsection 106.05, "Certificate of Compliance."*** Samples of material from local sources shall be taken by or in the presence of the Engineer; otherwise, the samples will not be considered for testing.

106.07 PLANT INSPECTION

A. The Engineer may inspect the production of material or the manufacture of products at the source of supply. The Contractor and material producer shall assure the Engineer of their cooperation and assistance to perform plant inspection prior to production of materials for the project. The Engineer or the Engineer's authorized representative shall have free entry at all times to such parts of the plant as concerns the manufacture or production of the materials. Adequate facilities shall be furnished free of charge to make the necessary inspection.

B. It is understood that the Owner reserves the right to retest all materials prior to incorporation into the work which have been tested and accepted at the source of supply after the same have been delivered and to reject all materials which, when retested, do not meet the requirements of these specifications, or the requirements of the contract documents.

106.08 STORAGE OF MATERIALS

A. Materials shall be so stored as to ensure the preservation of their quality and fitness for the work. When considered necessary by the Engineer, materials shall be stored in waterproof buildings, placed on wooden platforms or other hard, clean surfaces, and not on the ground, and shall be covered when directed.

B. Stored materials, even though approved for use before storage, may be inspected prior to their use in the work, and materials shall meet the requirements of the specifications at the time of this proposed use. Stored materials shall be located so as to facilitate their prompt inspection.

C. Upon approval of the Engineer, that portion of the right-of-way not required for public travel may be used for storage purposes and for placing of the Contractor's plant and equipment, but any additional space required therefor shall be provided by the Contractor at no additional cost to the Owner. Private or public property shall not be used for storage purposes without written permission of the owner or lessee.

D. All storage sites shall be restored to their original condition by the Contractor at no additional cost to the Owner. This shall not apply to the stripping and storing of top soil or to other material salvaged from the work or specifically prescribed under the specifications. Construction materials may not be stored in streets, roads, or highways for more than 5 days after unloading. All materials or equipment not installed or used in the construction within 5 days after unloading shall be stored elsewhere by the Contractor at no additional cost to the Owner unless the Contractor is authorized additional storage time.

E. Construction equipment shall not be stored at the work site before its actual use on the work nor for more than 5 days after it is no longer needed on the work unless the Contractor is authorized additional storage time. Time necessary for repair or assembly of equipment may be authorized by the Engineer.

F. Excavated material, except that which is to be used as backfill in the adjacent trench, may not be stored in public streets, roads, or highways unless otherwise permitted. After placing backfill, all excess material shall be removed immediately from the site.

106.09 HANDLING MATERIALS

A. All materials shall be handled in such manner as to preserve their quality and fitness for the work.

B. Aggregates shall be transported from the storage site to the work in tight vehicles so constructed as to prevent loss or segregation of materials after loading and measuring in order that there may be no inconsistencies in the quantities of materials intended for incorporation in the work as loaded, and the quantities as actually received at the place of operation.

106.10 GUIDANCE ANALYSIS OF NONCOMPLYING MATERIALS

A. In the event of a non-compliance of a produced or placed material, the Contractor is responsible for submitting a recommendation report to the Engineer for the determination of the basis of acceptance of the material by the Engineer based on AASHTO R-9, this section, and/or other industry practices as approved by the Engineer. This report shall be performed by a Nevada Professional Engineer. The receiving of the report by the Engineer does not imply acceptance of the report recommendations.

B. The policy of the Engineer is that a project shall have been constructed "... in reasonably close conformity with the approved plans and specifications..." to be eligible for full payment of the material and installation. However, there will be instances when test results, as a result of the above noted variability may indicate apparent nonconformance

to the specification limits, yet the construction product may be acceptable for the use intended at full or reduced pay. In these cases, an analysis of the materials and/or materials test results will be necessary by the Contractor through a professional engineer before payment is made.

C. As a general guidance and unless otherwise stipulated in other specification sections or contract Special Provisions, if more than 10 percent of the test values for any construction product are outside of the applicable specifications, there may be a question of "reasonably close conformity." In these cases, an analysis of the test values should be made to determine the magnitude and extent of the nonconforming materials.

106.11 OWNER FURNISHED MATERIAL

A. The Contractor shall furnish all materials required to complete the work, except those specified to be furnished by the Owner. Material furnished by the Owner will be delivered or made available to the Contractor at the points specified in the Special Provisions.

B. The cost of handling and placing all materials after they are furnished to the Contractor shall be considered as included in the contract price for the item in connection with which they are used.

C. The Contractor will be held responsible for all material furnished to the Contractor, and deductions will be made from any money due to the Contractor to make good any shortages and deficiencies, from any cause whatsoever, and for any damage which may occur after such delivery and for any demurrage charges. The responsibility by the Contractor includes any project inspection and testing that is required in these specifications.

END OF SECTION 106

SECTION 107 – LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.01 LAWS TO BE OBSERVED

A. The Contractor shall keep fully informed of all federal and state laws, all local bylaws, ordinances, and regulations, and all orders and decrees of bodies or tribunals having jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, bylaws, ordinances, regulations, orders, and decrees, and shall protect and indemnify the Contracting Agency and its representative against any claim or liability arising from or based on the alleged violation of any such law, bylaw, ordinance, regulation, order, or decree, whether by the Contractor, the Contractor's employees, or agents.

107.02 PERMITS, LICENSES, AND TAXES

A. The Contractor shall obtain all permits and licenses, and give all notices necessary and incident to the due and lawful prosecution of the work, including vehicular registration or prorate registration and carrier licensing as applicable. Privilege taxes are in addition to the above fees.

B. The Contractor shall obtain Grading and/or Stockpile permits for on-site storage or disposal of materials from the City of Las Vegas Building Department prior to beginning the work.

C. It shall be the Contractor's responsibility to determine if the permit requirements of Section 637 “Pollution Control” shall be required.

D. The Contractor shall obtain a permit from the Las Vegas Valley Water District to use a hydrant as a water source.

E. The contract documents detail the right-of-way and construction easement/AEPs and in some cases staging areas the contractor may occupy during the duration of the project and traffic control requirements associated with the occupation of said areas. If the contractor desires to use any areas outside the limits described in the drawings and specifications, he shall be responsible for meeting the requirements of Title 19 (The Zoning Code) or applicable requirements for jurisdictions outside of the City. The contractor shall obtain all permits required for the use of private property and provide copies to the City prior to any use of the site. If a temporary commercial permit is required for work performed on private property, the Contractor shall ensure that a temporary commercial permit is obtained through the City of Las Vegas Planning Department or other applicable jurisdictions prior to any use of the site. All work, fees, and scheduling associated with compliance to this subsection shall be borne entirely by the contractor and shall not be a justification for delay claims.

107.03 PATENTED DEVICES, MATERIALS, AND PROCESSES

A. If the Contractor employs any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement

with the patentee or owner. The Contractor and the surety shall indemnify and save harmless the Owner, and affected third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which the Owner may be obliged to pay by reason of any alleged infringement, at any time during the prosecution or after the completion of the work.

107.04 RESTORATION OF SURFACES OPENED BY PERMIT

A. The right to construct or reconstruct any utility service in the public right-of-way, or to grant permits for same, at any time, is hereby expressly reserved by the Agency or the proper authorities of the municipality or other political subdivision in which the work is done and the Contractor shall not be entitled to any damages either for the digging up of the street or for any delay occasioned thereby.

B. Any individual, firm, or corporation wishing to make an opening in the highway or street must secure a permit from the proper authority. The Contractor shall allow parties bearing such permits, and only those parties, to make openings in the highways or streets. The Contractor shall, when ordered by the Engineer, make in an acceptable manner, all necessary repairs due to such openings, and such necessary work will be paid for as extra work, or as provided in these specifications, and will be subject to the same conditions as original work performed.

C. The Owner, the Contractor, and each of such workmen, contractors, and others shall coordinate their operations and cooperate to minimize interference.

D. BLANK

E. BLANK

107.05 SAFETY

A. General: Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The name and telephone number of the Contractor's safety officer shall be provided to the Contracting Agency. He shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. All employees engaged in the work and the other persons who may be affected thereby;
2. All the work and all materials or equipment to be incorporated therein, whether in storage or on the project site, and
3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of the work.

B. Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect, install, employ and maintain, as required by the

conditions and progress of the work, all necessary safeguards. Contractor's duties and responsibilities for the safety and protection of the work shall continue until such time as all the work is completed and a "Notice of Completion" has been issued to the Contractor by the Engineer.

C. Trench Safety: Trench Safety shall be per Subsection 208.03.01.

107.06 SANITARY PROVISIONS

A. The Contractor shall provide and maintain in a neat, sanitary condition, such accommodations for the use of the Contractor's employees as may be necessary to comply with the requirements and regulations of the Southern Nevada Health District and of other bodies or tribunals having jurisdiction thereover. The Contractor shall commit no public nuisance.

107.07 TRAFFIC AND ACCESS

A. The Contractor's operations shall cause no unnecessary inconvenience. The access right of the public shall be considered at all times. Unless otherwise authorized, traffic shall be permitted to pass through the work, or an approved detour shall be provided.

B. Safe and adequate pedestrian and vehicular access shall be provided and maintained to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, hospitals, and establishments of similar nature. Access to these facilities shall be continuous and unobstructed unless otherwise approved by the Engineer.

C. Safe and adequate pedestrian zones and pedestrian crossings of the work at intervals not exceeding 300 feet shall be maintained unless otherwise approved by the Engineer.

1. When the Contractor’s construction operations encroach upon a sidewalk, walkway, or crosswalk area, the Contractor shall take special precautions to protect the pedestrian's safety including provisions to separate pedestrian traffic from the work area and vehicular traffic.
    a. When pedestrian traffic is routed onto the roadway, at other than existing crosswalk locations, the Contractor shall use portable precast concrete barrier rails to separate the pedestrian traffic from the work area and vehicular traffic.
    b. All portable precast concrete barrier rails shall be butted tight and pinned in accordance with the requirements of the NDOT Standard Drawing R-8.7.1, entitled “Portable Precast Concrete Barrier Rail.”

D. Safe and adequate access shall be maintained to existing bus or transit stops throughout duration of road construction in accordance with the following minimum requirements:

1. Unless otherwise specified in the Special Provisions, no public bus or transit stop shall be temporarily closed without the written consent of the Regional Transportation Commission of Southern Nevada (RTC) General Manager or the RTC General Manager's designee. The Contractor shall not close down any two consecutive bus

stops on routes for buses traveling in the same direction. The RTC shall be notified at least 10 working days prior to the proposed temporary closure of any bus or transit stop, including those listed in the Special Provisions.

2. No bus stops at transfer points shall be closed during construction. Bus stops at transfer points can, however, be temporarily relocated with the approval of the RTC.

3. Temporary bus stops may be considered upon approval by the RTC. The Contractor may call the RTC with any questions. A map of bus stop locations may be obtained from the RTC. If bus or transit stop is temporarily relocated, the existing bus or transit stop sign panels shall be relocated to temporary bus or transit stops and shall remain until temporary stop is removed. Temporary relocation of sign panels shall conform to ***Subsection 627.03.05, "Relocation."*** The Contractor shall relocate existing bus-stop signs at designated areas into existing sidewalk, and the sign relocation shall be incidental to other items of work.

4. The Contractor shall maintain access that is in conformance to the requirements of the Americans with Disabilities Act to and from bus or transit stops which remain open at all times during construction.

E. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time. If backfill has been completed to such extent that safe access may be provided, and the street is opened to local traffic, the Contractor shall immediately clear the street and driveways and provide and maintain access.

F. The Contractor shall cooperate with the various parties involved in the delivery of mail and the collection and removal of trash and garbage to maintain existing schedules for these services.

G. Grading operations, roadway excavation, and fill construction shall be conducted by the Contractor in a manner to provide a satisfactory surface for traffic. When rough grading is completed, the roadbed surface shall be brought to a smooth, even condition satisfactory for traffic.

H. Unless otherwise authorized, work shall be performed in only one half the roadway at one time. One half shall be kept open and unobstructed until the opposite side is ready for use. If one half a street only is being improved, the other half shall be conditioned and maintained as a detour.

I. The Contractor shall absorb in the Contractor's bid all costs for the above requirements.

J. The Contractor shall comply with all applicable state, county, and city requirements for closure of streets. Traffic work zone technicians on the project shall be certified in the work zone traffic control at least at the "Technician" level by ATSSA, IMSA, or NICET. The Contractor shall provide barriers, guards, lights, signs, temporary bridges, flagmen, and watchmen, advising the public of detours and construction hazards. The Contractor shall also be responsible for compliance with additional public safety requirements that may arise

during construction. The Contractor shall furnish and install, and upon completion of the work, promptly remove all temporary signs and warning devices.

K. Notifications:

1. The Contractor shall cooperate with, and give written notice to all emergency agencies, public entities, each resident, homeowner, homeowner association, business or school that will be affected by any part of the construction process, particularly concerning temporary interruptions to vehicular access.

2. This notice of the approximate schedule and explanation of work shall be distributed at least fourteen (14) days prior to commencement of work in the area.

3. A second written notice, as well as a verbal notice, including door-to-door communication shall be made at least twenty-four (24) hours prior to construction to remind all affected parties of the construction to take place.

4. The Contractor shall notify by phone the following agencies:

METRO DISPATCH	702-795-3111
FIRE DEPARTMENT DISPATCH	702-382-3001
AMBULANCE DISPATCH CENTER	702-384-3400
RTC – Bus Stop Closures, when applicable Contact Carl Scarborough, per SP 624.01.71	702-676-1608
RTC TRANSIT, when applicable	702-676-1731
CLARK COUNTY SCHOOL DISTRICT	702-799-8100 X 5395
NEVADA DEPT. OF TRANSPORTATION (NDOT), when applicable	702-385-6588
CLV - DEPT. OF PUBLIC WORKS	
PUBLIC INFORMATION SPECIALIST	702-229-6581
TRAFFIC ENGINEERING DIVISION	702-229-6327
UNITED STATES POSTAL SERVICE	1-888-275-8777
REPUBLIC SERVICES	702-735-5151 X 314

5. The Owner shall receive a copy of all notifications for acceptance.

L. All costs involved shall be absorbed in the Contractor's bid. All barricades, warning signs, lights, temporary signals, and other protective devices shall conform with the Traffic Control Plans for Highway Work Zones for the Clark County Area and the current edition of the Manual on Uniform Traffic Control Devices.

M. Construction materials may not be stored in streets, roads or highways for more than five days after unloading. All materials or equipment not installed or used in the construction within five days after unloading shall be stored elsewhere by the Contractor at his expense unless he is authorized additional storage time.

N. Construction equipment shall not be stored at the work site before its actual use on the work nor for more than five days after it is no longer needed on the work. Time necessary for repair or assembly of equipment may be authorized by the Engineer.

O. Excavated material, except that which is to be used as backfill in the adjacent trench, may not be stored in public streets, roads or highways unless otherwise permitted. After placing backfill, all excess material shall be removed immediately from the site.

B. Wherever possible the contractor shall use high early strength concrete for final utility grade adjustments to facilitate reopening the road to traffic.

107.08 BLANK

107.09 BLANK

107.10 EXPLOSIVES

A. Explosives may be used only when authorized in writing by the Engineer, or as otherwise stated in the Special Provisions. Explosives shall be handled, used, and stored in accordance with all applicable regulations.

B. The Engineer's approval of the use of explosives shall not relieve the Contractor from the Contractor's liability for claims caused by the Contractor's blasting operations.

C. All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the Engineer and in general not closer than 1,000 feet from the road or from any building or camping area or place of human occupancy.

D. The Contractor shall notify each public utility company having structures or pipelines in proximity to the site of the work of the Contractor's intention to use explosives. Such notice shall be given in writing a week in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury.

107.11 BLANK

107.12 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE

A. The Contractor shall be responsible for the preservation from injury or damage resulting directly or indirectly from the work under the contract of all public and private property, crops, trees, vegetation, monuments, fences, highway signs and markers, etc., along and adjacent to the project, and shall use every precaution necessary to prevent damage to waterlines,

sewers, and other underground structures, to poles, wires, cables, and other overhead structures, whether shown on the plans or not, shall protect carefully from disturbance or damage all land monuments and property marks until the Engineer has witnessed or otherwise referenced their location, and shall not remove them until directed. The Contractor shall not willfully or maliciously injure or destroy trees or shrubs, and the Contractor shall not remove or cut trees or shrubs without proper authority.

B. The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the work resulting from any act, omission, neglect, or misconduct in the Contractor's manner or method of executing said work, or at any time due to defective work or materials, and such responsibility shall not be released until the project shall have been completed and accepted.

C. The Contractor shall be responsible for the preservation of archeological and paleontological objects, including all ruins, sites, buildings, artifacts, fossils, or other objects of antiquity encountered during construction. When such objects are encountered, the Contractor shall immediately cease operations and notify the Engineer that such objects exist. Construction operations shall be rescheduled to avoid the section until the removal of the artifacts or the gathering of historical data has been accomplished by the appropriate authority. When directed by the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper authorities.

D. Extension of contract time will be allowed for any delay to the Contractor due to preservation of archeological and paleontological objects.

E. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the work, or in consequence of the nonexecution thereof on the part of the Contractor or the Contractor's agents, suppliers, or subcontractors, the Contractor shall restore at no additional cost to the Owner such property to a condition similar or equal to that existing before such damage or injury was done by repairing, rebuilding, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner. In case of failure on the part of the Contractor to restore such property or make good such damage or injury within 10 days, the Owner may, upon 48 hours' written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost thereof shall be deducted from any money due, or which become due the Contractor under the contract.

F. The Contractor shall restrict the movement of the Contractor's vehicles and other construction equipment and personnel to the construction area and designated roads. Every precaution shall be taken to prevent the marking of the natural ground with equipment tracks or other means outside of the staked area and in median areas where it is not required to disturb the existing ground. Where such markings of the natural ground are caused either by the Contractor's equipment, personnel, or operations, the Contractor, at no additional cost to the Contracting Agency, shall eradicate such marks to the satisfaction of the Engineer.

G. All roads used for construction operations shall be spaced at least 1,000 feet apart from flat bottom ditches and material deposits, except that such roads may also be located in ditch and dike areas. When roads are located in ditch and dike areas, equipment shall not be allowed to travel outside the area occupied by said ditch or dike, except as provided for in ***Subsection 203.03.13, "Channels."*** The crossing of median areas shall be at structures or areas approved by the Engineer.

H. Where there is a high potential for erosion and subsequent water pollution, the area of erosive land that may be exposed by construction operations at any one time shall be held to a minimum, and the duration of the exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion control features shall be constructed concurrently with other work and at the earliest practicable time.

I. Disturbance of the lands and of waters that are outside the limits of the construction as staked is prohibited, except as may be found necessary and approved by the Engineer.

J. Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the site in the performance of the work. Drainage facilities shall be adequate to prevent damage to the work, the site and the adjacent property.

K. Contractor shall prevent erosion of soil on the site and adjacent property resulting from his construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation or other operation that will disturb the natural protection of the soil.

107.13 FIRE PROTECTION

A. There shall be no open burning unless approval has been given in writing by the Clark County Air Pollution Control Officer and the Engineer has concurred. Before setting any fires whatsoever, the Contractor shall notify the responsible agency having jurisdiction for the area concerned. The Engineer shall have authority to enforce correction of any condition which is, in the Engineer's opinion, unsafe.

107.14 DISPOSAL OF MATERIAL OUTSIDE PROJECT RIGHT-OF-WAY

A. The Contractor shall make the Contractor's own arrangements for disposal of materials outside the project right-of-way at no additional cost to the Owner.

B. When any material is to be disposed of outside the project right-of-way, the Contractor shall first obtain a written permit from the property owner on whose property the disposal is to be made, and the Contractor shall file in writing with the Engineer said permit or the certified copy thereof together with a written release from the property owner absolving the agency of any and all responsibility in connection with the disposal of material on said property.

C. When material is disposed of as above provided and the disposal location is visible from the project, the Contractor shall dispose of the material in a neat and uniform manner to the satisfaction of the Engineer.

D. Unless otherwise provided in the Special Provisions, full compensation for all costs involved in disposing of material as specified in this section, including all costs of hauling, shall be considered as included in the price paid for the contract items of work involving such materials and no additional compensation will be allowed therefore.

107.15 RELIEF FROM MAINTENANCE AND RESPONSIBILITY

A. Upon the written request of the Contractor, or upon order of the Engineer, the Contractor may be relieved of the duty of maintaining and protecting certain portions of the work as described below, which have been completed in all respects in accordance with the requirements of the contract and to the satisfaction of the Engineer, and thereafter except with the Engineer's consent, the Contractor will not be required to do further work thereon. In addition, such action by the Engineer will relieve the Contractor of responsibility for injury or damage to said completed portions of the work resulting from use by the public traffic or from the action of the elements or from any other cause, but not from injury or damage resulting from the Contractor's own operations or from the Contractor's negligence.

B. Portions of the work for which the Contractor may be relieved of the duty of maintenance and protection as provided in the above paragraph include but are not limited to the following:

1. A bridge or other structure of major importance.

2. A complete unit of a traffic control signal system or of a highway or street lighting system.

3. Non-project facilities constructed for other agencies.

C. However, nothing in this subsection providing for relief from maintenance and responsibility will be construed as relieving the Contractor of full responsibility for making good defective work or materials found at any time before the formal written acceptance of the entire project by the Contracting Agency.

107.16 CONTRACTOR'S RESPONSIBILITY FOR THE WORK AND MATERIALS

A. Until the acceptance of the contract, the Contractor shall have the charge and care of the work and of the materials to be used therein and shall bear the risk of injury, loss, or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution or from the nonexecution of the work, except as provided in ***Subsection 107.15, "Relief from Maintenance and Responsibility."***

B. The Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the work or the materials occasioned by any cause before its completion and acceptance and shall bear the expense thereof, except as otherwise expressly provided in ***Subsection 203.03.11, "Slides and Slipouts,"*** for Object Markers and Guide Posts, and except for such injuries, losses, or damages as are directly and proximately caused by acts of the federal government or the public enemy. The Contractor shall, at no additional cost to the Contracting Agency, provide suitable drainage for the project and erect such temporary structures as are necessary to protect the work or materials from damage.

C. The suspension of the work from any cause whatever shall not relieve the Contractor of the Contractor's responsibility for the work and materials as herein specified. If ordered by the Engineer, the Contractor shall, at no additional cost to the Owner, properly store materials which have been fully or partially paid for and furnished by the Owner. Such storage by the Contractor shall be on behalf of the Owner and the Owner shall at all times be entitled to the possession of such materials, and the Owner shall promptly return the same to the site of the work when requested. The Contractor shall not dispose of any of the materials so stored except on written authorization from the Engineer.

107.17 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICE

A. At points where the Contractor's operations are adjacent to properties of railroad, telegraph, telephone, and power companies, or are adjacent to or in conflict with other property or utilities, damage to which might result in considerable expense, loss, or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.

B. The Contractor shall not begin any operations which may interfere with or impair the normal service being rendered by public or private utility operations, until such operators have been notified, and shall cooperate with the owners of any underground or overhead utilities in their removal and rearrangements operations in order that these operations may progress in a reasonable manner, and that duplication of rearrangements work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted. The Contractor will be held responsible for the protection of the property of public or private utilities within the limits of the work.

C. In general, the repair and adjustment of street structures such as waterlines, sewers, telephone, telegraph, gas, and electric lines, above or below the ground, will be made by the owners thereof as specified in ***Subsection 105.06, "Cooperation with Utilities."*** When included in the proposal, the adjustment of sewer manhole frames and covers, inlets and catch basin frames and covers and the like, will be within the Contractor's responsibility. The Contractor shall see that they are adjusted to conform to the lines, grades, and typical cross sections as shown on the plans, or as prescribed, without respect to whether the repairs and the roughing-in work have been performed by the Contractor or others.

D. Pipes or other construction shall be maintained in continuous service as far as practicable and shall be properly protected and supported. In no case shall interruption of the water service be allowed to exist outside of working hours.

E. Fire hydrants shall be accessible at all times to the fire department. No material or other obstruction shall be placed closer to a fire hydrant than permitted by ordinances, rules, or regulations, or within 15 feet of the fire hydrant in the absence of such ordinances, rules, or regulations.

F. The Contractor shall give notice in writing to the proper authorities in charge of streets, gas, water pipes, sewer lines, electric, and other conduits, railroads, poles, manholes, catch

basins, and all other property that may be affected by the Contractor's operations, at least 48 hours before breaking ground.

G. In the event of interruption to water or utility services as a result of accidental breakage, the Contractor shall promptly notify the proper authority. The Contractor shall cooperate with said authority in the restoration of service as promptly as possible.

H. Attention is directed to ***Subsection 105.06, "Cooperation with Utilities."***

I. All utility valves, manholes, vaults, pull boxes, etc., which are buried, shall be conspicuously marked by the Contractor to allow their location to be determined by the Engineer or utility personnel under adverse conditions (i.e. inclement weather or darkness).

107.18 FURNISHING RIGHT-OF-WAY

A. The Owner will be responsible for the securing of all right-of-ways shown in the plans. Any exceptions will be indicated in the contract.

B. Contractor shall provide copy of necessary permits and written consent from property owner(s) prior to entering or occupying any lands outside the right-of-way or easement or where no Authorization to Enter Property exists.

107.19 BLANK

107.20 NO WAIVER OF LEGAL RIGHTS

A. The Contracting Agency shall not be precluded or estopped by any measurements, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefor, from showing the true amount and character of the work performed, and materials furnished by the Contractor, nor from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor that the work or materials do not in fact conform to the contract. The Owner shall not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor or the Contractor's sureties, or both, such damages as it may sustain by reason of the Contractor's failure to comply with the terms of the contract. Neither the acceptance by the Contracting Agency, or any representative of the Contracting Agency, nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Contracting Agency, shall operate as a waiver of any portion of the contract or of any power herein reserved, or of any right to damages. A waiver of any breach of the contract shall not be held to be a waiver of any other or subsequent breach.

107.21 DUST CONTROL

A. Dust that originates from the Contractor's operations, either inside or outside the right-of-way, shall be controlled at all times by the Contractor in accordance with federal, state, and local laws, ordinances, and regulations at the sole expense of the Contractor.

B. A permit from the Clark County Air Pollution Officer shall be obtained by the Contractor prior to the start of construction operations.

C. Reference is made to ***Section 637, "Pollution Control."***

107.70 CONTRACTOR'S RESPONSIBILITY TO THE PUBLIC

A. The Contractor is responsible to answer and resolve any conflicts that may arise between a homeowner or business owner and himself during the construction process.

107.71 ALLOWABLE WORK HOURS

A. No work between the hours of 6 p.m. and 7 a.m. will be allowed in residential areas unless approved by the Engineer or otherwise stated in the Special Provisions. If work after the aforementioned hours is approved, then the Contractor shall provide each affected resident at least forty-eight (48) hours written notice explaining the reason for the work after hours and providing an approximate duration of the activity.

107.72 NATURAL DRAINAGE AND STORM WATER RUNOFF

A. The Contractor shall be responsible for protecting and preserving public and private property from damage directly or indirectly caused by drainage or storm water runoff leaving the project during construction of all improvements, including downstream properties if damage is a result of the Contractor's actions in diverting or redirecting existing natural runoff patterns.

END OF SECTION 107

SECTION 109 – MEASUREMENT AND PAYMENT

109.01 MEASUREMENT OF QUANTITIES

A. The measurements and determination of the number of units of each pay item will be made in general as prescribed hereinafter and specifically as set out under "Method of Measurement" and "Basis of Payment" in the specification of each pay item.

B. After the items of work are completed and before final payment is made, the Engineer will determine the quantities of the various items of work performed as the basis for final settlement for all other than lump sum contracts. In the case of unit price items, the Contractor will be paid for the actual amount of work performed and materials used in accordance with these specifications, as shown by the final measurements, unless otherwise specified.

C. Actual authorized quantities of work satisfactorily completed under the contract, shall be measured by the Engineer in accordance with United States Standard Measures, and well recognized engineering practices. Unauthorized wastings of material will be deducted and only such quantities as are actually incorporated in the completed work will be included in the final estimate. The planimeter shall be considered an instrument of precision adapted to the measurement of areas, but other acceptable methods may be used.

D. Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures having an area of 9 square feet or less. Unless otherwise specified, transverse measurements for area computation will be the neat dimensions shown on the plans or ordered in writing by the Engineer.

E. In computing volumes of excavation, embankment, and borrow, the average end area method will be used unless otherwise specified.

F. All items that are measured by the linear foot such as pipe culverts, underdrains, guardrails, etc., shall be measured parallel to the base or foundation upon which such structures are placed, unless otherwise shown on the plans.

G. Items may be measured by surface area, either square foot or square yard. The term "gage" when used in connection with the measurement of plates, shall mean the U.S. Standard Gage. When reference is made, however, to the measurements of galvanized sheets used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing, the term "gage" shall mean that specified in the respective test designation for the material as described in the "Materials" section of these specifications.

H. When the term "gage" refers to the measurement of wire, it shall mean the wire gage specified in the AASHTO M 32 for cold drawn steel wire for concrete reinforcement.

I. Unless otherwise specified, water meters shall be accurate to within 2 percent of the indicated amount. The frequency of checking water meters will be determined by the Engineer.

J. The term ton shall mean the short ton consisting of 2,000 pounds avoirdupois. All materials that are specified for measurement by ton shall be weighed on accurate, approved scales set at locations designated by the Engineer. All materials shall be weighed on platform scales with the following exception: In lieu of platform scales, the

Contractor may provide an automatic printer system that will print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching control system. Such a system shall issue a weigh ticket for each load. The Contractor shall have on hand not less than ten 50-pound standard weights for testing the scales.

K. Scales:

1. All scales shall be furnished by and at the expense of the Contractor and shall have a certificate of inspection by the Bureau of Weights and Measures. The scales shall be tested and inspected by the Bureau of Weights and Measures and a new inspection certificate required as often as the Engineer may deem necessary, and after each scale move, in order to ensure the accuracy of the scales. The cost of inspecting the scales shall be borne by the Contracting Agency.

2. Platform scales shall be of sufficient size and capacity to weigh, in one operation, the entire loaded vehicle. Combination vehicles may be weighed as separate units, provided the connecting device between vehicles is so constructed that no weight other than that of the device itself is transmitted to either vehicle. When combination vehicles are used, approaches to and from the scale platform shall be level for sufficient distance to accommodate that portion of the combination vehicle that is off the scale platform. In instances where combination vehicles are weighed, the approaches to and from the scale platform shall be level with the scale platform for a minimum distance of 50 feet from each end of the scale platform.

3. If combination vehicles are utilized, provisions shall be made to ensure that all braking devices are disengaged during weighing operations as insurance against stresses being transmitted between either vehicle.

4. The scale pit shall be of sufficient width to permit access to all scale components for purposes of inspection, repair, cleaning, and adjusting.

5. Support members for platform scales shall consist of 12-inch by 12-inch or 6-inch by 16-inch (minimum) timbers placed on a firm gravel foundation. Scales consisting of more than one section shall be supported with 12-inch by 12-inch or 6-inch by 16-inch (minimum) timbers at each end of each section to avoid settlement of the scale platform. Concrete support members conforming to the minimum timber size requirements may be utilized in lieu of timber at the Contractor's option.

6. Platform scales shall be equipped with weatherproof housing so constructed as to protect the recording device and permit the weighmaster convenient access to all beams and dials. The housing shall not be less than 6 feet wide, 8 feet long, and 7 feet high; shall have 2 windows, adjustable for ventilation with one facing the scales; and shall be equipped with an adequate shelf suitable to the Engineer. The Contractor shall provide heat and electric lights when requested by the Engineer.

7. Conveyor scales of an approved type may be used. The conveyor scales shall be furnished with 1 master counter to run continuously and 1 remote counter which will print the weight in individual loads, then reset to zero automatically. The remote unit shall be placed in a weatherproof house with 2 windows. One window shall face the point of loading and the conveyor scales. This window shall also be equipped with a shelf 2 feet wide and 6 feet long. A controlled method of heating shall be supplied for cold weather operations.

8. A locked door shall be provided on the access to the conveyor balances (where fine adjustment must be made). The key shall be in the hands of the Engineer and the door shall be opened only for maintenance and adjustment of conveyor scales to meet the accuracy of the platform scales. This door shall be locked at all times during the operation of the conveyor scales. If conveyor weighing equipment is used, the following procedures shall be followed:

    a. The conveyor scales shall be calibrated against the platform scales, which shall have a certificate of inspection.

    b. At the beginning and middle of each shift, or as requested by the Engineer, 2 consecutive loads of material weighed over the conveyor scales shall be reweighed on the platform scales. The total weight indicated by the conveyor scales on the 2 loads shall check with the platform scale weight within 0.5 percent. If the conveyor scales weigh out of this tolerance, all loads shall be weighed on the platform scales until the condition is rectified.

    c. Consecutively numbered, individual weigh tickets shall be used with conveyor scale weights stamped by the remote counter.

L. Unless otherwise specified, materials shipped by rail shall be weighed over the authorized project scales before incorporation into the work.

M. Cement will be measured by the barrel or ton. The term "barrel" will mean 376 pounds of cement.

N. Timber will be measured by the thousand feet board measure (Mfbm) actually incorporated in the structure with no allowance for any waste except beveled ends. Measurement will be based on nominal widths and thicknesses, and the extreme length of each piece.

O. When a complete structure or structural unit (in effect, "lump sum" work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

P. All materials for which measurements are obtained by the cubic yard "loose measurement" or "measured in the vehicle" shall be hauled in approved vehicles and measured therein at the point of delivery. No allowance will be made for the settlement of material in transit. Vehicles for this purpose may be of any size or type acceptable to the Engineer, provided that the body is of such shape that the actual delivered contents may be readily and accurately determined and will remain constant. Unless all approved vehicles on the work are of uniform capacity, each vehicle shall bear a plainly legible identification mark, indicating its specified approved capacity. All vehicles shall be loaded to at least waterlevel capacity. Loads not hauled in approved vehicles or of a quantity less than the specified approved quantity for the hauling vehicle will be subject to rejection and no compensation will be allowed for the hauling of the material.

Q. Liquid Asphalts, Asphalt Cement, and Asphaltic Emulsions:

1. The unit of measurement for liquid asphalts, asphaltic emulsions, and paving asphalts shall be a ton or gallon at 60 degrees F.

2. Quantities of bituminous binders wasted or disposed of in a manner not called for under these specifications, or remaining on hand after completion of the work, will not be paid for.

3. When permitted by the Engineer, pay quantities of bituminous binder may be determined from volumetric measurements of the bituminous binder, in which case the bituminous binder shall be delivered in calibrated tanks and each tank shall be accompanied by its proper measuring stick and a calibration card signed by a sealer of weight and measures, and pay quantities shall be determined in accordance with the following procedure.

4. Volumetric measurements at any temperature shall be reduced to the volume the material would occupy at 60 degrees F, before converting the volumetric measurements to weight.

5. The following tables shall be used to convert volumes from gallons to weight. All types, SC, MC, and RC of the same grade shall be considered to have equal weights and volume.

AVERAGE WEIGHTS AND VOLUMES OF LIQUID ASPHALT AT 60 DEGREES FAHRENHEIT

Grade of Liquid Asphalt	Gallons Per Ton	Pounds Per Gallon
70	253	7.90
250	249	8.03
800	245	8.16
3000	241	8.30

AVERAGE WEIGHTS AND VOLUMES OF ASPHALT CEMENT AT 60 DEGREES FAHRENHEIT

Grade	Gallon Per Ton	Pounds Per Gallon
AC-40	233	8.59
AC-30	235	8.51
AC-20	235	8.51
AC-10	237	8.43

AVERAGE WEIGHTS AND VOLUMES OF ASPHALTIC EMULSION AT 60 DEGREES FAHRENHEIT

Type of Emulsion	Gallon Per Ton	Pounds Per Gallon
All Grades	240	8.33

6. When converting the volume of liquid asphalt, asphalt cement, or asphaltic emulsion at any temperature to the volume of 60 degrees F, a conversion factor for correlation shall be used. Said conversion factors shall be those prescribed in The Asphalt Institute (Pacific Coast Division) publication "Asphalts -- Paving Liquids and Emulsions" (PCD-7).

R. Rental of equipment will be measured by time within 1/2 hour of actual working time and necessary traveling time of the equipment within the limits of the project. If equipment has been ordered on the job on a standby basis by the Engineer, half-time rates for the equipment will be paid.

S. BLANK

END OF SECTION 109

SECTION 201 – CLEARING AND GRUBBING

DESCRIPTION

201.01.01 GENERAL

A. This work shall consist of clearing, grubbing, removing, and disposing of all vegetation and debris within the limits of construction, except such objects as are designated to remain or be removed in accordance with other sections of these specifications. This work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.

CONSTRUCTION

201.03.01 GENERAL

A. The Engineer will establish clearing limits and designate all trees, shrubs, plants, and other things to remain. Areas to be cleared will be as set forth in ***Subsection 201.03.02, "Areas to be Cleared."*** The Contractor shall preserve all things designated to remain. Paint required for cut or scarred surfaces of trees or shrubs selected for retention shall be an approved asphaltum base paint prepared especially for tree surgery. ***Subsection 107.21, "Dust Control"*** shall be complied with.

201.03.02 AREAS TO BE CLEARED

A. Areas to be cleared shall be one or more of the following:

1. The entire area upon which the project construction is to be performed to the width of the excavation and embankment slope lines.
2. Ditch and dike areas to the width of the slope lines.
3. Areas on which service roads or ramps, streets, approaches, and all other accessory roads and connections are to be constructed, such areas to extend to the width of the excavation and embankment slope lines.
4. Designated material sites and designated borrow pits.
5. Areas designated in the plans or Special Provisions.

201.03.03 CLEARING AND GRUBBING

A. Surface objects and trees, stumps, roots, and other protruding obstructions, designated for removal, shall be cleared or grubbed or both. Unless otherwise specified, the Contractor may leave stumps and nonperishable solid objects provided they do not extend more than 6 inches above the ground line or low water level, and are a minimum of 3 feet below subgrade or embankment slope.

B. The Engineer may permit sound stumps to be cut off not more than 6 inches above the ground and to be left outside of the construction limits of cut and embankment areas, except in the area to be rounded at the top of backslopes where stumps are to be cut off flush with or below the surface of the final slope line.

C. Where feasible, trees shall be felled toward the center of the area to be cleared. Where trees cannot be felled without danger to traffic or injury to other trees, structures, or property, the trees shall be cut in sections from the top down.

D. There shall be no burning unless approval has been given in writing by the Clark County Air Pollution Control Officer and this approval concurred with by the Engineer. If perishable material is burned, it shall be burned under the constant care of competent watchmen at such times and in such a manner that anything designated to remain on the right-of-way, the surrounding forest cover, or other adjacent property will not be jeopardized. Burning shall be done in accordance with applicable laws, regulations, and ordinances.

E. When permitted by the Engineer, materials, debris, and perishable materials may be removed from the right-of-way and disposed of at locations off the project outside the limits of view from the project with the written permission of the property owner on whose property the materials and debris are placed. The Contractor shall make all necessary arrangements with property owners for obtaining suitable disposal locations and the cost involved shall be included in the unit price bid. Attention is directed to ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

F. Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable materials and compacted in accordance with ***Subsection 203.03.18, "Compaction, Dirt Embankment"*** or ***Subsection 203.03.19, "Compaction, Rock Embankment"*** if within the staked prism. Payment for backfilling and compacting will be considered subsidiary to other items of the work and no further compensation will be made therefor.

G. All merchantable timber in the clearing area shall become the property of the Contractor unless otherwise provided. Timber and debris may be stored or decked within the right-of-way only in areas approved by the Engineer and shall be removed prior to final acceptance of the project.

H. Low hanging branches and unsound or unsightly branches on trees or shrubs designated to remain shall be removed as directed. Branches of trees extending over the road shall be trimmed to give a clear height of 20 feet above the road surface. All trimming shall be done by skilled workmen and in accordance with good tree surgery practices.

I. Scalping shall include the removal of material such as brush, roots, sod, grass, residue of agricultural crops, sawdust, and decayed vegetable matter from the surface of the ground.

J. Unless otherwise permitted by the Engineer, the Contractor shall scalp areas where excavation or embankment is to be made, except that mowed sod need not be removed where the embankment to be constructed is 4 feet or more in height to subgrade elevation.

END OF SECTION 201

SECTION 202 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

DESCRIPTION

202.01.01 GENERAL

A. This work shall consist of the removal, wholly or in part, and satisfactory disposal of all buildings, fences, guardrails, structures, old pavement, abandoned pipelines, and any other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed of under other items in the contract. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes, and pits.

CONSTRUCTION

202.03.01 GENERAL

A. The Contractor shall raze, remove, and dispose of all buildings and foundations, structures, guardrail, culvert markers and guide posts, fences, and other obstructions, any portions of which are on the right-of-way, except utilities and those for which other provisions have been made for removal. All designated salvable material shall be removed, without unnecessary damage, in sections or pieces which may be readily transported, and shall be stored by the Contractor at specified places within the project limits. Unusable material shall be disposed of in accordance with ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."*** Basements or cavities left by structure removal shall be filled to the level of the surrounding ground and, if within the prism of construction, shall be compacted in accordance with ***Subsection 203.03.18, "Compaction, Dirt Embankment"*** or ***Subsection 203.03.19, "Compaction, Rock Embankment."***

202.03.02 REMOVAL

A. Bridges, culverts, and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic.

B. All operations necessary for the removal of any existing structure which might endanger the new construction shall be completed prior to the construction of the new work. No equipment or devices shall be used which might damage structures, facilities, or properties which are to be preserved and retained.

C. Unless otherwise directed, the substructures of existing structures shall be removed down to the natural stream bottom and those parts outside of the stream shall be removed down one foot below natural ground surface. Where such portions of existing structures lie wholly or in part within the limits for a new structure, they shall be removed as necessary to accommodate the construction of the proposed structure.

D. Operations necessary for the removal of an existing structure or obstruction, which may damage new construction, shall be completed prior to placing the new work.

E. Bituminous pavement shall be removed to clean straight lines. Saw cutting of edges to be joined is required. Where only the surface of existing bituminous pavement is to be removed by heater-planing, or by other approved methods, a minimum laying depth of

1 inch of new pavement material shall be provided at the joint line. Where bituminous pavement adjoins a trench, the edges adjacent to the trench shall be saw cut to neat straight lines before resurfacing.

F. Concrete pavement shall be removed to neatly sawed edges. Saw cuts shall be made to a minimum depth of 1-1/2 inches. If a saw cut in concrete pavement falls within 3 feet of a construction joint, cold joint, expansion joint, or edge, the concrete shall be removed to the joint or edge. The edges of existing concrete pavement adjacent to trenches, where damaged subsequent to saw cutting of the pavement, shall again be saw cut to neat straight lines for the purpose of removing the damaged pavement areas. Such saw cuts shall be either parallel to the original saw cuts or shall be cut on an angle which departs from the original saw cut not more than 1 inch in each 6 inches.

G. Concrete curb, walk, gutters, cross gutters, driveways, and alley intersections shall be removed to nearest score line or joint.

H. In removing manholes, catch basins, and inlets, any live sewers connected to item shall be rebuilt and properly reconnected and a satisfactory bypass service shall be maintained during such construction operations. When abandoning manholes, catch basins, and inlets, they shall be thoroughly cleaned and existing pipe connections shall be plugged with concrete of the class and grade specified for structures. The portions of the structures shall then be removed to the required elevations and any necessary backfill shall be placed and compacted to specifications.

202.03.03 EXTENSIONS

A. Where existing culverts and bridges are to be extended or otherwise incorporated in the new work, only such part or parts of the existing structure shall be removed as is necessary to provide a proper connection to the new work. The connecting edges shall be cut, shaped, and trimmed to the required lines and grades without weakening or damaging the part of the structure to be retained. Reinforcing bars which are to be left in place, so as to project into the new work as dowels or ties, shall not be injured during removal of concrete.

202.03.04 CLOSING CULVERTS

A. Existing culverts within construction limits, the top of which are 5 feet or more below finished roadway grade, shall be abandoned and closed unless otherwise noted on the plans. The headwalls of such culverts, or any part of the structure that is within 3 feet of the finished grade line shall be removed. The ends of the culvert shall be completely filled with satisfactory soil for a distance of at least 2 feet, plus the height of the opening of the structure.

202.03.05 SALVAGE

A. When specified, gravel, roadmix, or plantmix surface suitable for reuse shall be removed to the depth required and surfacing so removed shall be carefully salvaged and placed in compact stockpiles at locations approved by the Engineer. Care shall be exercised to prevent contamination of stockpiled material. Any remaining unsuitable material shall be scarified and incorporated in embankment as set forth in ***Section 203, "Excavation and Embankment."***

B. Fences and gates designated for reuse shall be removed in such a manner that all material can be salvaged. Wire shall be carefully removed from the posts and rolled in rolls of a size that can be conveniently handled. Posts shall be removed by methods that will keep breakage to a minimum.

C. Guardrail, culvert markers, and guide posts designated for reuse shall be removed in such a manner that all material can be salvaged. Bolts, supports, and other hardware shall be removed from all rails, plates, and posts and all parts shall be sorted and stored at the locations specified. Rail, plates, and posts shall be properly stacked and miscellaneous hardware shall be stacked or boxed and reasonable care exercised in handling, storage, and preservation of materials as will ensure the maximum salvage value for the entire operation. Attention is directed to ***Section 619, "Object Markers and Guide Posts."***

D. When specified for salvage, structural steel removed from old structures shall be stored in a neat and presentable manner on blocking and at locations suitable for loading. Structures or portions thereof which are specified for re-erection shall be stored in separate piles.

E. When re-lay culvert pipe is required, the Contractor shall remove the pipe in such a manner as not to damage the material in any way. If no particular pipe is noted for re-lay, the Contractor shall salvage and clean sufficient amount of the best available pipe to satisfy the re-lay pipe item.

F. Timber or piling from all structures designated to be salvaged shall have all nails and bolts removed therefrom and shall be stored in neat piles at locations suitable for loading.

202.03.06 DISPOSING OF MATERIALS

A. Unless otherwise provided, excavated material shall be used in backfilling excavations made in removing the structure, in constructing embankment, or otherwise disposed of in a manner satisfactory to the Engineer.

B. When the placement of riprap and similar structures is included in the proposal, suitable broken concrete or masonry removed from old structures may be used in such construction. Any concrete or masonry which cannot be placed in backfills or embankments or used as riprap, shall be disposed of in accordance with ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."*** The material shall not be placed where it will obstruct any drainage course.

C. When concrete or masonry is placed in embankments, it shall be placed in accordance with ***Subsection 203.03.16, "Embankment Materials."***

END OF SECTION 202

SECTION 203 – EXCAVATION AND EMBANKMENT

DESCRIPTION

203.01.01 GENERAL

A. This work shall consist of grading and excavating the roadway, excavating borrow pits, removing slide material, and excavating ditches and stream channels and satisfactorily disposing of all excavated material and all work necessary for the construction and completion of cuts, embankments, slopes, ditches, dikes, stream channels, approaches, parking areas, intersecting driveways and highways, and subsidiary work. Exceptions are slope rounding, structure excavation, or other separately designated pay items of work, which are made a part of the contract. All work shall be in conformity with the alignment, grades, and cross sections shown on the plans or established by the Engineer.

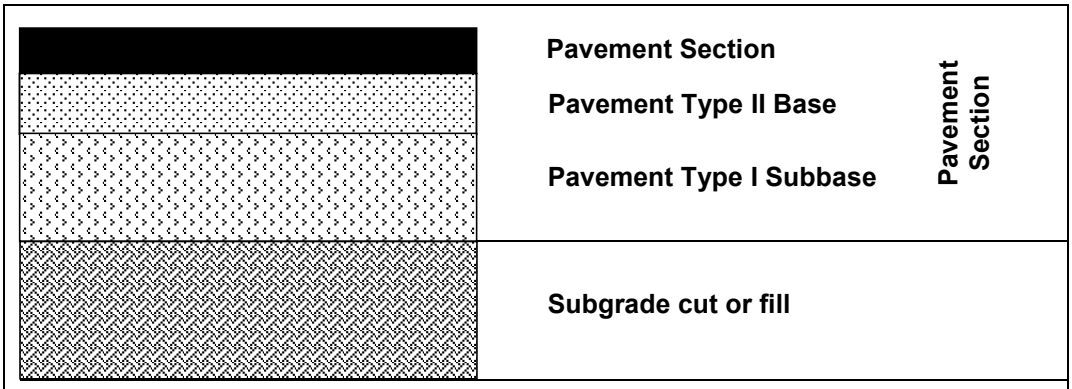


Figure 1- Definition of Terms

B. The compacted subgrade shall be maintained at optimum moisture content until placement of an aggregate base course.

MATERIALS

203.02.01 ROADWAY EXCAVATION

A. Roadway excavation shall consist of all excavation involved in grading and constructing the roadway and appurtenances, irrespective of the nature or type of material encountered; except excavation designated as structure excavation, drainage excavation, channel excavation, and borrow excavation when these items are provided as items of work under the contract. Dividing the project into construction stages shall not be construed as separate material classifications.

B. When cementitious material is encountered within the excavation limits, the treatment, removal, trimming, and working of that material shall be considered as incidental to the excavation work.

203.02.02 DRAINAGE EXCAVATION

A. Drainage excavation shall include all excavation in the construction of open ditches less than 12 feet in bottom width, excepting ditches that are part of the roadway prism as shown in the plans. The nature or type of material encountered shall have no bearing on the classification of material.

B. When cementitious material is encountered within the excavation limits, the treatment, removal, trimming, and working of that material shall be considered as incidental to the excavation work.

203.02.03 CHANNEL EXCAVATION

A. Channel excavation shall include all excavation in the construction of open ditches or stream channels with a bottom width of 12 feet or more with the exception of ditches that are part of the roadway prism as shown in the plans. The nature or type of material encountered shall have no bearing on the classification of material.

B. When cementitious material is encountered within the excavation limits, the treatment, removal, trimming, and working of that material shall be considered as incidental to the excavation work.

203.02.04 BORROW

A. Borrow shall consist of approved material excavated and used in the construction of fills, or for other construction purposes. Borrow shall be material that is excavated from sources specified in the Special Provisions or designated by the Engineer. The source of material to be excavated shall be approved in advance by the Engineer. Borrow shall be excavated to the lines and grades established by the Engineer.

B. The Contractor shall notify the Engineer, sufficiently in advance, of opening any borrow site so that adequate time will be allowed for testing the material and establishing cross section elevations and measurements of the ground surface. The widening of roadway cuts shall be considered as roadway excavation and not as borrow, unless otherwise specified. Borrow excavation will not be classified according to type or character of material encountered in the borrow area unless otherwise required in the Special Provisions.

203.02.05 SELECTED BORROW

A. Selected borrow shall consist of approved material required for the construction of embankments within the required limits shown on the plans or directed by the Engineer, and shall be obtained from approved sources.

B. Selected borrow shall conform to the requirements set forth in the Special Provisions.

CONSTRUCTION

203.03.01 ROADWAY EXCAVATION

A. All excavation shall be made true to lines and grades staked by parties under the supervision of a Nevada licensed professional land surveyor working for the Engineer or Contractor and shall be so conducted as to avoid removing or loosening any material outside the required slopes. If any material is so disturbed, it shall be replaced and thoroughly compacted to the required cross section, unless such replacement is impractical as determined by the Engineer.

B. The work done under this section shall begin at some definite point or points on the project subject to the approval of the Engineer, and the work shall progress toward completion in an orderly manner. The roadway shall be graded to full cross section width before placing base or surfacing of any type, unless otherwise specified.

C. Intersecting roads, service highways, ramps, approaches, and driveways shall be graded as shown on the plans or established by the Engineer.

D. All suitable material removed from the excavation shall be used as far as practicable in the formation of embankments, subgrade, shoulders, slopes, dikes, and backfill for structures, unless otherwise indicated on the plans or specifications herein or disposed of in a manner satisfactory to the Engineer. Excavated material shall not be wasted without permission.

203.03.02 GRADE TOLERANCE

A. Immediately prior to placing subsequent layers of material thereon, the grading layer shall conform to one of the following:

1. The subgrade shall not vary more than 0.10 foot above or below the grade established by the Engineer or Contractor.

2. The final subgrade layer prior to application of the structural base shall not vary more than zero foot above or 0.10 foot below the grade.

203.03.03 UNSUITABLE MATERIAL

A. Unsuitable material as defined in Section 101 “Definitions”, and that is unsuitable for planned use, including material below the natural ground surface in embankment areas, shall be excavated and disposed of in a manner approved by the Engineer or as specified in the contract documents.

B. When unsuitable material is removed and disposed of, the resulting space shall be filled with material suitable for the planned use. Such suitable material shall be placed and compacted in layers as specified below under embankment.

C. Disposal of material outside the right-of-way shall be in accordance with ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

203.03.04 BLASTING

A. Any material outside the authorized cross section on the backslopes which may be shattered or loosened because of blasting shall be removed by the Contractor at no additional cost to the Contracting Agency. Shattered or loosened material below the bottom limits of required excavation shall be uniformly distributed and compacted or otherwise disposed of in a manner satisfactory to the Engineer. The Contractor shall discontinue any method of blasting which leads to overshooting or is dangerous to the public or destructive to property or to natural features.

B. The use of coyote holes in blasting is prohibited. Attention is directed to ***Subsection 107.10, "Explosives."***

203.03.05 ROCK CUTS

A. In excavating side hill rock cuts and rock cliffs, the Contractor shall exercise care and use precautionary methods so as not to break down, loosen, or otherwise damage supporting rock below the bottom limits of required excavation. In general, such cuts shall be worked from the top of lifts of such height that will not damage the bench of rock below the bottom limits of required excavation. The Contractor shall be responsible for the methods used and for any damage to the roadbed resulting from Contractor's operations.

B. The slope of all rock cuts shall be scaled and dressed to a safe, stable condition by removing all loose spalls and rock not firmly keyed to the rock slope. Overhanging rock shall be removed when, in the opinion of the Engineer, it may be a hazard to public use of the roadway.

C. In solid rock excavation, slopes shall be constructed to the approximate neat lines staked by the Engineer. No rock shall project or overhang more than 12 inches from the true slope.

203.03.06 OVERBREAK

A. Overbreak is that portion of material excavated, displaced or loosened outside and beyond the slopes or grade as staked or re-established, regardless of whether any such overbreak is due to blasting, the inherent character of any formation encountered, or to any other cause. Slides and slipouts as defined in ***Subsection 203.03.11, "Slides and Slipouts,"*** and that portion of rock subgrade as set forth below shall not be considered overbreak. All side slope overbreak as so defined shall be removed by the Contractor and shall be disposed of in the same manner as provided for the surplus under the heading of "Surplus Material," but at no additional cost to the Contracting Agency and without any allowance for overhaul.

B. Rock removed to a maximum depth of 6 inches below subgrade will be measured for payment as described in ***Subsection 203.04.01.C.2, "Overbreak."***

203.03.07 SLOPES

A. All excavation and embankment slopes, except in solid rock, shall be trimmed to the lines staked by the Engineer. The degree of smoothness shall be that normally obtained by hand shovel operations or blade grader operations.

203.03.08 WIDENING CUTS

A. If the Engineer directs the Contractor to excavate beyond the limits of the typical cross section originally proposed and within the limits of the right-of-way, the Contractor shall do so and compensation therefor will be as set forth in ***Subsection 203.04.01.C.3, "Widening Cuts."***

203.03.09 SURPLUS MATERIAL

A. Unless otherwise specified in the contract documents, surplus excavated material shall be used to widen embankments uniformly, or to flatten slopes, or at other locations, all in a manner satisfactory to the Engineer. No surplus material shall be disposed of above the grade of the adjacent roadbed nor shall the Contractor waste any material unless approved in writing by the Engineer.

B. If the quantity of surplus material is specified in the contract documents, such quantity shall be considered approximate only. The Contractor shall verify that there is sufficient material available for the completion of the embankments within the areas involved before disposing of any indicated surplus material inside or outside the right-of-way. Any shortage of material caused by premature disposal of the indicated surplus material by the Contractor shall be replaced by the Contractor and no compensation will be allowed the Contractor for such replacement.

203.03.10 SELECTED MATERIAL

A. When specified in the contract documents, or when selected by the Engineer, suitable selected material encountered in excavating or widening the roadway prism or any other excavation within the right-of-way, or in the excavation or borrow, shall be used for finishing the top portion of the subgrade. The top portion of the subgrade shall be 2 feet in depth, or as determined by the Engineer.

B. Selected material shall be defined as material that is excavated from one or more of the above sources and is used for selective purposes.

C. When practical, selected material shall be hauled directly from excavation to its final position and compacted in place and such work shall be paid for at the contract unit price for the excavation item involved. Attention is directed to ***Subsection 104.05, "Rights In and Use of Materials Found on the Project."***

D. When the transporting of selected material directly from excavation to its final position is impractical, the selected material shall be left in place until it can be placed in final position and no additional compensation will be made because of the delayed excavation. If, however, the conditions are such that the undisturbed selected material will hamper

ordinary grading operations or cause unnecessary movements of equipment, the Engineer may order, in writing, the removal of sufficient selected materials and the stockpiling thereof to enable practical hauling operations. If the excavation and stockpiling of selected material is specified in the contract documents or is ordered by the Engineer, the excavation and stockpiling locations shall be designated by the Engineer. The selected material shall be removed from the stockpile and placed in final position when approved by the Engineer.

E. Measurement for payment of selected material will be in accordance with ***Subsection 203.04.01.C.4, "Selected Material."***

203.03.11 SLIDES AND SLIPOUTS

A. Material outside the planned roadway or ditch slopes that is unstable and constitutes potential slides in the opinion of the Engineer, material from slides that has come into the roadway or ditch, and material that has slipped out of new or old embankments shall be excavated and removed. The material shall be excavated to designated lines or slopes either by benching or in a manner approved by the Engineer. Such material shall be used in the construction of the embankments or disposed of as approved by the Engineer.

B. The above provisions shall not be so construed as to relieve the Contractor from the duty of maintaining all slopes true and smooth. Erosion, regardless of amount or extent, caused by the action of the elements which results in damage to work or materials, shall in no case be considered a slide or slipout. Measurement for payment will be in accordance with ***Subsection 203.04.01.C.6, "Slides and Slipouts."***

203.03.12 DRAINAGE

A. During construction of the roadway, the roadbed shall be maintained in such condition that it will be well drained at all times.

B. V-type ditches shall be formed to the cross section and dimensions on the plans by means of suitable equipment, which will deposit all loose material on the downhill side. The bottom of the finished ditches shall not be less than 2 feet 6 inches below the crest of the loose material piled on the downhill side.

C. In going from cut-to-fill, the roadway ditches shall be so cut as to avoid damage to embankments by erosion.

D. The flat-bottom ditches indicated on the plans, or staked by the Engineer, shall be excavated to the required cross section and grade. Materials so obtained shall be used to construct roadway embankments or dikes or both, to form a continuous diversion channel as staked by the Engineer.

203.03.13 CHANNELS

A. To avoid destruction of natural growth during construction of ditches, channels, or dikes, travel of equipment shall be confined to the construction limits. Where ditches, channels, and dikes are nearly parallel to the roadway, turn-around shall not be located closer than

200 feet apart. Attention is directed to ***Subsection 107.12, "Protection and Restoration of Property and Landscape."***

B. Fine grading of channel bottoms will not be required unless paving is specified.

203.03.14 BORROW

A. A possible source of borrow material may be indicated in the contract documents. If the Contractor desires to use borrow materials from sources other than those described in the contract documents, the Contractor shall, at no additional cost to the Contracting Agency, acquire the necessary right to take materials and pay all costs involved. All costs of exploring such alternate sources shall be borne by the Contractor. Use of material from these sources will not be permitted until approved in writing by the Engineer.

B. The Contractor shall, at the time of execution of the contract, execute an "Agreement" for all borrow deposits obtained under an "Option and Agreement for Sale of Materials" when said "Option" is contained in the Special Provisions. This agreement shall be executed whether the material is to be used or not.

C. In case designated borrow deposits fail to contain the necessary quantity of acceptable material, the Contractor shall immediately notify the Engineer in writing. The Engineer shall thereupon investigate, and if the Engineer's investigation shows that there is not sufficient quantity of acceptable material, the Engineer shall designate an alternate deposit from which to obtain the deficit.

D. In all borrow pits having undesirable material, including overburden, refuse, organic and deleterious substances, the material shall be removed and wasted or redistributed, in a manner satisfactory to the Engineer. All costs incurred therefor shall be considered as incidental and subsidiary to the borrow material.

E. Borrow shall not be obtained until all other excavation items are complete to the extent necessary to determine the need for borrow.

F. The Contractor shall notify the Engineer 30 days in advance of opening any borrow areas so that cross section elevations and measurements of the ground surface after stripping may be taken, and the borrow materials can be tested before being used. Sufficient time for testing of the borrow material shall be allowed.

G. Borrow deposits shall be excavated to regular lines as staked to permit accurate measurement. The dimensions of the borrow deposit will be designated and the Contractor shall not excavate below the depth or outside limits given, except with prior approval. The depth of excavation throughout the area of the borrow pits shall be as uniform as practicable and the side slopes shall conform to the requirements of ***Section 626, "Final Cleanup."*** Unless otherwise permitted, borrow pits shall be excavated so that the pits will drain to the nearest natural outlet.

H. All materials that are not satisfactory for use for the purposes intended shall be rejected at the pit and disposed of in a manner satisfactory to the Engineer.

I. If the Contractor excavates more material than is required, the excess will not be measured for payment.

J. All work and materials required to build and maintain borrow haul roads and obliteration of haul roads in accordance with ***Section 626, "Final Cleanup"*** shall be considered subsidiary to the "borrow" item and no further compensation will be allowed.

203.03.15 FOUNDATION

A. When embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is to be built one half width at a time, the slopes that are steeper than 5:1, when measured at right angles to the roadway, shall be continuously benched as the work is brought up in layers. Benching shall be of sufficient width to permit operations of placing and compacting equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus cut out shall be recompacted along with the new embankment material at no additional cost to the Contracting Agency.

B. All foundations for embankment shall be cleared and grubbed in accordance with ***Section 201, "Clearing and Grubbing."***

C. In designated areas, unsuitable material shall be removed and disposed of as prescribed in ***Subsection 203.03.03, "Unsuitable Material."***

D. Where 12 inches or less of embankment is placed over existing bituminous surface, such surface shall be removed and incorporated in the embankment or otherwise disposed of as approved by the Engineer. Where more than 12 inches of embankment is placed over existing bituminous surface, such surface shall be left undisturbed. Measurement for removal of existing bituminous material will be measured and paid for as roadway excavation unless the contract documents specifically call for payment under ***Section 202, "Removal of Structures and Obstructions."***

203.03.16 EMBANKMENT MATERIALS

A. Embankments shall be constructed with suitable materials, excavated as prescribed and with any excess materials from other operations which are acceptable and suitable for use.

B. All materials used in embankment shall be free from objectionable material such as leaves, grass, roots, logs, stumps, brush, or other perishable material.

C. When there is a choice of material, the excavation shall be made so the best material will be placed on top of the embankment for at least 1 foot in depth. This paragraph shall not be interpreted as to require the Contractor to stockpile and subsequently rehandle embankment materials except as provided in ***Subsection 203.03.10, "Selected Material."***

D. Material shall not be placed in the embankment when either the material, foundation, or the embankment on which it would be placed is frozen.

E. Where embankments are to be made of material from rock cuts or other material that is unsuitable for finishing the roadbed, the upper 6 inches of the roadbed shall be formed of approved material.

F. Embankment material for the detention basin berm shall be granular backfill in accordance with ***Subsection 207.02.02 "Granular Backfill."***

203.03.17 PLACING EMBANKMENT

A. For embankment or backfill deposited against structures, attention is directed to Subsection 207.03.02, "Placing and Compacting at Abutments, Piers, Wingwalls and Retaining Walls."

B. Where structure abutments are placed on embankment, the embankment shall be constructed to subgrade elevation prior to excavating for the construction of the abutment. Where the abutment is supported on piles, the embankment shall be constructed to the elevation of the bottom of the footing.

C. Where a structure is to be covered by a rockfill, it shall be covered with not less than 2 feet of satisfactory soil or granular materials before the rock embankment is placed over the structure.

D. Embankments shall, except as specified herein, be constructed in layers. The construction of embankments shall begin at the lowest point of the fill below the grade or the bottom of ravines. Individual layers shall be spread evenly to uniform thickness throughout and parallel with the finished grade for the full width of the embankment, unless otherwise permitted. The thickness of the layer shall be as necessary to secure the required compaction with 12 inch maximum thickness after compaction. Excepted provisions for placing in marsh and placement of rock are outlined below. Hauling equipment shall be routed to obtain uniform compaction and channelization of haul routes and rutting of the fill shall be avoided.

E. When embankments are constructed across wet or swampy ground that will not support the weight of heavy hauling and spreading equipment, the Contractor will be expected to choose such methods of embankment construction and to use such hauling and spreading equipment as will least disturb the soft foundation. When soft foundations are encountered, and when approved by the Engineer, the lower part of the fill may be constructed by dumping and spreading successive vehicle loads. This shall be in a uniformly distributed layer of a thickness not greater than that necessary to support the vehicle while placing subsequent layers, after which the remainder of the embankment shall be constructed in layers and compacted as specified.

F. It is not the policy of the Contracting Agency to allow an increase in the planned depth of embankment material over soft, wet, or swampy ground for the sole purpose of providing support for heavy hauling and spreading equipment, unless the Contractor proves to the satisfaction of the Engineer that the planned depth is inadequate to support light hauling vehicles. If it proves necessary for the Contractor to use smaller hauling vehicles or different methods of embankment construction than the Contractor had originally

contemplated in order to comply with the foregoing, such shall not be the basis for a claim for extra compensation against the Contracting Agency. The unit contract price for the various pay items involved shall be full compensation for all labor, materials, and equipment necessary to perform the work as outlined herein.

G. Embankment which, in the opinion of the Engineer, contains enough rock larger than 9 inches to make it impractical to place and compact in 12-inch lifts shall be considered as "Rock Embankment." The materials shall be spread in a uniform horizontal layer over the full width of the embankment. The layer thickness shall not exceed 1-1/3 times the vertical dimension of maximum size material larger than 9 inches. The largest size rock allowed in the embankment will be 3 feet measured in vertical direction and rocks larger than this shall be broken up before being placed in the embankment. Rock to be wasted may exceed 3 feet and be disposed of in an inconspicuous manner approved by the Engineer.

H. In rock fills where end dumping is employed, direct end dumping upon the previously constructed layer of embankment will not be permitted. Rock shall be dumped on the layer of embankment being constructed and dozed ahead into place. Care shall be exercised to work the fines and smaller rock into the spaces between the larger rock. Compaction will be required as provided in Subsection 203.03.19, "Compaction, Rock Embankment."

I. To the extent of project requirements for embankments, all rock from excavation shall be used for embankment. The Contractor shall plan the grading operation to use rock that may be encountered in excavation in accordance with the following provisions:

J. Rock, in general, shall be placed to form the base of embankment for the full width of the cross section under the following condition:

1. on the side slope or slopes of a new embankment being placed; or

2. on the side slope or slopes of an embankment already in place requiring widening; or where excess rock may be wasted; or

3. on the side slopes and top of rolled embankment made of embankment materials other than rock.

K. The Contractor shall not place large rock in embankments where piles will be driven. The Contractor shall be responsible for penetrating the embankment with specified piles.

L. When rock and other embankment materials are excavated at approximately the same time, the rock shall be distributed throughout the fill and not nested in one location.

M. When there is insufficient material other than rock in the excavation to permit properly compacted layers, the rock shall be placed for the full cross section width with the larger rocks well distributed and the void spaces filled with the smaller rocks and fragments.

N. When shown on the plans or considered necessary by the Engineer, embankments shall be built to such elevation above required grade to allow for settlement, or sufficient surcharge shall be placed above the required elevation of earth grade over deposits of

unstable material to secure displacement or settlement. Surcharge shall be removed only after the fill has reached stability or the required settlement time has been reached.

203.03.18 COMPACT, DIRT EMBANKMENT

A. Optimum moisture content and material density of the various soils will be determined by a Geotechnical Engineer and acceptable ranges for optimum moisture and material density shall be approved by the Engineer. At the time of compaction, the moisture content of the various soils shall be within the approved ranges.

B. The compacted subgrade shall be maintained at a minimum of optimum moisture content until placement of an aggregate base course or cement treated base.

C. When necessary, each layer before being compacted shall be processed as required in order to bring its moisture content within the prescribed limits. The material shall be wetted by the application of water or dried as necessary and either process may be carried out either on the embankment or at the source of the material or otherwise as approved by the Engineer. Full compensation of any work involved in wetting or drying embankment material to obtain the required moisture content shall be considered as included in the contract unit price bid for excavating or furnishing the material and no additional compensation will be allowed therefor.

D. Hauling and leveling equipment shall be routed over each layer of the fill in such a manner as to uniformly distribute the compaction afforded by the wheel load. In addition to hauling and leveling equipment, the Contractor shall provide compaction equipment that is specifically designed and manufactured for compacting dirt embankments. The compaction equipment shall work continuously with the grading equipment.

E. The top 8 inches of the base of cuts and natural ground having less than 5 feet of embankment, measured from the subgrade, and all embankment material, shall be compacted to not less than 90 percent relative compaction unless otherwise specified. When natural ground material is encountered that cannot be compacted to the required density, compaction requirements shall be determined by the Engineer.

F. All selected borrow and structure backfill placed within the limits of embankment shown on the plans for approaches to bridges shall be compacted to not less than 95 percent relative compaction unless otherwise specified.

G. It is to be expected that a loss of density in the upper portion of earth subgrade may occur due to the elements, or for lapse of time, or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed.

203.03.19 COMPACTION, ROCK EMBANKMENT

A. Field density tests will not be required on rock embankments. In lieu thereof, the required compaction shall be tested by proof rolling. Unless otherwise specified, compaction shall be attained and tested by using construction methods and equipment as follows:

1. Methods:

    a. The material for the embankment shall be deposited, spread, and leveled the full width of the embankment, and the layer of thickness may be 1-1/3 times the vertical dimension of maximum size material. The maximum size rock shall not exceed 3 feet.

    b. Hauling and leveling equipment shall be routed and distributed over each layer of the fill in such a manner as to make use of the compaction afforded thereby. Rollers, vibrators, or compactors shall compact the embankment full width with a minimum of 3 complete passes for each layer of embankment. The compacting equipment shall not exceed a speed of 5 miles per hour and shall work continuously with the grading equipment.

    c. Rolling shall be done in a longitudinal direction along the embankment and shall begin at the outer edges and progress toward the center. The travel paths of traffic and construction equipment shall be kept dispersed over the entire width of the embankment to aid in obtaining uniform compaction. Weights of equipment used in making embankments over soil having an excessive moisture content may be limited, if, in the judgment of the Engineer, such limitations are necessary in order to maintain the fill in a satisfactory condition.

    d. Water shall be applied to the embankment in the amount necessary to obtain the required compaction.

2. Equipment:

    a. Compaction equipment shall be adequately designed to obtain compaction requirements without adverse shoving, rutting, displacement, or loosening and shall meet the requirements specified herein. Rollers shall have displayed thereon in permanent legible characters, the manufacturer's guaranteed net operating weights as distributed on each axle.

    b. The proof roller shall be a pneumatic-tired roller or pneumatic-tired compactor weighing not less than 50 tons, and capable of applying to the ground loads of not less than 25,000 pounds per wheel. All tires shall be of equal size and diameter and shall be capable of operating at an air pressure of at least 90 psi. The tires shall be kept uniformly inflated so that the difference in pressure in any 2 tires shall never exceed 5 psi and means shall be provided by the Contractor for checking the tire pressure on the job at any time.

3. Tests:

    a. Subsequent layers shall not be placed until the previous layer of the embankment is compacted to the degree that no further appreciable deflection is evidenced under the action of proof rolling equipment, as determined by the Contractor with approval of the Engineer.

b. Rolling and proof rolling may be deleted on any layer or portion thereof when, in the judgment of the Engineer, accomplishment is physically impractical.

c. Payment for rolling and proof rolling or for the correction of any subgrade weakness or deficiencies disclosed by the proof rolling operation shall be considered subsidiary to the price bid for the "Excavation" item.

4. The Contractor shall submit an inspection report to the Engineer that has been reviewed and stamped by a Nevada professional engineer.

203.03.20 MAINTENANCE

A. Embankment material that may be lost or displaced as a result of natural settlement of the ground or foundation upon which the embankment is constructed shall be replaced by the Contractor with acceptable material from excavation or borrow, etc. The quantity of material required will be paid for at the regular contract price for the type of material used.

B. The Contractor shall, at no additional cost to the Contracting Agency, remove and replace with acceptable material any embankment or portion thereof which has been constructed with unapproved material as well as remove and replace portions of the embankment which may become unstable or displaced as the result of carelessness or negligence on the Contractor's part.

203.03.21 SUBGRADE TOLERANCE

A. Subgrade shall comply with ***Subsection 203.03.02, "Grade Tolerance."***

203.03.70 OVEREXCAVATION AND BACKFILL

A. Where overexcavation below the depths as shown on the plans or required by the specifications is necessary to remove unsuitable material, the Engineer may require the Contractor to remove the unsuitable materials and backfill to the finished graded section with Type I aggregate base, conforming to 3-inch size per subsection 704.03.03, compacted to a minimum of 90% of ASTM D1557 Modified Proctor and in accordance with the methods in the USS.

B. Unless otherwise provided in the Special Provisions, overexcavation and backfill below the limits shown on the plans will be paid for as "Extra Work".

203.03.71 HAZARDOUS MATERIAL

A. Hazardous material shall be defined as material or water contaminated with volatile organic compounds, inorganic non-metals, petroleum hydrocarbons or other contaminates as specified by the Nevada Division of Environmental Protection Agency (NDEP).

B. The Contractor shall retain a Certified Environmental Manager (CEM) for making periodic inspection of the project for potential hazardous materials. In addition, the CEM will be available for inspection of the project as directed by the Engineer and/or NDEP should material be uncovered that may be potential hazardous material.

C. When potential hazardous material is encountered with the project, the Contractor shall:

1. Immediately contact the CEM, Engineer and City of Las Vegas Environmental Officer.

2. Have the CEM perform the inspection of the potential hazardous material and if required perform the inspection for the removal and disposal of the hazardous material.

3. Retain a certified geotechnical firm to perform the required tests for hazardous materials and/or contaminants.

4. If required, perform the removal and disposal of the hazardous materials as directed by the CEM, Engineer and/or City of Las Vegas Environmental Officer in coordination with NDEP.

203.03.72 EXCAVATION

A. It is expected excavation for storm drain and detention basin items will require removal of various types of material, including cemented soils and rock (i.e. caliche).

B. Prior to construction, baseline distress evaluation by a qualified professional shall be conducted by the Contractor. The evaluations shall document existing distress to the structures and other improvements in the area of work.

C. Vibration monitoring by a qualified professional shall be conducted by the Contractor during excavation of cemented soils. The Contractor shall be required to conduct impact assessment tests of the equipment excavating cemented soils prior to construction. The Contractor shall submit an Impact Assessment Test Plan and Impact Assessment Test Results. The frequency and amplitude of the vibratory equipment shall be calibrated and used to measure ground velocity for conformance to the current regulatory limit of 0.3 inch per second peak ground velocity at the nearest affected structure. The measurements shall comply with the recommendations of the “Office of Surface Mining, Blasting Guidance Manual, 1987.”

D. The Contractor shall submit to the Owner a plan detailing his proposed excavation techniques. This excavation plan shall include the results of a seismic survey performed by a certified seismic survey firm. The plan must show all proposed locations of excavation operations utilizing methods involving headache balling, hoe ram, or other techniques. The excavation plan shall include recommendations from certified seismic survey firm for limiting ball weights, height of drop, etc. for all areas headache balls and/or hoe rams techniques are proposed. In addition, the plan must include the results of a pre-excavation survey and a seismic monitoring plan. The excavation plan shall also include as a minimum; detailed examination of adjacent structures, including videotaping and

installation of crack monitoring tape along existing structural cracks. The excavation plan must be approved by the Owner prior to construction.

E. If damage to structures becomes evident, the Contractor shall immediately cease his excavation operations and submit a new excavation plan detailing new or modified methods to end the adverse effects. The Contractor shall make no claims for any delay caused by the re-submittal nor any additional expense resulting from changing his proposed excavation methods.

F. The excavation plan shall be updated and resubmitted to the Owner any time the Contractor proposes altering his methods. The plan(s) will be considered shop drawings and will be handled as such. The Contractor shall make no claim for any losses resulting from delays during the review of these submittals in accordance with the limitations detailed for shop drawings in these specifications.

G. The Contractor's methods for excavation are solely his responsibility. Approval of the excavation plan by the Owner will in no way limit the Contractor's liability regarding property damaged and subsurface damage beyond the excavation limits by his operations, nor will it alter the Contractor's sole responsibility for the safety of his operations. The Contractor shall be responsible for all damage caused by his excavation operations and be responsible for answering all complaints. Provide the Owner with advance warning of the use of excavation techniques which may lead to property damage, to review the proposed techniques, to confirm general compliance with these specifications, and to allow monitoring of the excavation methods.

H. Excavations near mapped alluvial faults shall be inspected by a qualified professional prior to RCP/RCB installation. If a fault is encountered, appropriate remedial action shall be taken by the Contractor per geotechnical recommendations.

203.03.73 COMPACTED FILL

A. Compacted fill will consist of native material excavated, hauled, screened, placed, and compacted within the neat lines shown on the Drawings and as specified in Subsection 203.03.16.

B. All fill materials shall be placed in continuous horizontal layers in maximum 12-inch lifts. Each layer shall be moisture conditioned to at least minus 2 percent of optimum moisture content and compacted by rolling with compaction equipment methods to at least 95 percent of the maximum dry density as determined by ASTM D1557.

C. The existing soil in areas to receive fill along the dam embankment shall be scarified to a minimum of 8 inches, reworked, moisture conditioned, and recompacted to at least 95 percent of the maximum density as determined by ASTM D1557. Moisture content at time of compaction should be at least optimum. The depth of excavation, replacement, and compaction may be reduced or increased by the Owner's representative depending on the representative's visual inspection of uncovered soils. Hard cemented soils may result in a decrease in required excavation depth while partially cemented soils or soft spongy or deleterious soils may result in an increase in required excavation depth. Any increase in depth shall comply with Subsection 203.03.70, Over-Excavation and Backfill.

203.03.74 EMBANKMENT PROTECTION

A. Completed excavation and embankment grading planes and other disturbed areas within the limits of construction shall be protected by soil stabilizer placed on all exposed soil surfaces. Soil stabilizer shall be applied to all disturbed soil areas not specified to be covered with riprap, decomposed granite, aggregate base, asphalt pavement or other surfacing. Unless otherwise specified in these Special Provisions, herbicide shall not be placed on any surfaces within the detention basin.

B. Apply soil stabilizer within 14 days of when no further disturbance of the surface will be made. Protect all structures, walls, landscaping, etc. from overspray. Store and handle soil stabilizer in accordance with the manufacturer's recommendations. Do not spray when weather conditions are windy. Windy conditions are defined as a sustained wind of 8 mph or more, or any condition that may cause dispersal of material to be difficult or inaccurate. Soil stabilizer shall form a crust like barrier within 4 to 8 hours. The use of accelerators is recommended.

C. Soil stabilizer shall be PLAS-TEX, Enviro-Shield Bonded Fiber Matrix, or approved equal and shall be applied at the manufacturer's recommended application and dilution rates.

D. Add a color pigment to the soil stabilizer at the time of application. Apply a suitable pigmentation to the soil stabilizer slurry such that is used for pigmenting concrete at an application rate of 50 pounds per acre. The color of the pigmentation shall be approved by the Engineer.

203.03.75 QUALITY CONTROL TESTING

A. Quality control testing will be performed for Dam Safety Permit compliance in accordance with the State Engineers Office. The testing will be performed by an independent testing laboratory.

B. The Contractor shall schedule his operations so as to allow and facilitate quality control testing by the independent laboratory.

C. The following standard tests will be used as a basis for classifying soil materials and for control testing:

Test Designation	Test
ASTM C136 AASHTO T27	Test for Sieve or Screen Analysis of Fine and Course Aggregates
ASTM D1556	Density of Soils In-Place by the Sand-Cone Method
ASTM D1557 AASHTO T180	Moisture-Density Relations of Soils and Soil Aggregate Mixing Using 10 Pound Rammer and 18-Inch Drop
AASHTO T310	In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

ASTM D4318 AASHTO T89/T90	Plasticity Index of Soils
AWWA 4500E	Maximum Sulfate Content
AWWA 4500CL	Maximum Chloride Content
Southern Nevada Amendments to the Building Code	Maximum Expansive Potential 60 psf
ASTM C117	Test for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
ASTM D422	Particle-Size Analysis of Soils
ASTM D6938	Nuclear Methods
ASTM D5084	Permeability
ASTM D3080	Direct Shear Testing

D. Two representative soil samples of imported fill will be performed at the beginning of construction. Additional tests will be conducted to classify and establish the moisture density relationship for each type of soil encountered in areas that may yield excavated materials suitable for placement in embankment. Whenever the material encountered is different from previously tested material, a new set of classification and moisture-density tests will be performed.

E. The number of locations of in-place density tests for embankment and compacted fill construction shall be sufficient to determine that each layer of material placed in embankment has been compacted adequately to obtain the density specified therefore. The minimum number of in-place density tests by ASTM D1556 and AASHTO T310 procedures will be one for each 5,000 square feet per 8-inch lift of fill.

F. The following standard tests will be used for concrete material quality control testing:

Test Designation	Test
ASTM C1064	Temperature of Freshly Mixed Portland Cement Concrete
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C173/C231	Air Content of Freshly Mixed Concrete
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens

G. The concrete will be tested a minimum of once per day and per every 100 cubic yards placed.

H. The above frequency of tests is approximate and is provided for the Contractor's information in planning Contractor's work and interruptions during testing. The actual number of tests will depend on the variability of materials being placed and uniformity of the Contractor's placement operations.

I. Quality control test data will be reviewed and submitted monthly. All quality control test data will be compiled in a final report and submitted at the completion of work for Dam Safety Permit compliance. All reports submitted to the City shall be stamped by a Nevada Registered Professional Engineer.

203.03.76 CALICHE EXCAVATION

A. Caliche is anticipated to be encountered on this project and is defined as a rock-like material that occurs in soil deposits erratically in thickness, hardness, and lateral extent and it is therefore difficult to predict in terms of interference with below-grade construction. Contractor shall take adequate precautions to reduce the potential for vibrational damage to adjacent or nearby structures when using heavy impact equipment during removal of caliche. In the event structures are damaged, Contractor shall be responsible for all repairs.

B. Generation of oversized material (rocks or hard chunks greater than 6 inches nominal diameter) shall be anticipated by Contractor when excavating caliche. Oversize material shall be crushed prior to being used as structural fill, backfill, and compacted fill, or disposed of in a suitable manner.

TESTING

203.05.02 TESTING

SECTION	DESCRIPTION	TEST	REFERENCE SPECIFICATION AND/OR TEST PROCEDURE	RECOMMENDED FREQUENCY
203.02.01	Roadway Excavation (Subgrade)	Field Density	AASHTO T 310	1/5000 SF
203.02.02	Drainage Excavation (Subgrade)	Field Density	AASHTO T 310	1/5000 SF
203.02.03	Channel Excavation (Subgrade)	Field Density	AASHTO T 310	1/5000 SF
203.02.04	Borrow	Sieve Analysis	AASHTO T 11 & T 27	1/Type
		Plasticity Index	AASHTO T 89 & T 90	1/Type[1]
203.02.05	Selected Borrow	R-Value	AASHTO T 190	1/Type
		Proctor	AASHTO T 180	1/Project or Change
203.03.01	Roadway At Grade or Fill (Subgrade)	Field Density	AASHTO T 310	Residential = 1/5000 SF/Lift/Day
				Arterial and Collector = 1/5000 SF/Lift/Day
203.03.10	Selected Material	Sieve Analysis	AASHTO T 11 & T 27	1/1000 LF
		Plasticity Index	AASHTO T 89 & T 90	1/1000 LF
		R-Value	AASHTO T 190	1/Type
		Field Density	AASHTO T 310	1/5000 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change
203.03.15	Foundation[2] (Subgrade)	Field Density	AASHTO T 310	1/500 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change
203.03.18	Embankment	Field Density Fill	AASHTO T 310	1/5000 SF/Lift/Day
		Field Density Native Below Embankment Fill Operations	AASHTO T 310	1/5000 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change
203.03.19	Rock Embankment	Visual	Issue Inspection Report	Full Time

END OF SECTION 203

[1] A maximum testable lift is defined as a 12-inch layer of compacted material.
[2] This is in reference to benched slope construction of embankment only.

SECTION 206 – STRUCTURE EXCAVATION

DESCRIPTION

206.01.01 GENERAL

A. This work shall consist of the removal of all material of whatever nature encountered in the construction of foundations for bridges, retaining walls, headwalls for culverts and other structures; the excavation of trenches for pipe culverts, box culverts, cut-off walls for slope paving and concrete aprons, footings for riprap and other excavation specifically designated on the plans, in these specifications or in the Special Provisions as structure excavation, which shall include the work of disposing of surplus material and cleaning up the sites. Structure excavation shall include dewatering and the furnishing of all equipment and the construction or installation of all cofferdams, cribs, and other facilities, which may be necessary to perform the excavations and the subsequent removal of such facilities except where they are required or permitted by the plans or specifications to remain in place. It shall also include all the necessary clearing and grubbing within the proposed structure area and removing old structures or parts thereof as required if the proposal does not include separate bid items for such work.

B. For separate requirements pertaining to the excavation involved in the installation of pipe culverts and underground piping, attention is directed to those sections of these specifications governing such work.

C. Where structure over-excavation below the depths as shown on the plans or required by the specifications is necessary to remove unsuitable material, the Engineer may require the Contractor to remove the unsuitable materials and backfill to the required grade with material conforming to ***Subsection 704.03.02, "Drain Backfill,"*** compacted to a minimum of 90% of ASTM D1557 Modified Proctor and in accordance with the methods in the USS.

D. If groundwater is encountered within the excavated area, dewatering shall be performed as specified in ***Section 270, "Dewatering."***

CONSTRUCTION

206.03.01 GENERAL

A. The Contractor shall notify the Engineer in sufficient time in advance of the beginning of excavation for structures so that elevations and measurements may be taken of the existing ground before it is disturbed and of existing substructure units within the limits of excavation for structures before they are removed. Any material excavated or removed before these measurements have been taken will not be paid for.

B. The excavated area shall conform to the outlines of the footings, as shown on the plans, and shall be of sufficient size to permit placing of the full width and length of the footings shown. The elevation of the bottoms of footings as shown on the plans shall be considered as approximate only, and the Engineer may order, in writing, such changes in dimensions or elevation of footings as may be necessary to secure a satisfactory foundation.

C. Unless otherwise permitted by the Engineer, foundations shall be compacted to not less than 95 percent relative compaction for culvert pipe and structures. For fine-grained soils, which are classified by having 50 percent or more passing the No. 200 sieve, the relative compaction may not be less than 90 percent if approved by the Engineer.

D. All rock or other hard foundation material shall be freed from all loose material, cleaned and cut to a firm surface, either level, stepped or serrated, as may be permitted by the Engineer. All seams and crevices shall be cleaned out and filled with concrete mortar or grout.

E. Where masonry is to rest on material other than rock or boulders, special care shall be given not to destroy its bearing value.

F. Should the Contractor remove structure excavation below grade, the Contractor shall backfill to the required elevation at no additional cost to the Contracting Agency with backfill in a manner satisfactory to the Engineer.

G. Wet pits shall be dewatered for inspection and for construction of foundations unless otherwise provided.

H. Excavated material, which is suitable for backfilling, shall be so utilized or used in embankments, in a manner satisfactory to the Engineer. Surplus or unsuitable material shall be disposed of to cause no obstruction to flow of streams or otherwise impair the efficiency or appearance of the structure. It shall be disposed of in such a manner as to prevent damage to property or the creation of unsightly conditions, and shall not be placed where it will interfere with the operation of drains or impair the roadway ditches, etc.

I. After each excavation is completed, the Contractor shall notify the Engineer, and no masonry shall be placed until the Engineer has approved the depth of excavation and the character of the foundation material.

206.03.02 SAFETY REQUIREMENTS AND REGULATIONS

A. The Contractor shall follow OSHA safety regulations (29 CFR, Part 1926, Subpart P, Excavations) for sloping the sides of excavations, using shoring and bracing, and for using other safety features. When the sides of excavations are sloped for safety considerations, the Contractor shall provide, for informational purposes, one copy of the design that demonstrates conformity with OSHA regulations to the Engineer. Where support systems, shield systems, or other protective systems are to be used, the Contractor shall be responsible for their design and shall submit design calculations along with detailed drawings that demonstrate conformity with OSHA regulations to the Engineer. These calculations and detailed drawings shall be stamped and signed by a professional engineer licensed to practice in the state of Nevada. The design calculations and detailed drawings are considered working drawings and shall be submitted in accordance with ***Subsection 105.02, "Plans and Working Drawings."***

END OF SECTION 206

SECTION 207 – STRUCTURE BACKFILL

DESCRIPTION

207.01.01 GENERAL

A. This work shall consist of placing and compacting, to the lines designated on the plans or as established by the Engineer, backfill material in excavations for bridges, retaining walls, headwalls for culverts, and other structures; placing and compacting backfill material for box culverts and other non-pipe culverts; and other backfill specifically designated in the contract documents as structure backfill. This item does not include backfilling pipes within a trench or minor miscellaneous structure excavations outside the limits of the roadway.

MATERIALS

207.02.01 SELECTED BACKFILL

A. Selected backfill shall be of a quality acceptable to the Engineer and shall consist of suitable material from the excavation complying to Table 1 and Table 2. It shall be free from sod, frozen earth, organic materials, rubbish, or debris. If the material does not comply with Table 1, it may be used only if approved by the Engineer.

Table 1 – Select Backfill Gradation

Sieve Sizes	Percentage of Weight Passing
6-inch	100
3-inch	80-100
No. 4	35-100

Table 2 – Select Backfill Maximum Plastic Index Requirement

Percentage by Weight Passing No. 200 Sieve	Plasticity Index Maximum
10-10.0	15
10.1-20.0	12
20.1-50.0	10
50.1-80.0	8
80.1-100.0	6

B. When the completed select backfill test results from the sample indicate a Plasticity Index of 12 or greater, a swell potential test may be required. Contact the Contracting Agency for further procedure requirements or comply with the contract Special Provisions.

C. The liquid limit of the material shall not exceed 50 percent maximum.

D. Stones or lumps exceeding 3 inches shall not be used within the zones 12 inches or less from the structure, 12 inches or less from the finish subgrade in unpaved areas, or 16 inches or less below the finish subgrade in paved areas.

E. Acceptable material from excavation "Selected Backfill" may be used for structure backfilling unless "Granular Backfill" is specified.

207.02.02 GRANULAR BACKFILL

A. Granular backfill shall consist of natural sand or a mixture of sand with gravel. Broken Portland cement concrete and bituminous type pavement will be permitted, subject to the gradation limits specified herein. The granular backfill material shall have a sufficient amount of fine material to fill the voids between the coarser aggregate.

B. In addition, the material shall conform to the following requirements:

Table 3 – Granular Gradation

Sieve Sizes	Percentage of Weight Passing
3-inch	100
No. 4	35-100
No. 16	25-100
No. 200	5-15

C. The plasticity index of the material shall be as specified in ***Subsection 704.03.01, "Plastic Limits."***

D. The total available water soluble sulfate content of the material shall not exceed 0.3 percent by dry soil weight.

CONSTRUCTION

207.03.01 GENERAL

A. Compaction of backfill or embankment around all structures shall be in accordance with the requirements of AASHTO LFRD Bridge Construction Specifications with exceptions as described in this section. The compaction shall be performed with mechanical tamping units and the material shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used subject to approval by the Engineer.

B. Unless otherwise specified or approved by the Engineer, the compaction requirement shall be a minimum of 95 percent.

C. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used. Backfill material shall be placed in uniform horizontal layers with a maximum compacted depth of 12 inches and shall be brought up uniformly on all sides of the structure or improvement.

D. Backfill material to be used around buried structures where water is present or anticipated to be present shall be carefully selected so that it will protect the surrounding soil from infiltrating into the backfill as determined by the Engineer. This select material shall serve as a filter material. If the drain material is to remove an appreciable quantity of water, graded filter drains using separate fine-grained layers for filters and coarse-grained layers

to conduct the water may be required. As an alternate to using a filter material, a filter fabric may be placed between the backfill material and surrounding soil.

E. Material resulting from structure excavation and not used, shall be deposited in roadway embankments in accordance with the requirements specified elsewhere or otherwise disposed of in a manner approved by the Engineer and no additional compensation will be allowed for such work.

F. Structure backfill shall not be placed until the structure or facilities have been inspected by the Engineer and approved for backfilling. Backfill material shall not be deposited against the back of concrete abutments, concrete retaining walls, or the outside walls of concrete box culverts until the concrete has reached 80 percent of the required compressive strength and approved by the Engineer.

G. Backfill operations placed against concrete walls that will support any deck shall not be performed until after the deck has been placed.

H. Where backfill is placed against waterproofed surfaces, care shall be taken that no damage is done to the waterproofing material.

207.03.02 PLACING AND COMPACTING AT ABUTMENTS, PIERS, WINGWALLS AND RETAINING WALLS

A. With the approval of the Engineer, all spaces excavated and not occupied by abutments, piers, or other permanent work shall be refilled with earth up to the surface of the surrounding ground or to the limits designated on the plans or as described herein. All backfill shall be thoroughly compacted in accordance with the provisions set forth in ***Subsection 207.03.01, "General."***

B. Where backfill is to be placed on one side of an abutment, wingwall, pier, or headwall, care shall be exercised to prevent displacement of line, or batter, or both.

C. Existing slopes that are shaped to cause wedge action in the backfill shall be step-cut or benched before backfilling.

207.03.03 PLACING AND COMPACTING AT CULVERTS

A. After the bedding has been prepared and the culverts installed or constructed as required by the pertinent specifications, "Selected Backfill" or "Granular Backfill" shall be placed along both sides of the culvert equally in uniform layers such that the elevation of the top of the backfill on either side of the culvert does not exceed the elevation of the top of the backfill on the other side of the culvert by more than 6 inches. The thickness of each layer shall be compatible with the characteristics of the backfill and the type of equipment being used, but shall not exceed 12 inches in depth after compaction nor a loose lift of 16 inches. Each layer shall be wetted as required and thoroughly compacted to the density requirements as set forth in ***Subsection 207.03.01, "General."***

B. Special care shall be taken in placing and thoroughly compacting the material under the haunches of all pipe culverts.

C. Unless otherwise directed, the backfilling shall continue as directed to the level of the ground or to an elevation 6 inches above the structure in the case of a pipe culvert in projection, or even with the top of the structure in the case of reinforced concrete box culvert in projection.

D. No construction equipment or other traffic shall be permitted to cross any culvert until a safe minimum depth of fill above the culvert has been placed and compacted in accordance with these specifications. The Contractor shall be solely responsible for protecting the structure from superimposed loading by construction equipment and shall repair any damage to the structure or replace the structure as ordered without extra compensation.

E. Special care shall be taken in backfilling arches, particularly half-circle arches. The arch shall be covered in layers, each layer conforming to the shape of the arch and tamped thoroughly.

207.03.04 PLACING AND COMPACTING OF BIN-TYPE RETAINING WALLS

A. Placing and compacting backfill material for bin-type retaining walls shall progress concurrently with the assembly of the bins, and backfilling around the outer sides thereof shall be kept approximately level with the inside fills. The materials shall be thoroughly tamped and meet the density requirements as set forth in ***Subsection 207.03.01, "General."*** Care shall be exercised to completely fill the depressions of stringers and spacers without displacing them from established line and batter.

TESTING

207.06.01 TESTING

Table 4 - Testing

Spec. Section	Description	Test	Reference Specification and/or Test Procedure	Recommended Frequency[1]
207.02.01	Selected Backfill	Sieve Analysis	AASHTO T11 & T27 ***USS 301*** & Special Provisions	1/1000 CY
		Plasticity Index	AASHTO T89 & T90 ***USS 301*** & Special Provisions	1/1000 CY
207.02.02	Granular Backfill	Sieve Analysis	AASHTO T11 & T27 ***USS 301*** & Special Provisions	1/1000 CY
		Soluble Sulfates	AWWA 4500E	1/Type
207.03.01	General	Field Density	AASHTO T310	If Riding Equipment Used: 1/5000 SF/Lift
				If Walk Behind Equipment Used: 1/1000 SF/Lift Per Structure Per Day

END OF SECTION 207

[1] A maximum testable lift is defined as a 12-inch layer of compacted material.

SECTION 208 – TRENCH EXCAVATION AND BACKFILL

DESCRIPTION

208.01.01 GENERAL

A. This work shall consist of the excavation and backfill of trenches for the accommodation of substructures including, but not limited to electrical conduits, telephone conduits, television cable, traffic signal conduits, gas lines, sewer lines, water lines, and storm drains except where governed by utility agency specifications. These other agencies are responsible for the trench to the top of subgrade (bottom of the pavement section).

B. When the terms "Backfill" or "Trench Backfill" are used herein, they shall be construed to mean one or more of the types of backfill specified below under "Materials."

C. The designing engineer shall comply with the intent of the pipe material as defined as either rigid or flexible in conformance with the AASHTO LRFD Bridge Design and Construction Specifications and this Section. Special attention shall be given to the sidewall material properties as this section assumes a minimum AASHTO A1 or A3 material. Other sidewall material type shall be given special consideration for minimum trench widths, the use of Controlled Low Strength Materials (CLSM), or other critical processes that would affect the pipe ability to withstand the load and shall also be noted on the plans and specifications for the project.

D. The type of pipe and applicable installation requirement (trench and embankment) to be used as demonstrated by the design and approved by the Agency Engineer shall be clearly noted on the drawings and specifications along with installation procedures that may differ from this section.

E. Quality control field inspection and testing requirements including frequency shall be in accordance with Contracting Agency requirements. Frequency of quality control field inspection and testing shall be in accordance with ***Subsection 203.05.02, "Testing."***

F. Ponding and jetting will not be allowed on City of Las Vegas projects.

208.01.02 DEFINITIONS

A. **Foundation:** Over-excavation and backfill of the foundation is required only when the native trench bottom does not provide a firm-working platform for placement of the pipe bedding material.

B. **Bedding:** In addition to bringing the trench bottom to required grade, the bedding levels out any irregularities and ensures uniform support along the length of the pipe.

C. **Haunch Zone:** The backfill under the lower half of the pipe (haunches) distributes the superimposed loadings.

D. **Initial Zone:** The backfill from the springline to the top of the pipe zone provides the primary support against lateral pipe deformation for flexible pipe.

E. **Final Zone:** Backfill above the pipe zone to the top of subgrade.

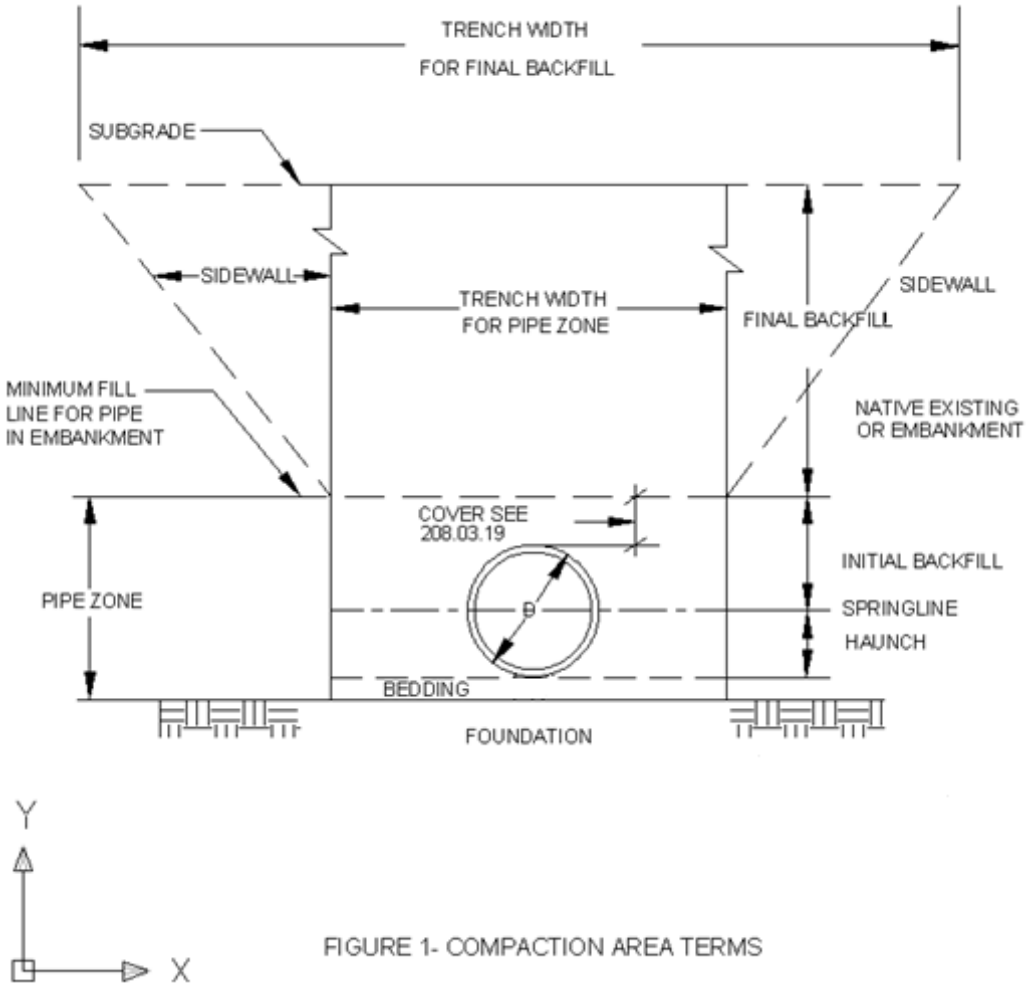


FIGURE 1- COMPACTION AREA TERMS

MATERIAL

208.02.01 GENERAL

A. The material placement in the pipe zone area shall first comply with Table 1, when applicable. Note that CLSM backfill is required for storm drain pipes within the detention basin embankment, see plans for specific limits.

Table 1 - Pipe Zone Maximum Particle Size for Backfill

Nominal Pipe Size (inches)	Maximum Particle Size (inches)
2 to 4	1/2
6 to 8	3/4
10 to 16	1
18 and larger	1-1/2

B. One of two methods of compaction of the trench pipe zone shall be used and shall be specified in the Construction Documents and approved by the Engineer prior to construction:

1. **Method A:** The use of CLSM as defined in this section. This method is required for storm drain pipe within the detention basin embankment, see plans for specific limits.

2. **Method B:** The use of aggregate materials as described in this section as associated with either Rigid or Flexible designed pipe shall be as specified in this subsection below.

C. Prior to construction, the materials and method type shall be submitted and approved by the Engineer.

208.02.02 SELECTED BACKFILL

A. This material shall be similar to that removed from the trench excavation or may be imported material as specified in ***Subsection 207.02.01, "Selected Backfill,"*** or as otherwise shown on the Drawings.

208.02.03 GRANULAR BACKFILL

A. Granular backfill shall be as specified in ***Subsection 207.02.02, "Granular Backfill."***

208.02.04 SAND BACKFILL

A. Sand backfill shall consist of natural sand or a mixture of sand with gravel or stone. In addition thereto, the material shall conform to the following gradation requirements:

Table 2 - Sand Backfill Gradation

Sieve Sizes	Percentage of Weight Passing
3/8 inch	100
No. 4	80-100
No. 200	5-20

B. The plasticity index of the material shall be as specified in ***Subsection 704.03.01, "Plastic Limits."*** The soluble sulfate content shall not exceed 0.3 percent by dry weight of soil.

208.02.05 TYPE II AGGREGATE BASE BACKFILL

A. Type II aggregate base backfill shall be as specified in ***Subsection 704.03.04, "Type II Aggregate Base."*** The total available water soluble sulfate content shall not exceed 0.3 percent by dry weight of soil.

208.02.06 DRAIN BACKFILL

A. Drain backfill shall be as specified in ***Subsection 704.03.02, "Drain Backfill."*** The type shall be as shown on the plans or approved by the Engineer.

208.02.07 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. Backfill shall be as specified in ***Subsection 704.03.07, "Controlled Low Strength Material."***

208.02.08 CRUSHED ROCK

A. The materials properties shall conform to ***Subsection 704.03.06, "Crushed Rock."***

208.02.09 TYPE III AGGREGATE

A. Aggregate properties and gradation shall conform to Type III as specified in ***Subsection 704.03.05, "Type III Aggregate,"*** or as approved by the Engineer.

208.02.70 STRUCTURAL BACKFILL

A. Structural backfill shall consist of material conforming to subsection 207.02.02 “Granular Backfill” or subsection 207.02.01 “Selected Backfill”. Additionally, the backfill material shall be non-gypsiferous (solubility less than 4%), have an expansion potential less than 4%, shall be free of vegetation and debris and contain no rocks larger than four inches nominal diameter.

CONSTRUCTION

208.03.01 TRENCH EXCAVATION, GENERAL

A. Excavation including the manner of supporting excavation and provisions for access to trenches, shall comply with the current regulations as determined by NOSHA. Excavation shall include, without classifications, the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grade shown. Excavation for pipe, wire, or conduits shall be by open trench unless otherwise specified or shown on the plans. However, should the Contractor elect to tunnel or jack any portion not so specified, he shall first submit a design by a Nevada Professional Engineer to and obtain an approval from the Engineer. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavation, and all pumping, ditching, or other approved measures for the removal or exclusion of water, including storm water and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. The Contractor shall be responsible for any damage to persons or property due to interruption or diversion of storm or wastewater because of his operations. If due to delays in delivery of materials or for other reasons, and the Contractor is not expected to fully complete the work within any excavated area in a reasonable length of time as determined by the Engineer, the Engineer may require the Contractor to backfill the excavation and

re-excavate when the work can be completed expeditiously, with no additional payment therefor.

B. Except as otherwise shown or provided herein, excavation shall be open cut trenches with vertical sides up to the top of the pipe zone.

C. Trenching and shoring operations shall be conducted in accordance with 29 CFR (Code of Federal Regulations) Part 1926, Occupational Safety and Health Standards (OSHA) – Subpart P – Excavations (July 1, 1990).

208.03.02 MINIMUM TRENCH WIDTH

A. Excavation of pipe trench for flexible and rigid pipe is as required in Table 3 and this width is only applicable for trenches that have trench sidewall of native material"" which meets the classification class A1 or A3 installation as defined in AASHTO M145 table. In all cases, the trench width shall be wide enough to allow for the compaction equipment.

Table 3 - Minimum Trench Widths

Flexible Pipe	Minimum shall be not less than 1.5 times the pipe outside diameter plus 12 inches
Rigid Pipe	Minimum shall be not less than the outside diameter plus the outside diameter times 0.33

B. For pipe backfill using CLSM, the minimum trench width may be reduced to the pipe diameter plus 12 inches and enough room needed to allow for the proper placement of the CLSM using tools to "spade" the material under the pipe haunches. This condition applies only for trench sidewalls meeting the minimum AASHTO material class A1 or A3.

C. If the sidewall trench soil is classified other than AASHTO Class A1 or A3, a recommendation by a Nevada Professional Engineer shall be submitted and approved by the Engineer prior to construction. However, minimum trench width shall not be less than the minimum stated in this section.

208.03.03 MAXIMUM TRENCH WIDTH

A. The maximum width of the trench shall be determined by the Contractor based on the method and means for the installation. However, trench width shall not exceed the width of a ride-along compactor plus 2 feet when working alongside the pipe or culvert. If for any reason this maximum trench width is exceeded, a higher strength of pipe may be required as determined by the Engineer with no additional cost to the Contracting Agency.

B. Except when otherwise specified or ordered by the Engineer, the bottom of the trench shall be excavated uniformly to the grade or depth indicated on the drawings. The maximum amount of open trench permitted in any one location shall be per Section 624 of these Special Provisions. Trench shall be considered open until backfilled to the top of subgrade. Trenches crossing streets shall be completely backfilled immediately after pipe, wire, or conduit installation.

C. Substantial bridging, properly anchored, capable of carrying the design loading, in addition to adequate trench bracing, shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular working hours. Safe and convenient passage for pedestrians and access to all properties shall be provided.

208.03.04 TRENCH OVER-EXCAVATION

A. Wherever the excavation is made below the grade shown on the drawings, or below the grade ordered by the Engineer, it shall be refilled to the required grade with suitable backfill and bedding material ""at no additional cost to the Contracting Agency.

B. Trench over-excavation below the specified level of bedding material, and additional backfill material, ordered by the Engineer where unsuitable materials are encountered, shall be paid by the appropriate contract item.

C. Trench over-excavation and backfill to control groundwater shall be at the option and expense of the Contractor; however, the backfill material shall comply with this specification and the approved design of the pipe.

208.03.05 DISPOSAL OF UNSTABLE AND EXCESS EXCAVATED MATERIALS

A. Excess material and excavated material unsuitable for backfill shall be removed from the site of the work by the end of each working day unless otherwise approved by the Engineer and disposed of by the Contractor as specified in ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

208.03.06 CHANGES IN ALIGNMENT OR GRADE

A. In the event that changes in elevation of the trench of less than 6 inches are ordered by the Engineer, no changes in the contract amount will be allowed.

208.03.07 PORTABLE TRENCH SHEILD

A. Portable trench shields or boxes that provide a moveable safe working area for installing pipe may be used for the installation of pipe. After placing the pipe in the trench, backfill material shall be placed in lifts and the shield shall be lifted to allow for the backfill material to be placed for each lift, trench wall to trench wall.

208.03.08 MINIMUM PIPE SPACING

A. If the pipe space between parallel pipes in a single trench is not conducive to mechanical backfill, then CLSM shall be used.

208.03.09 TRENCH BACKFILL

A. The backfilling of the trench differs in each zone due to the complexity of providing a secure support for the pipe as well as ensuring that all voids are filled to prevent nuisance

water flow under the pipe. The zones are foundation, bedding, haunch, initial, and final as illustrated in Figure 1.

208.03.10 USE OF CLSM

A. CLSM Class II is required for storm drain pipe within the detention basin embankment, see plans for specific limits. CLSM Class I and Class II may be placed in other installations. However, for flexible pipe, in the pipe zone region, either full CLSM or full aggregate backfill is required. There can not be applied a mixing of CLSM and aggregate fill layers due to the different stresses that can occur on the pipe at the interface of both types of products.

B. CLSM shall be placed directly into the space to be filled. The placement of CLSM shall include "spading" under the pipe haunches and into the corrugations or other difficult areas around a structure. Care shall be taken to prevent flotation or misalignment of the pipe by means of straps, soil anchors or other designed and approved means of restraint as per the manufacturer's recommendation. Material may be placed in stages equally on both sides of the pipe to prevent movement or flotation of pipe.

C. If CLSM Class III - Bonded Aggregate Fill (BAF) is to be used, it shall be as specified in ***Subsection 704.03.07, "Controlled Low Strength Material (CLSM)."*** When used as backfill, CLSM Class III shall comply with ***Subsection 704.03.02, "Drain Backfill."***

208.03.11 FOUNDATION

A. Trench foundation shall be stable prior to placing bedding material. If the Engineer determines that unsuitable materials exist at the trench foundation, the Contractor shall remove and replace the material as directed by the Engineer and as specified in ***Subsection 208.03.04, "Trench Over-Excavation."***

208.03.12 PIPE BEDDING

A. **Dry Utilities:** Dry utilities shall be defined as facilities for fiber optics, electrical, telephone, television cable, traffic signals, and natural gas lines. Pipe bedding for dry utilities only may consist of sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a bedding material, the sand shall be moisture conditioned and mechanically compacted.

B. **Wet Utilities:** Wet utilities shall be defined as facilities for sewer lines, water lines, and storm drains. Except as otherwise provided herein, or in the Special Provisions, or as otherwise shown on the plans, the trench shall be excavated to a depth of at least 4 inches to 6 inches below the bottom of the pipe barrel and to a depth that will be sufficient to provide at least 2 inches of clearance under the pipe bell (where applicable).

C. Uniform and stable bedding shall be provided for the pipe and any protruding features of its joints and/or fittings with the exception that the middle of the bedding equal to 1/3 the pipe outside diameter shall be loosely placed (see Figure 1). The compaction shall be:

1. Compaction density minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

D. The material for use as bedding shall be Type II Aggregate Base or CLSM complying with this section.

E. Bedding shall be backfilled to the required grade of the bottom of the pipe. When Crushed Rock is used for foundation stabilization, the Contractor shall follow the same procedures described below in ***Subsection 208.03.16, "Drain Backfill."***

F. All pipes shall be placed directly on the bedding material unless otherwise required or approved by the Engineer. If groundwater is present or anticipated to be present, the need for a filter material as specified in ***Subsection 207.03.01, "General,"*** shall be reviewed and approval may be required by the Engineer.

208.03.13 HAUNCH ZONE BACKFILL

A. **Dry Utilities:** After pipe or conduit is laid, the haunch areas shall be backfilled with sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a backfill material, the sand shall be moisture conditioned and mechanically compacted.

B. **Wet Utilities:** After the pipe or conduit is laid, the haunch areas shall be backfilled with Type II, Type III, Aggregate Base Backfill, or CLSM. Crushed Rock or drain backfill may be used for the haunch zone only if material use has been specifically approved by the governing agency. If crushed rock or drain backfill is used, comply with ***Subsection 208.03.16, "Drain Backfill."***

C. Compaction of the haunching material can best be accomplished by hand with tampers or suitable power compactors for maximum compacted lift thickness of 6 inches. The Contractor shall take care to not disturb the pipe from its line and grade and shall compact to:

1. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

D. While compacting the embedment near the pipe with impact-type tampers, caution shall be taken to not allow direct contact of the equipment with the pipe.

208.03.14 INITIAL ZONE BACKFILL

A. **Dry Utilities:** Initial zone backfill for dry utilities may consist of sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a backfill material, the sand shall be moisture conditioned and mechanically compacted.

B. **Wet Utilities:** After the pipe or conduit is laid, the initial backfill areas shall use Type II, Type III, Aggregate Base, or CLSM. Avoid usage of impact tampers directly above the pipe until the full loose layer backfill depth above the pipe is obtained. Crushed Rock or drain backfill may be used for the initial zone only if material use has been specifically

approved by the governing agency. If crushed rock or drain backfill is used, comply with ***Subsection 208.03.16, "Drain Backfill."*** The depth of initial backfill above the pipe shall comply with Table 4:

Table 4 - Initial Zone Material Depths

Pipe or Conduit	Initial Zone
2-inch or less diameter	6 inches above the top of pipe
Greater than 2-inch diameter	12 inches above top of the pipe

208.03.15 FINAL ZONE BACKFILL

A. The remaining backfill shall consist of one of the following types as determined by the Engineer.

B. Selected Backfill or CLSM Backfill. Backfill material from the initial backfill zone to finished grade, shall be "Selected Backfill," or CLSM.

1. The material shall be compacted to:

   a. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

   b. If "Selected Backfill" is used in trenches 2 feet or less in width, no stones or lumps greater than 3 inches will be permitted.

2. **CLSM:** When used, CLSM backfill shall be placed from the top of the initial backfill zone to the finished grade.

208.03.16 DRAIN BACKFILL

A. In the event that Drain Backfill is used to control groundwater, the Contractor shall, at no additional cost to the Contracting Agency, construct dams conforming to the requirements of ***Section 501, "Portland Cement Concrete,"*** Class II CLSM, or compacted Type II Aggregate Base. Construct the dams within the drain rock bedding material at each manhole or at intervals of 600 feet, whichever is less. Dams shall extend the width of the trench, a minimum of 18 inches in length, for the height of the drain backfill, and where Type II is used, the compaction shall be:

1. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

B. The Contractor shall install nonwoven geotextile filter fabric between the bedding and backfill material in such a manner to prevent migration of the backfill material into the bedding whenever Drain Rock or Crushed Rock is used as bedding.

C. Geotextile filter fabric shall conform to the requirements specified in AASHTO M288, "Subsurface Drainage Geotextile."

208.03.17 COMPACTION

A. Compaction shall be performed by mechanical means. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used and shall have a maximum lift thickness as indicated in Table 5 - Compaction Lift Thickness. The lifts shall be placed on both sides of the pipe at the same time to reduce pipe movement.

Table 5 - Compaction Lift Thickness

Location	Maximum Compacted Lift Thickness (inches)	Maximum Loose Lift Thickness (inches)
Bedding, Haunch, and Initial Zones	6	8
Final Zone Backfill	12	16

B. Each layer shall be evenly spread, moistened, and tamped or rolled until the specified relative compaction has been attained.

C. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

208.03.18 TRANSITION INSTALLATIONS

A. When differential conditions of pipe support might occur, such as in transitions from manholes to trench, a transition support region shall be provided to ensure uniform pipe support and preclude the development of shear, or other concentrated loading on the pipe.

208.03.19 MINIMUM DEPTH OF COVER

A. The minimum cover shall be as stated on the plans and/or contract Special Provisions. For flexible pipe, the minimum cover for compaction process using wheel or hydro hammer loads is 24 inches. Equipment used for the initial zone shall allow compaction to the lift requirements of this specification without damage to the pipe.

208.03.20 TESTING

A. Where tests reveal non-compliance with the requirements of the Contract, the Contractor shall bear the costs of subsequent rework and retesting until the required specification compliance is obtained to the satisfaction of the Engineer.

208.03.21 CUTTING AND RESTORING STREET SURFACING

A. Prior to beginning work within any public right-of-way, or cutting any street surfacing therein, an encroachment permit and barricade plan approval shall be obtained from the governmental entity or agency having jurisdiction over that right-of-way.

B. Permit fees and construction restrictions shall be in accordance with the rules, regulations, and ordinances of the entity or agency having jurisdiction.

C. While undergoing improvements, all streets upon or within which any work is being done shall be kept open to all traffic by the Contractor, as specified in ***Subsection 104.04, "Maintenance of Traffic,"*** unless otherwise approved by the Engineer, or as provided in the Special Provisions.

D. Prior to beginning the work, barricading and traffic control devices conforming to the latest editions of the Traffic Control Plans for Highway Work Zones for the Clark County Area and the Manual on Uniform Traffic Control Devices shall be in place, and shall be in compliance with the governmental agency approved traffic control and barricade plan.

E. Pavement in the area of the trench excavation may be wheel cut or spade cut.

F. Temporary Steel Plate Bridging: When approved by the Engineer or Contracting Agency, the Contractor may use steel plates to bridge excavated trenches in areas where the roadway surface is to be opened to traffic. Steel plates shall extend at least 12 inches beyond the edges of the trench. Trenches shall be adequately reinforced to support the bridging and traffic loads. Trench plate thickness shall be at least 3/4 inches for a 1 foot wide trench and shall increase 1/8 inch for every foot of trench width up to a thickness of 1-1/4 inch for a 5 foot wide trench. Steel plates for trench widths greater than 5 feet shall require a special structural design. Trench plates shall be coated with an Antiskid type surface meeting current Caltrans standards of a nominal Coefficient of friction of 0.35 in accordance with California test method 342 (Appendix H). Trench plates shall not be overlapped or stacked on top of another plate. At no time shall the length of any configuration of steel plates exceed three hundred feet or be left in place for longer than 14 days without prior written approval from the Engineer. The Contractor shall ensure that anchoring, strength and side supports are adequate to prevent collapse or movement of the plates. The placement and installation method for temporary steel plate bridging shall be as follows:

1. **Method 1: Roadways with posted speeds of 45 mph and greater, or when required by the Engineer** – The pavement shall be cold-planed to a depth equal to the thickness of the plate and to a width and length equal to the dimensions of the plate(s). Any voids shall be filled with cold mix and compacted to ensure that the roadway has a smooth drivable surface and the plate is flush with the top of the roadway surface (recessed into the asphalt.) The Contractor shall ensure that the approach and ending plates are securely attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement, subsequent plates shall be butted to each other. Steel Plate Ahead (W8-24) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes.

2. **Method 2: Roadways with posted speeds less than 45 mph** – Approach and ending plates shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement. Subsequent plates shall be butted to each other. Fine graded asphalt concrete shall be compacted to form ramps with a maximum slope of 8.5% and a minimum 18 inch

taper to cover all edges of the steel plates. Steel Plate Ahead (W8-24) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry, or equivalent slurry approved by the Engineer.

G. Whenever permanent pavement patches are not constructed immediately following trench backfilling operations, temporary pavement patches consisting of a minimum of 2 inches of hot or cold plantmix or plates shall be utilized to provide the required number of paved travel lanes. Bump Ahead (W8-1) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes. Temporary pavement patches may be left in place for a maximum of 30 working days following completion of backfilling operations unless otherwise approved by the Engineer.

H. The following surface tolerance for temporary patches shall be observed. When a 12-foot straight edge is laid across the temporary patch parallel to the centerline of the street and in a direction transverse to the centerline, a rut, hump, or depression of more than 1/2 inch shall not be evident. Deteriorated temporary patches exhibiting ruts, humps, or depressions shall be repaired or replaced immediately upon notification of the Engineer. If the existing street exceeds the above tolerances, then the temporary patch shall be equal to or better than the condition of the surrounding pavements.

I. Unless otherwise specified and approved, prior to placing the permanent patch, the existing pavement shall be saw cut to a neat line and to a minimum width as shown on the Standard Drawings for Pavement Restoration.

J. Existing aggregate base, shall be scarified and recompacted to meet the requirements of ***Section 302, "Aggregate Base Courses."*** Compaction by rolling with vehicle tires will not be permitted. Aggregate base courses that were constructed with geosynthetics shall be repaired in conformance with the manufacturer's recommendations.

K. BLANK

L. Completion of the permanent patch in areas where an open graded surface course exists, which is less than 10 years in age, shall include placement of a surface course to match the existing surface texture and material mix design, including original bituminous cement type.

M. In areas where lime treated sub-base, cement modified sub-base, soil cement, or similar materials have been used, the Contractor may substitute a lean concrete mix or asphalt concrete equivalent, subject to approval of the Engineer.

N. Upon completion of the permanent patch, including the surface treatment, the surface shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities. The Contractor shall inspect with a straightedge 12 feet long that is laid across the permanent patch parallel to the centerline of the street and in a direction transverse to the centerline. The surface shall not vary more than 1/4 inch from the lower edge of the straightedge. Patches exhibiting deviations greater than 1/4) inch shall be replaced or use mechanical grinding prior to acceptance of the patch. If the existing street

exceeds the above tolerances, then the patch shall be equal to or better than the condition of the surrounding pavement. The Contractor shall submit a report of the tolerance testing to the Engineer for approval prior to the acceptance of the patch.

O. Any concrete improvements disturbed or damaged during construction shall be replaced prior to placement of the permanent pavement patch.

P. All traffic control devices removed or disturbed during construction shall be replaced upon completion of the permanent patch including but not limited to delineation, paint, thermoplastic pavement markings, and traffic signal detector loops. Temporary lane lines and other markings used during construction shall be permanently removed, to the satisfaction of the Engineer, prior to placing the new traffic stripes or markings.

Q. Pavement in the area of the trench excavation shall be sawcut.

R. Cold mix patches will not be allowed.

END OF SECTION 208

SECTION 209 – DRAIN BACKFILL

DESCRIPTION

209.01.01 GENERAL

A. This work shall consist of furnishing, hauling, placing, and compacting drain backfill material around structures, pipes or perforated underdrains to the lines designated on the plans or established by the Engineer.

MATERIALS

209.02.01 GENERAL

B. Material shall conform to the requirements of ***Subsection 704.03.02, "Drain Backfill."***

CONSTRUCTION

209.03.01 GENERAL

C. The trench shall be excavated and drain backfill placed in accordance with provisions of ***Section 607, "Underdrains."***

D. Where drain backfill is part of the structural section, it shall be compacted to not less than 90 percent maximum density. Test method to be determined by the Engineer.

E. Compacting by ponding or jetting will not be permitted.

SECTION 210 – WATERING

DESCRIPTION

210.01.01 GENERAL

A. This work shall consist of, but is not limited to furnishing, hauling, and applying all water required for compaction of embankment foundation areas, embankments, subgrade, mineral aggregate base and surfacing materials, structure backfill, processing lime treated base or subgrade material, or cement treated base, and for controlling dust caused by grading operations, traffic, and natural conditions.

MATERIALS

210.02.01 GENERAL

A. All materials shall conform to the requirements set forth in ***Section 722, "Water."***

CONSTRUCTION

210.03.01 EQUIPMENT

A. Equipment used for applying water required for compacting embankment materials, subgrade, base and surfacing materials, and for controlling dust shall be pressure type distributors equipped with a spray system that will ensure uniform application of water. All the watering equipment used for the application of water shall be equipped with a positive means of shutoff and the use of equipment not so equipped will not be permitted. An approved pump, pipe, hose, and nozzle equipment may be used in embankment construction. Where the head is sufficient to provide enough pressure, the pump requirement may be eliminated.

B. The Contracting Agency does not require that watering equipment be provided with measuring or metering devices.

210.03.02 GENERAL

A. Water for dust control shall be applied in the amounts and on the areas designated by the Engineer.

B. The Contractor shall apply water in the amount necessary to attain the compaction in those materials requiring a specified density. In certain areas of the base courses, water may be introduced into the aggregate at the plant and when necessary to attain the specified compaction, shall be supplemented by additional wetting as specified above.

C. Excavation areas and borrow pits may be watered prior to excavating the material.

D. When water is applied directly to the roadbed, the material shall be processed by suitable equipment until the layer is uniformly wet. Care shall be taken to avoid disturbing layers which have been previously placed and compacted.

E. The Contractor shall make all arrangements for providing an adequate water supply. The Contractor shall negotiate with owners of supply and sign an agreement with each owner prior to removing the water. A copy of said agreement shall be furnished to the Engineer.

The Contractor shall pay all royalties occurring under such agreements and shall also obtain any necessary right-of-way.

END OF SECTION 210

SECTION 211 – EROSION CONTROL

DESCRIPTION

211.01.01 GENERAL

A. This work shall consist of preparing slopes, placing and compacting top soil, seeding, fertilizing, jute matting, and mulching graded and disturbed areas in accordance with these specifications and the details shown in the contract documents.

MATERIALS

211.02.01 GENERAL

A. The materials used shall be those prescribed for the several items which constitute the finished work and shall conform to the applicable requirements of ***Section 726, "Roadside Materials."***

211.02.02 PLANTING SOIL

A. Unless designated in the contract documents, the Contractor shall make the Contractor's own arrangements for obtaining soil at no additional cost to the Contracting Agency. Soil shall be transported directly from the source to final position unless otherwise permitted. Soil shall not be obtained from an area known to have noxious weeds growing in it.

B. Prior to removal of planting soil from the source, the Contractor shall contact the County Weed Control Agency or the State Quarantine Officer for the inspection and destruction of injurious and noxious weeds. Soil that has been treated with herbicides or sterilizers shall be tested by the Nevada State Department of Agriculture to determine the residual in the soil.

211.02.03 SEED

A. All seeds shall conform with all laws and regulations pertaining to the sale and shipment of seed required by the Nevada State Department of Agriculture and the Federal Seed Act. All shipments of seed shall be reported to the Nevada State Department of Agriculture for inspection. Seed shall be of the varieties and proportions specified in the contract documents.

211.02.04 FERTILIZER AND AGRICULTURAL MINERALS

A. All fertilizer and agricultural minerals shall conform with all "Rules and regulations governing the registration, and collection of license tonnage fees for commercial fertilizer in the State of Nevada" as required by the Nevada State Department of Agriculture. Commercial fertilizer formulation and rate of application shall be as specified in the contract documents and subject to sampling for verification of analysis.

211.02.05 MULCH

A. **Hay or Straw:** Hay or straw shall be acceptable to the Engineer. All shipments of hay or straw shall be free of noxious weeds as defined by Nevada State Department of Agriculture. Rate of application shall be as specified in the contract documents.

B. **Wood Cellulose Fiber:** Wood cellulose fiber shall be manufactured in such a manner that after addition and agitation in slurry tanks with fertilizers, seeds, water, and other approved

additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry. When hydraulically sprayed on the ground, the material shall be uniformly impregnated with seed. Rate of application shall be as specified in the contract documents.

C. **Wood Chips:** Wood chips shall be as specified in ***Subsection 726.03.04.D, "Wood Chips and Shavings."***

D. **Bark:** Bark shall be as specified in ***Subsection 726.03.04.E, "Bark."***

211.02.06 ASPHALT EMULSION

A. Asphalt emulsion used as a tie-down for mulch shall be as described in the contract documents.

CONSTRUCTION

211.03.01 PREPARATION

A. Excavation slopes shall be thoroughly cultivated to the depth shown in the contract documents, after which planting soil, if required by the contract, shall be uniformly spread to an approximate thickness of 4 inches, the exact thickness will be determined by the Engineer.

B. Cultivation of embankment slopes shall be required before placing planting soil unless otherwise specified in the contract documents or ordered by the Engineer. Such cultivation shall be considered subsidiary to other portions of the work and no direct payment will be made for such work.

C. Cultivation shall not be performed until all equipment is through working in the area, except equipment required to cultivate the area and spread planting soil.

D. After cultivation and prior to seeding, all rocks 1 inch in smallest dimension and larger shall be removed from all slopes to be seeded and shall be disposed of as approved by the Engineer.

211.03.02 PLACEMENT OF PLANTING SOIL

A. Planting soil shall be evenly spread over the specified areas to the depth shown on the plans unless otherwise approved by the Engineer. After the planting soil has been spread, all large clods, hard lumps, rocks, and litter shall be raked up, removed, and disposed of by the Contractor.

B. Planting soil shall not be placed when the ground is frozen, excessively wet, or, in the opinion of the Engineer, in a condition detrimental to the work.

C. All damage occurring to existing roadbeds, shoulders, walks, curbs, or other existing adjacent structures or areas due to the Contractor's operation in hauling and placing the planting soil shall be repaired by the Contractor at no additional cost to the Contracting Agency.

211.03.03 FIRMING OF PLANTING SOIL

A. Planting soil shall be made firm by use of a heavy or weighted disk set at an acute angle. The entire planting area shall be firmed by a minimum of three passes of the disk. The planting soil surface shall be brought to finished grade by one pass of a toothed harrow with teeth set at a 45-degree angle or by one pass of a steel-wire mat. Soil firming

operations shall be performed by traveling at right angle to the slope, except slopes greater than 30 percent shall be firmed by equipment conveyed up and down the slope by means devised by the Contractor. After firming operations, the planting soil shall be 2 inches below the top of all structures.

211.03.04 SEEDING AND FERTILIZING

A. The Contractor shall notify the Engineer not less than 24 hours in advance of any seeding operation and the Contractor shall not begin the work until areas prepared or designated for seeding have been approved. Following the Engineer's approval, seeding and fertilizing of the approved slopes shall begin immediately.

B. Seeding shall not be done during windy weather or when the ground is frozen. Seed and fertilizer shall be uniformly spread over the area at the rate and mix specified in the contract documents. Seed and fertilizer may be sown by one of the following methods:

1. An approved type hydro-seeder which utilizes water as the carrying agent and maintains a continuous agitator action that will keep seed and fertilizer mixed in uniform distribution until pumped from the tank. Pump pressure shall be such as to maintain a continuous, nonfluctuating stream of solution.

2. Approved blower equipment with an adjustable disseminating device capable of maintaining a constant, measured rate of material discharge that will ensure an even distribution of seed and fertilizer at the rate herein specified.

3. Helicopters properly equipped for aerial seeding and fertilizing. Helicopters so equipped shall have the following:

   a. Two hoppers or seed compartments each capable of containing a minimum of 100 pounds of grass seed or granular fertilizer.

   b. Power driven, readily adjustable disseminating mechanisms capable of maintaining a constant, measured rate of distribution of grass seed or granular fertilizer.

   c. Where liquid fertilizer is furnished in lieu of dry granular fertilizer, the helicopter shall be equipped with two barrels or containers capable of containing a minimum of 15 gallons each. Distribution shall be a spray boom of sufficient size and length, fitted with proper nozzles to distribute uniformly, liquid fertilizer as herein specified.

4. Approved power-drawn drills, with double-disc front delivery openers, and depth bands for positive depth control. Depth control shall be set at a depth of 3/4 inch for consistent furrow bottom placement.

   a. An approved deep furrow drill may be used where it is determined the seedbed is firm and there is little danger of soil blowing. An approved spreader may be used for fertilizer placement. Drills and spreaders shall be calibrated before use on the project.

   b. Areas inaccessible to above methods of application shall be seeded and fertilized by approved hand methods. Distribution of the material shall be uniform and at the rates specified.

c. The Contractor shall provide qualified personnel experienced in all phases of the seeding and fertilizing operation, equipment, and methods as herein specified.

211.03.05 SPREADING MULCH:

A. **Hay or Straw:** Hay or straw mulch shall be furnished, hauled, and evenly applied at the rates indicated, and shall be spread by means of an approved type mulch spreader. The spreader shall produce a uniform distribution of the hay, without cutting or breaking it into short stalks. Areas beyond the range of the mulch spreader shall be mulched by approved hand methods. Distribution of the material shall be uniform and at the rate specified in the contract documents.

1. Unless otherwise specified, straw or hay shall be anchored into the soil by use of a heavy disc with flat serrated discs approximately 1/4 inch thick, having dull edges and spaced no more than 9 inches apart.

2. Anchoring shall be to a depth of 2 inches across the slope, and with no more than one pass of the equipment on the same surface.

B. **Wood Cellulose Fiber:** Wood cellulose fiber utilized as a mulch may be applied with seed and fertilizer in one operation by approved hydraulic equipment. The equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed, and water. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic discharge spray nozzles which will provide a uniform distribution of the slurry.

C. **Wood Chips:** Wood chips utilized as a mulch may be applied by available mechanical chip spreaders or by approved hand methods. The wood chips shall be spread to an average depth of 3 inches.

D. **Bark:** Bark utilized as a mulch may be applied by available mechanical spreaders or by approved hand methods. The bark shall be spread on open slope areas to an average depth of 3 inches. Bark applied as a mulch for tree and shrub rings shall be spread to an average depth of 4 inches.

211.03.06 APPLYING ASPHALT EMULSION

A. When called for in the contract documents, mulch material shall be anchored in place with asphalt emulsion as herein specified. Asphalt emulsion shall be sprayed into the mulch as it leaves the blower pipe and shall be uniformly mixed with the mulch. Asphalt emulsion as specified shall be applied at the rate of 250 gallons per acre. Any mulch disturbed or displaced following application shall be removed, reseeded, and remulched as specified.

211.03.07 PLACING JUTE MATTING

A. Jute matting shall be unrolled and placed parallel to the flow of water immediately following the bringing to finished grade the area specified in the plans or the placing of seed and fertilizer. Where more than one strip is required to cover the given areas, the strips shall overlap a minimum of 4 inches. Ends shall overlap at least 6 inches with the up-grade section on top. The up-slope end of each strip of matting shall be buried in

6-inch slots with the soil firmly tamped against it. The Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be buried in a similar manner. Check slots shall be placed between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as up-slope ends. Check slots shall be spaced so that one check slot or one end occurs within each 50 feet of slope.

B. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting shall be spread evenly and smoothly and in contact with the soil at all points.

C. Jute matting shall be held in place by approved wire staples, pins, spikes, or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in 3 rows for each strip of matting, with 1 row along each edge and 1 row alternately spaced in the middle. All ends of the matting and checks slots shall be fastened at 6-inch intervals across their width. Fastening devices shall anchor the matting against the soil and be driven flush with the finished grade.

END OF SECTION 211

SECTION 270 – DEWATERING

DESCRIPTION

270.01.01 GENERAL

A. This work shall consist of furnishing all materials, labor, equipment and supervision to design, install, operate, remove dewatering systems and to lower the water table sufficient to prevent ground water from entering excavations.

B. The work shall also consist of, but is not necessarily limited to, the proper disposal of groundwater removed by a dewatering system **in accordance with local, state, and federal regulations**. Prior to discharging groundwater into the storm drain system, the Contractor shall be responsible for obtaining the groundwater discharge permit from the Nevada Division of Environmental Protection, comply with the conditions of the permit and pay all costs associated with the permit requirements such as permit fees, laboratory analysis and treatment of the discharge water, if required. The permit application can be downloaded at: ndep.nv.gov/BWPC. Sampling and laboratory analysis shall be completed by Nevada Certified Environmental Manager and Certified Laboratory.

C. Dewatering shall conform to the requirements of ***Section 208, "Trench Excavation and Backfill"*** and ***Section 502, "Concrete Structures"*** unless otherwise specified herein.

MATERIALS

270.02.01 GENERAL

A. At or prior to the preconstruction conference, the Contractor shall submit the dewatering plan showing method of dewatering, piping locations, discharge points, sewer and storm drainage facilities utilized and estimated discharge quantities.

CONSTRUCTION

270.03.01 GENERAL

A. Dewatering for structures and pipelines shall commence when groundwater is first encountered and shall be continuous until such times as water can be allowed to rise in accordance with the following provisions. Dewatering shall be conducted such that no concrete footings or floors or pipelines are placed in water nor shall water be allowed to rise over them until the concrete or mortar has set at least eight (8) hours. Water will not be allowed to rise in pipeline trenches or drained excavations until pipelines or facilities are backfilled or restrained to prevent flotation.

B. The Contractor shall remove all dewatering equipment and materials at the completion of the work or as otherwise directed by the Engineer.

C. The dewatering system shall be kept in operation until all work in the excavation is backfilled and properly compacted to a point three (3) feet above the existing water table elevation.

D. The Contractor shall arrange for and provide all necessary utilities to operate the dewatering system.

270.03.02 POINT OF DISCHARGE

A. The Contractor shall dispose of groundwater removed by the dewatering system into the storm drain system in accordance with local, state and federal regulations.

END OF SECTION 270

SECTION 301 – SELECTED MATERIAL SUBBASE

DESCRIPTION

301.01.01 GENERAL

A. This work shall consist of excavating and placing selected granular materials in one or more courses for subbase in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer. This material is designated to be placed below the Type II aggregate structural layer for pavements and is a part of the pavement structure.

301.01.02 REFERENCE CODES AND STANDARDS

A. Related Interagency Quality Assurance Committee (IQAC) procedures at:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

MATERIALS

301.02.01 GENERAL

A. Material shall be as set forth in the Special Provisions.

B. When Type I Aggregate Base is specified, the gradation acceptance limits and testing methods shall be as set forth in ***Subsection 704.03.03, "Type I Aggregate Base."***

CONSTRUCTION

301.03.01 SUBGRADE PREPARATION

A. The surface of the subgrade upon which the selected material is to be placed shall conform to the established lines and grade, shall be smooth and uniform, and shall be compacted to the required density. The tolerance to the plan elevation grade shall be +0 inches and -1/2 inch.

301.03.02 PLACING

A. In producing, handling, and placing selected materials, care shall be taken to prevent segregation of the fine particles from the coarse. When the required compacted thickness is more than 6 inches, the material shall be placed in layers, none of which shall exceed 6 inches in depth after compaction, except as provided in ***Subsection 301.03.04, "Compaction."***

B. After the material has been uniformly deposited, it shall be thoroughly blade-mixed to the full depth of the layer by alternately blading the entire layer to the center and back to the edges of the roadbed.

1. The material shall then be spread and finished to the required cross section.

2. At the option of the Contractor, selected material may be spread with equipment meeting the requirements of ***Subsection 303.03.03, "Surface Tolerances."***

C. Binder material, if required, shall be incorporated either in the surfacing aggregate at the plant where the aggregate is produced or uniformly on the roadbed in amounts designated by the Engineer.

301.03.03 WATERING

A. Water shall be applied prior to and during all blading operations to moisten the material sufficiently to prevent segregation of the fine and coarse particles.

B. Water shall also be applied during the compaction and maintenance stages in sufficient amounts to attain compaction and prevent raveling.

301.03.04 COMPACTION

A. Compaction shall immediately follow the spreading operation.

1. Where the required thickness is 6 inches or less, the base course may be spread and compacted in one layer.

2. However, if vibratory compaction equipment approved by the Engineer is used, and the requirement for density is complied with, the compacted thickness of any one layer may be increased to 8 inches.

B. Aggregate bases placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations that are inaccessible to the spreading equipment may be spread in one or more layers by any means to obtain the specified results.

C. Each layer of material shall be compacted to not less than 95 percent relative compaction, except under sidewalk areas. Under sidewalk areas, the material shall be compacted to not less than 90 percent compaction.

D. A loss of density in the upper portions of the material may occur due to the elements or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed for such recompaction.

END OF SECTION 301

SECTION 302 – AGGREGATE BASE COURSES

DESCRIPTION

302.01.01 GENERAL

A. This work shall consist of furnishing, placing, and compacting aggregate base courses constructed as specified below and in conformity with the lines, grades, thicknesses, and cross sections shown on the plans or established by the Engineer.

302.01.02 REFERENCE CODES AND STANDARDS

A. Related Interagency Quality Assurance Committee (IQAC) procedures at:
http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

MATERIALS

302.02.01 GENERAL

A. Materials shall meet the requirements of the following subsections:

Materials	Subsection
Type I Aggregate Base	***704.03.03***
Type II Aggregate Base	***704.03.04***

CONSTRUCTION

302.03.01 SUBGRADE PREPARATION

A. Any ruts, holes, defects, or soft yielding places which occur in the subgrade or subbase for any cause whatsoever shall be corrected and compacted to required density and stability before an aggregate base course is placed thereon.

1. The above mentioned repairs shall be made at no additional cost to Contracting Agency, except as provided for in ***Subsection 203.03.03, "Unsuitable Material."***

2. The tolerance to the plan elevation grade shall be +0 foot and -0.1 foot.

B. Unless otherwise specified, the top 6 inches of subgrade shall be compacted to not less than 90 percent compaction.

302.03.02 SPREADING AGGREGATES

A. The aggregate shall be uniformly deposited on the approved subgrade by means of the hauling vehicle with or without spreading devices. Aggregate shall be distributed over the surface to the depth specified on the plans or established by the Engineer.

B. After base course material has been deposited, it shall be thoroughly blade-mixed to full depth of the layer by alternately blading the entire layer to the center and back to the edges of the road. The material shall then be spread and finished to the required cross section by means of a self-propelled pneumatic-tired motor grader.

C. At the option of the Contractor, the aggregate may be spread with an approved self-propelled spreader with the aggregate ready for compaction without further shaping. If

this option is exercised, however, the operation shall become subject to the requirements of ***Subsection 302.03.03, "Watering and Mixing Aggregates."***

D. Reference points will be established on one side of the roadway at intervals approved by the Engineer.

E. Furnish, place, maintain, remove, and dispose of all materials required to provide continuous line and grade control to the placing machine.

302.03.03 WATERING AND MIXING AGGREGATES

A. The base course material and water may be mixed at the plant in a mixer approved by the Engineer.

B. Water shall be added during the mixing operation by means of spray bars in the amount necessary to provide the optimum moisture content for compacting.

C. After mixing to the extent that the product has a uniform homogeneous appearance, the material shall be transported to the job while it contains the proper moisture content and may be placed on the roadbed by means of an approved self-propelled aggregate spreader.

D. If the material has dried appreciably prior to final compacting, additional water shall be added by means of a pressurized water truck to assist in compaction and to prevent raveling.

302.03.04 WATERING

A. Water may be applied prior to and during all blading and processing operations to moisten the material sufficiently to prevent segregation of the fine and coarse particles.

B. Water shall be applied during the compaction and maintenance stages in sufficient amounts to assist in compaction and prevent raveling.

C. Comply with ***Section 210, "Watering."***

302.03.05 COMPACTION

A. Compaction shall immediately follow the spreading operation.

1. Where the required thickness is 6 inches or less, the base course may be spread and compacted in 1 layer.

2. However, if vibratory compaction equipment of a type approved by the Engineer is used, and the requirement for density is complied with, the compacted thickness of any 1 layer may be increased to 8 inches.

B. Aggregate bases placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations that are inaccessible to the spreading equipment may be spread in one or more layers by any means to obtain the specified results.

C. Each layer of material shall be compacted to not less than 95 percent compaction, except for under sidewalk areas, where the material shall be compacted to not less than 90 percent compaction.

D. A loss of density in the upper portions of the material may occur due to the elements or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed for such recompaction.

302.03.06 TOLERANCE FOR FINISHED SURFACE

A. When a 10-foot straightedge is laid in any direction, the finished surface shall not deviate at any point more than 1/2 inch from the bottom thereof.

B. The tolerance to the plan elevation grade shall be +0 foot and -0.05 foot.

END OF SECTION 302

SECTION 310 – SOIL CEMENT SLOPE TREATMENT

DESCRIPTION

310.01.01 GENERAL

A. This section covers high compressive strength and low compressive strength soil cement concrete in addition to bedding mix, and also includes requirements for producing, transporting, placing, compacting, curing, and other work appurtenant to constructing soil cement concrete. In these Specifications, high strength and low strength soil cement concrete differ in aggregate, cement, water, and performance requirements. All other requirements contained herein including producing, transporting, placing, compacting, curing, performing quality control, etc. apply to all soil cement regardless of its strength classification.

B. Soil cement concrete shall be placed and compacted to the line, grades, and sections indicated on the drawings. Bedding mix to be used for special treatment of cold joints in soil cement structures shall consist of fine aggregate, cement, and water.

C. The Contractor shall have full responsibility for administration of a Quality Control Plan for soil cement concrete, which shall meet the same quality control requirements of ***Section 106, "Control of Materials."***

310.01.02 GOVERNING STANDARDS

A. Except as modified or supplemented herein, all materials and construction methods for soil cement work shall comply with the applicable provisions of the ACI and ASTM standards specified.

B. Mix design proportions will be determined by the Contractor and meet the specification requirements contained herein.

MATERIALS

310.02.01 MATERIALS

A. Materials used for soil cement concrete shall conform to the following requirements and no substitutions or alternate material sources shall be permitted without the advance approval of the Engineer:

(a) Portland Cement	ASTM C150, Type V, having a maximum tricalcium aluminate content of 5 percent.
(b) Pozzolan	ASTM C618, Class F.
(c) Water	ASTM C94.
(d) Admixtures (optional)	Retarder ASTM C494, Type D.

(e) Fine Aggregate	Natural onsite soil, or crushed rock, clean and free of organic contaminants (solid or chemical). Clay lumps or balls larger than 2-inch shall be pulverized to pass a No. 4 sieve prior to mixing.
(f) Coarse Aggregate	Natural onsite soil, or crushed rock. Sound crushed rock, in accordance with ASTM C33, free of potential alkali reactivity. Gradation shall be as required to achieve the blended aggregate requirements as specified herein.
(g) Bedding Mortar Aggregate	Neat cement slurry. Mixture of cement, fly ash if desired, and water without any aggregate. Artificial or manufactured sand will not be acceptable.

310.02.02 BLENDED AGGREGATE REQUIREMENTS

A. Contractor shall screen, blend, and otherwise process aggregates from onsite sources to produce a blended soil cement aggregate with a plasticity index of zero that meets the following requirements in accordance with ASTM C136:

LOW STRENGTH SOIL CEMENT BLENDED AGGREGATE REQUIREMENTS	
U.S. Standard Sieve	Percent Passing By Weight
1”	100
No. 4	30 - 80
No. 200	0 - 25

HIGH STRENGTH SOIL CEMENT BLENDED AGGREGATE REQUIREMENTS	
U.S. Standard Sieve	Percent Passing By Weight
1"	100
3/4"	80 - 100
No. 4	30 - 50
No. 30	10 - 25
No. 200	3 - 12

310.02.03 ONSITE AGGREGATE

A. Geotechnical analysis indicates that processed onsite aggregate is acceptable for the soil cement mix. Onsite material should be screened of material larger than 1 inch in diameter. Crushing of oversize material for use in soil cement mix is acceptable and is encouraged to increased fractured faces in the mix. Screening (e.g. at the number 4 sieve) of onsite aggregates and recombining stockpiles (e.g. 50-50 mix) may be required in order to meet

specified gradation. Processing methods for aggregate production, including any washing, shall be at the Contractor's discretion.

B. Contractor shall provide necessary aggregate to allow for overbuild, stockpile bases, trial placement, testing, waste, and materials used for Contractor's convenience.

C. Unless otherwise approved, Contractor shall maintain sufficient quantities of aggregate on-site for a minimum of three days of soil cement placement at the maximum anticipated production rate.

310.02.04 ADMIXTURES

A. If used, the admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations for minimum shrinkage and for compliance with these specifications. Retarding admixture may be used in all soil cement.

310.02.05 BEDDING MIX

A. Use bedding mix as shown in the drawings between the foundation and soil cement and wherever required between layers of soil cement. Retard bedding mix so that its initial set time exceeds 3 hours at 95° F. It may be re-tempered within this time period before it is spread on the foundation or lift surface. Spread bedding so that the maximum thickness over rock foundations does not exceed 2-Inches or 3/4-Inch on soil cement surfaces. Spread bedding mix to a minimum thickness of 1 inch on rock foundations and 3/8-Inch on soil cement lift surfaces. Spread soil cement over the bedding and begin compacting within 45 minutes from the time the bedding mix was discharged. Use mix proportions of fine aggregate, cement, and water developed by the Contractor, based on trial mix testing approved by the Engineer. Use materials of the same type and from the same source as those used for the trial-mix testing. Proportion the bedding mix within the following general guidelines:

Slump (placed on soil cement)	7 to 9 Inches
Maximum aggregate size	3/8-Inch
Minus 200 material (aggregate)	2% maximum
Water reducing admixture	may be required
Design strength (28 day)	2500 psi minimum
Retarder	as required to achieve the required delayed set time

B. Admixtures may be introduced into the mix to maintain its workability. Proportion the mix to be broomable and to minimize segregation. Batch bedding mix either on-site or offsite and transport to the lift surface by crane and bucket, transit truck mixer, pump, or other methods approved by the Engineer. Do not use conveyor delivery unless it can be demonstrated that the mix can be transported on the conveyor without any segregation. The mix design shall have 15% to 30% Pozzolan substituted for cement, by volume, provided that all other specification requirements are met.

310.02.06 SOIL CEMENT MIX DESIGNS

A. At least 90 days prior to construction of the soil cement test sections, Contractor, using the services of an independent testing laboratory acceptable to Owner, shall prepare soil cement mix designs and trial batches for the high strength and low strength mixes. The mix designs and testing shall be conducted under supervision of a Professional Engineer registered in the State of Nevada. Certified reports covering the materials, mix designs, and test results shall be submitted to the Engineer for review.

B. The mix designs will be determined by the Contractor's independent testing laboratory based on the following performance specifications:

Performance Specifications for Low Strength Soil Cement	
Minimum 28 day Compressive Strength of Test Cylinders	750 psi
Minimum 28 day Compressive Strength of Core Samples	750 psi

Performance Specifications for High Strength Soil Cement	
Minimum 28 day Compressive Strength of Test Cylinders	2,000 psi
Minimum 28 day Compressive Strength of Core Samples	2,000 psi

The Contractor is solely responsible for conforming to the performance specifications and may adjust proportions as needed to conform to them. Written approval of the Engineer is required for each mix design change, which must include new mix proportions and test results verifying it conforms to the performance specifications.

The mix design shall include the following information as a minimum:

1. Batch weights or proportions and specific gravities for each proposed aggregate size, water, cement, pozzolan and if required, filler.

2. AASHTO T-180 and ASTM D558 maximum density and optimum moisture.

3. Moisture content and dry density of compressive strength specimen.

4. Water/cement ratio of compressive strength specimen.

5. Compressive strength of soil cement at ages 7, 14, and 28 days and 2 specimens based on an average of at least 3 specimens at an age of 28 days and 2 specimens for other ages.
6. Recommended factor of safety used to determine the cement content that will reasonably assure compliance with the strength requirements.

CONSTRUCTION

310.03.01 SUBMITTALS

A. Placement Plan Submittal

Thirty (30) days prior to beginning soil cement placement, Contractor shall prepare and submit a Soil Cement Placement Plan. The plan shall include sketches and a written narrative containing the following information:

(1)	Working Hours	Tentative hours of work
(2)	Material Storage	Size and capacity of aggregate, cement, fly ash, Pozzolan, and water storage facilities.
(3)	Plant	Type, model and description of mixing plant proposed for use. Maximum hourly capacity and anticipated average hourly production rates. Calibration report.
(4)	Control of Mix Proportions	Location and type of measuring equipment used to control proportions of all mix ingredients.
(5)	Layout Diagram	Diagram showing location of plant, storage facilities, and stockpiles.
(6)	Equipment	General description of type and size of equipment to be used for transporting, conveying, placing, spreading, and compacting soil cement.
(7)	Form Systems	Description and sketches of forming systems.
(8)	Curing	General description of curing plan.

B. Material Submittals

(1)	Cement and Pozzolan:	Submit source(s) of cement and Pozzolan.
(2)	Aggregates:	Submit source(s) of all aggregates.
(3)	Delivery Schedule:	Submit delivery and production schedule for all materials.

C. Testing Laboratory Material Submittals

Contractor shall submit representative production samples of cement, Pozzolan, aggregates, and admixtures to the independent testing firm laboratory selected by the Contractor and approved by the Owner 90 days prior to soil cement placement. Contractor shall submit samples that are representative of those proposed for the project and include manufacturer's test reports indicating compliance with applicable specification requirements and showing all chemical and physical properties. Contractor shall identify all materials with labels and/or tags as appropriate, and provide minimum quantities of materials as shown in table below:

TESTING LABORATORY MATERIAL SUBMITTALS	
MATERIAL	**QUANTITY**
Fine Aggregate	2 tons
Coarse Aggregate	2 tons
Cement (in barrels or sealed bags)	0.3 ton
Pozzolan (in barrels or sealed bags)	0.15 ton
Water	Furnished by laboratory
Admixtures (if proposed by Contractor)	1 gallon each

D. Mix Design Submittals

(1) Bedding Mix Design: Submit mix design and test results for bedding mix showing that the selected mix meets the requirement of ***Subsection 310.03.05, "Batching and Mixing."*** Submit 28-day compressive strength test results no later than 90 days following Notice-to-Proceed.

(2) Soil Cement Mix Design: Submit mix design and test results for soil cement mix showing that the selected mix meets the requirement of ***Subsection 310.02.06, "Soil Cement Mix Designs."*** Submit 28-day compressive strength results no later than 90 days prior to the planned start of soil cement activities.

E. Soil Cement Aggregate Production, Delivery Plan, and Schedule Submittal

Prepare and submit to the Engineer for approval, a production and delivery schedule and a plan for stockpiling aggregate onsite. If onsite aggregate is not used for soil cement, submit a plan for transporting the soil cement aggregates from the aggregate plant(s) to the soil cement plant site. Include a map showing the proposed haul route(s); traffic control measures; the number, type, and weights (fully loaded) of haul vehicles to be employed; and height and weight restrictions for all bridges located along the proposed route(s).

F. Delivery Ticket Submittals

Submit delivery tickets for each delivery of cement, Pozzolan, and bedding mix. Include the source, date manufactured or produced, type or class, Contractor's name, project name, and a

certification that the material meets the specification requirements. Include the following information on each delivery ticket for each load or batch of bedding mix:

(1) Name and location of batch plant
(2) Ticket number
(3) Load and truck number
(4) Date
(5) Destination
(6) Concrete class
(7) Batch weights for all materials
(8) Amount of concrete
(9) Time mixer charged with concrete
(10) Recording of revolution counter (transit-mixed concrete)
(11) Space for initials of receiving party

G. Hot and Cold Weather Concreting Submittals

Submit proposed plan for placing soil cement during hot and cold weather conditions. Include planned procedures for heating and/or cooling materials, use admixtures, and protection of completed work.

H. Quality Assurance Plan Submittal

At least 30 days prior to soil cement placement, Contractor shall submit a Quality Assurance Plan to the Engineer. The Quality Assurance Plan shall include the names and qualifications of personnel involved in the Contractor's quality assurance program, a description of the procedures and frequency of testing, and a tentative format for the daily plant reports as specified in ***Subsection 310.03.10, "Curing and Protection."***

310.03.02 ENGINEER REVIEW

A. Owner will review the Soil Cement Placement Plan and Quality Assurance Plan for general conformance with the project requirements and for the purpose of planning its own quality control testing and inspection activities. Contractor must obtain Engineer's approval of all submittals in this section prior to placing soil cement.

310.03.03 SOIL CEMENT TEST SECTION

A. Prior to beginning placement of the permanent soil cement, the Contractor shall place low strength and high strength soil cement test sections using the mix designs prepared by the independent laboratory. The Contractor shall demonstrate the quality, efficiency, and workability of all the materials and equipment necessary for uninterrupted production and placement of the soil cement, expect that conveyor placement will not be required. Tasks are to include lift surface cleaning, compaction, density testing, cold joints, bedding mix placement, and forming and/or shaping of steps and training walls. Trial placement shall not be initiated until the plant and all equipment required for delivery and placement of the soil cement are operational and fully calibrated. Contractor shall demonstrate various spreading and compaction procedures including, but not limited to, various equipment types and number of passes. The Contractor shall use personnel on the test sections who will be working

directly on the low strength and high strength sections of the project in order to familiarize them with the process and products.

B. The test section for high strength soil cement and low strength soil cement will be constructed at a location determined by the Engineer and agreeable to Contractor. The test section shall consist of three twelve inch thick lifts of soil cement approximately 100 feet long at the base. The lift width shall be 8 feet. The total volume of high strength soil cement test section will be approximately 30 cubic yards.

C. The Contractor shall construct the first two lifts, and discontinue work for 24 hours. At that time, the Contractor shall prepare the surface for a cold joint in accordance with ***Subsection 310.03.07, "Joints Lift and Construction Joints,"*** and proceed with placing the remaining lift.

D. The trial section is to be placed 28 days prior to production of the remaining soil cement work. Acceptance of the trial section is predicated upon achieving the required strengths.

Subgrade Preparation

The foundation soil for the test section shall be cleared, graded, and compacted in accordance with ***Section 203, "Excavation and Embankment."*** The soil cement and bedding mortar shall be placed with the methods and in the sequence that will occur during the actual construction.

Mixing

Soil cement for test sections constructed shall be batched and mixed in accordance with the same requirements specified in ***Subsection 310.03.06, "Soil Cement Transporting, Placing, Spreading, and Compacting."***

Placement

Soil cement placement for test section construction shall be placed, spread, and compacted in accordance with the requirements specified in ***Subsection 310.03.06, "Soil Cement Transporting, Placing, Spreading, and Compacting."*** Equipment used for hauling and placing soil cement shall be clean and free of deleterious substances.

Testing and Quality Control

Prior to initiating the trial placement, Contractor shall perform testing of the aggregates in accordance with the requirements of ***Subsection 310.03.11, "Quality Control and Testing"*** to demonstrate that specification requirements are met. Contractor shall also perform all other tests and quality control measures Identified in ***Subsection 310.03.11, "Quality Control and Testing"*** during the trial placement. In addition, the Engineer will perform his own tests and inspections and the Contractor should anticipate interruptions. Contractor shall allow 3 days from the completion of his work to accommodate such tests and inspections of the trial section until production can begin so the Engineer can perform his evaluation of the test section.

Review Meeting

After completing construction of the test sections but prior to beginning soil cement construction, Contractor, Engineer, and Owner will assemble at a time and location determined by Owner to discuss the results of test section construction and the suitability of the soil cement mixtures. Soil cement mix proportions may be adjusted based on results obtained from test section construction.

310.03.04 JOB CONDITIONS

A. Cement and Pozzolan Delivery, Storage, and Handling

Cement and pozzolan for soil cement shall be stored in separate bins. Storage bins in which built cement and pozzolan are stored shall be weather tight and protected from exposure to moisture. Interior surfaces of storage bins shall be clean and free of deleterious substances to the satisfaction of the Engineer prior to storage. Each shipment of cement and pozzolan shall be stored in chronological order based on delivery date at the job site and shall be used in the same chronological order to prevent undue aging.

B. Temperature of Cement

Deliver cement to the job site at a temperature not exceeding 160° F. The temperature of the air used to transport cement into storage containers or silos must be less than 180°F. The temperature of the air will be determined by measuring the temperature on the outside of the transport pipe with a surface thermometer.

C. Storage

Immediately upon receipt at the soil cement mixing plant, store bulk cement, and pozzolan in a dry, weather-tight silos. All storage facilities are subject to approval and must permit easy access for inspection and identification. Store sufficient cement, and pozzolan to complete at least 5 hours of placement at the typical production rate being experienced.

D. Admixtures

Deliver admixtures (if proposed by Contractor) to the site in the original manufacturer's containers. Store and handle in accordance with manufacturer's printed instructions.

E. Aggregate Production, Delivery, Storage, and Handling

The Contractor’s responsibility includes producing aggregates onsite or providing and delivering aggregates to the site, monitoring delivered quantities, and stockpiling in a manner preventing segregation, intermixing, and contamination.

(1) General: The requirements of Subsection 310.03.04E (2) through (3) also apply when soil cement is produced off-site and hauled to the project site.

(2) Aggregate Production: Contractor shall operate the aggregate production plant in an efficient manner to achieve and maintain an adequate level of productivity and ensure that the final aggregate product is consistent and free from contamination by organic material, overburden, or other foreign materials.

(3) Environmental Controls:

a. Stormwater Control: Implement work to conform to Best Management Practices for control of site runoff and stormwater pollution for the work area that encompasses the aggregate production plant, stockpiles, and related construction site areas.

b. Pollutant Control: Contractor shall maintain aggregate plant areas in a clean orderly condition, free from spilled fuel, lubricant, coolant, or other potential pollutants. Contractor shall maintain material handling areas to reduce potential for pollutants to enter stormwater runoff and institute special precautions to prevent and to clean up spills of any material that might contaminate stormwater runoff.

(4) Delivery:

a. Compliance with Regulations: The Contractor's responsibility includes ascertaining and compliance with all state laws and regulations regarding haul vehicle weight limits and other restrictions as they relate to haul vehicles on public roads. Where the point of ingress or egress is connected to a paved public road, provide a stabilized construction entrance adjacent to the paved area to minimize the amount of mud transported onto the paved area. Contractor shall maintain the entrance pad and top dress with aggregate as required.

b. Delivery Route: Contractor shall deliver aggregates using route(s) identified in the approved delivery plan.

c. Maintenance of Roads: Contractor shall promptly remove, to the satisfaction of the Engineer and the haul route's jurisdictional authorities, any soil, aggregate, or other debris deposited on roads or adjacent areas as a result of the Contractor's activities associated with the work to be performed under this contract. If the Contractor fails to clean a road surface and adjacent areas in a timely manner, or fails to clean the road surface and adjacent areas to the satisfaction of the Owner of the road, the Owner of the road or the Owner has the right to perform the defective work and charge the Contractor for the cost incurred.

Contractor shall notify the Engineer as soon as any damage or deterioration to the road(s) occur that is likely to require remedial work.

(5) Stockpiling Procedures: Contractor shall maintain aggregate stockpiles in good condition to prevent segregation and inclusion of foreign materials. Stockpiles shall be located on level ground free of brush, roots, debris, and other deleterious substances. Stockpiles shall be constructed in uniform layers not exceeding 3 feet in thickness. The maximum height of any stockpile shall not exceed 15 feet. Ramps formed for stockpile construction shall be of the same material as that being stockpiled, and shall be considered a part of the stockpile. Prior to steepening or widening stockpile ramps, contaminated surface materials shall be removed. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

(6) Moisture Conditioning: If aggregate evaporative cooling is utilized, or if the aggregate is sufficiently dry to require moisture conditioning, continuously mist aggregates during stockpiling until a saturated surface-dry (SSD) condition is achieved. Use sprinklers or fog

spray type nozzles and do not apply pressurized water directly into stockpile. Exercise caution during aggregate stockpile misting to prevent washing of fine material.

(7) Stockpile Withdrawal: Withdraw aggregates from the stockpiles using conveyors, face loading with front-end loaders, or a combination of conveyors and face loading. Regardless of the method employed, withdraw materials that are representative of the entire stockpile, both in terms of gradation and moisture content. Blend any obviously segregated material with other material in a manner that will result in a gradation that meets the specifications. If the material cannot be suitably blended, separate it from the stockpile and use for other non-critical purposes, or waste the material.

F. Material Certification

With each shipment of cement and Pozzolan delivered to the project site, Contractor shall provide Engineer with one copy of the material supplier's certification as to the source quality, and weight of the material delivered to the project site.

G. Plant Calibration

After mobilizing and erecting plant equipment at the project site and prior to beginning soil cement production, Contractor shall perform, at his expense, all necessary shakedown and trial runs of his proportioning, mixing, hauling, handling, and conveying equipment so that when put into production operation for construction of the Work, the equipment shall consistently and accurately produce a uniform soil cement mixture of the quality specified.

Contractor shall calibrate the plant scales and other mixture proportion control devices and shall submit a calibration report prior to initiating soil cement placement. The accuracy of all scales and control devices shall be certified in accordance with State of Nevada standards for weights and measurement of concrete batching and mixing equipment. Contractor shall recalibrate the plant following each 30 shifts or 5,000 cubic yards of placement, whichever is less, or when quality control testing indicates a potential problem.

H. Flood Protection

The plant and all related equipment shall be built so that if the plant areas are temporarily inundated by flood waters, damage to the equipment or stockpiles shall not result in a delay caused by rebuilding of the plant or replacing stockpiles.

310.03.05 BATCHING AND MIXING

A. General

The Contractor shall select the type of concrete mixing plant to be used and shall determine the plant layout. The plant shall include all necessary mixers, volumetric or weight controls, storage bins, feed systems, and discharge mechanisms. A description of the plant shall be submitted to the Engineer for review and acceptance as described in ***Subsection 310.03.01, "Submittals."*** The plant may be a continuous pugmill or a batch type pugmill. The Contractor shall perform, at his expense, all necessary shakedown and trial runs of his mixing and proportioning equipment so that when put into production operation for construction, the equipment shall consistently and

accurately provide mixtures of the quality specified. The minimum sustainable capacity of the plant(s) must be at least 300 tons per hour using the specified mixes. Material not meeting the specified requirements will be rejected and not allowed in the construction. The Owner will require the Contractor to remove rejected material at the Contractor's expense.

B. Batching or Proportioning Tolerances

Batching or proportioning of soil cement materials shall conform to the mixture proportions directed, within the following tolerances:

BATCHING OR PROPORTIONING TOLERANCES	
MATERIAL	PERCENT*
Cement	± 2.0
Water	± 2.0
Blended Aggregate	± 3.0
Admixtures	± 3.0
Pozzolan	± 3.0

* For continuous mixing plants, the variation is in percent by weight of the total weight of each material for the specified mix in the total sample obtained for a given duration of time. The minimum sample collected shall be one to three cubic feet.

C. Continuous-Mixing Plant Requirements

(1) General

Continuous mix plants shall be capable of producing concrete of the same quality and uniformity as would be produced in a conventional batch-type plant. In general, the plants shall conform to the requirements of ASTM C685, except that proportioning tolerances shall be as specified herein and adaptation to accommodate aggregate size shall be made as needed.

The plant may be a central-type plant and shall have a stationary twin-shaft pugmill mixer and shall be a continuous-mixing type. The plant shall be equipped with positive means for controlling the mixing time maintaining constant mixing time, and maintaining a constant rotation speed of the pugmill shafts.

Mixers shall not be charged in excess of the capacity recommended by the manufacturer and shall be capable of combining the materials into a uniform mixture and shall be capable of discharging the mixture without segregation. The plant's transfer systems must be capable of charging and discharging the constituents and mixed product without bridging or choking.

Mixers shall be maintained on satisfactory operating condition and mixer paddles shall be kept free of hardened concrete. Mixer paddles shall be replaced when their face area has been reduced to less than 80% of their original area. The minimum mixing time for continuous mixing pugmills or batch type pugmills is 15 seconds. The minimum mix retention time for batch type pugmills is 90 seconds.

The intent is to operate continuous pugmills in a continuous manner at one set of feed rates with a minimum number of shutdowns and startups during soil cement production placing. Contractor shall calibrate and operate the plant so that all materials simultaneously begin feeding into the mixer at the specified rates when the mixer is started, and all materials simultaneously stop feeding into the mixer when it is stopped. No lag or lead-time between materials will be allowed at the point where they enter the mixer. After material feeds are shut down, discharge all remaining material in the mixer. The initial soil cement produced after a plant re-start may not conform to the specification requirements. If the plant can be stopped and re-started at the same mix proportions, no material has to be wasted. The need to waste material after a re-start will be evaluated for consistency and uniformity on a case-by-case basis by the Engineer. When the plant is shut down for over 30 minutes, waste the first one-half cubic yard of material.

(2) Aggregate Feed

Separate bins or compartments with steep side slopes, large gate openings, and the capability of handling aggregate in a damp condition shall be used for each aggregate group used in the soil cement mix. Each bin shall be of sufficient capacity to supply the mixer continuously while operating at full capacity. The bins shall be arranged to ensure separate and adequate storage of appropriate fractions of aggregate. Each compartment shall be provided with some means of preventing backing up of material into other bins. Unless the aggregate in the bin is readily visible to operating personnel, each aggregate bin shall be equipped with mechanical or electrical sensors to indicate when aggregate in the bin is below the level to permit accurate proportioning to the mixing unit. Each bin shall be constructed or equipped in such a manner that a representative sample may be taken readily and safely from each bin discharge during plant operations.

Feed cement and aggregates uniformly, continuously, and simultaneously, at the appropriate ratios for the mix design specified, into the mixer by belt or other acceptable method. Feed controls may be by volume or weight. Aggregate feed may be accomplished by a single belt from each stockpile or from feed bins of the various size groups through openings at the bottom of the feed bins. Provide each opening in aggregate feeders with a gate that can be locked at the necessary opening size to provide the correct feed rate. Keep return side of all belts clean. Keep bins sufficiently full to allow a uniform flow of aggregate at an essentially constant rate. Particular attention may be needed to guarantee a continuous flow of the fine aggregate if it is very damp and is graded towards the fine side of the specified gradation band. Feed cement (and Pozzolan) continuously in a manner that can be controlled by adjusting the belt speed or feed rate. Provide special attention to the cement (and Pozzolan) feed equipment so that it consistently and uniformly delivers materials even at low (100 lb./yd^3 or less) dosage rates.

Use feeds capable of gradual adjustment while in operation. Use continuously correcting automated gate openings and/or belt-feed rates by electronic feedback of weight sensor units on the belts if operation without them cannot provide the accuracy, consistency, and quality required by these specifications.
Provide individual silos for bulk cement and Pozzolan with ample size and so constructed that the various materials will remain separate under all working conditions. Separate all compartments containing cement and Pozzolan from each other by a free draining air space. Clearly mark cement and Pozzolan silos with signs to indicate the material contained in each silo.

(3) Cement and Pozzolan Feed

Feed cement and Pozzolan continuously in a manner that can be controlled by adjusting the belt speed or feed rate. Provide special attention to the cement (and Pozzolan) feed equipment so that it consistently and uniformly delivers materials even at low (100 lb./yd^3 or less) dosage rates. Metering and feed shall be designed and controlled so that cement is uniformly fed into the mixer or into the stream of aggregate on the feeder belt, all with necessary controls to prevent loss of cement as dust or in any other form. Control of the quantity of cement shall be linked either electronically or mechanically to the other feed systems. An electronic belt-weighing device shall be provided to meter and monitor the individual amount of cement delivered into the mixture.

(4) Water Control Units

Contractor shall provide a water dispenser that is capable of dispensing the mix water within the specified requirements. Contractor shall also provide piping, valves, and other components that are free from leakage for delivering water to the mixer. Water may be weighed or metered by an in-line volumetrically activated flow meter. The metering valve must be capable of gradual adjustment during the mixing process to compensate for varying moisture contents in the aggregates. Contractor shall use valves that are automatically controlled and will close if the cement, Pozzolan, or aggregate stops entering the mixer at the required rate. This control may be bypassed for cleaning operation. When the quantity of water is controlled by metering, provisions shall be made where the quantity of water delivered through the meter can be checked readily by weight. A water storage tank shall be provided to prevent surge drawdown effects.

(5) Mixer

The mixer unit shall be a stationary mixer of the twin-shaft pugmill type capable of producing a uniform homogenous mixture of the required soil cement materials within tolerances specified. Blades shall be adjustable for angular position on shafts and reversible to retard flow of mix. The mixer shall bear a manufacturer's plate indicating net volumetric contents of mixer at several heights inscribed on a permanent gate and the rate of feed of aggregate per minute at plant-operating speed.

(6) Discharge Hopper

A discharge hopper with a minimum capacity of five cubic yards shall be provided wherever the mixed soil cement temporarily accumulated before loading into trucks or conveyors for transport. The hopper shall be equipped with vibrators and dump gates that will permit rapid and complete discharge of soil cement without segregation. Hopper shall be constructed with side slopes, baffles, and gates as necessary to prevent segregation of the soil cement mixture. When discharging soil cement from conveyors into the hopper, the drop height shall not exceed 5 feet. When loading soil cement into trucks, scrapers, or other transport equipment, the maximum drop from the bottom of the discharge hopper to the bed of the transport equipment shall not exceed 5 feet. Telephone or radio communication between the discharge hoppers, the mixing plant, and the placement site shall be provided.

(7) Chutes and Drop Tubes

Unless specifically authorized in writing, chutes or uncontrolled drops exceeding 5 feet will not be permitted.

(8) Conveyors

Contractor shall design and/or provide conveyors and transfer components for low maintenance, continuous operation with clean return belt surfaces and without segregation or excessive loss of material. Fit all belts with covers or shields to prevent drying by the wind and sun, and over-wetting from rain. The maximum free fall drop from conveyors is 5 feet.

(9) Sampling Facilities

Suitable facilities and labor shall be provided for obtaining representative samples of materials as they enter the mixer, are discharged from the mixer, are discharged from the discharge hopper and from the placement after spreading. Contractor shall furnish all necessary platforms and equipment for obtaining samples, which will be used for quality control and quality assurance testing.

(10) Equipment Substitutions

After equipment is demonstrated as suitable for production and placement, as indicated by Contractor submittals, calibration report(s), and the trial placement, no substitution of equipment will be permitted without prior written approval by the Engineer.

310.03.06 SOIL CEMENT TRANSPORTING, PLACING, SPREADING, AND COMPACTING

A. General

The soil cement mass shall be constructed in as nearly a continuous operation as is practical. The spillway face, cut-off wall, and open channel cross section shall rise at essentially the same level across the entire area. As placement of a lift progresses, the exposed edges shall be kept "live" by progressively placing out from them. Whenever a cold joint at any edge of any lift does occur, it shall be prepared as required in the ***Subsection 310.03.07, "Joints Lift and Construction Joints."*** The rate and schedule of placement shall minimize the occurrence of cold joints. All surfaces of the concrete outlet conduit against which soil cement is to be placed shall be clean, free of dirt, oil, and grease, and properly prepared prior to placement of soil cement. All dirt, mud, water, and debris shall be removed from the space to be occupied by soil cement; all surfaces encrusted with dried soil cement from previous placement operations shall be cleaned; and the entire installation shall be acceptable to the Engineer.

B. Time Requirements

The time from mixing the soil cement to depositing it shall not exceed 20 minutes and the time from depositing the soil cement to spreading it shall not exceed 10 minutes. The compaction operation shall be started within 45 minutes after the addition of water to the soil cement moisture at the plant, and within 20 minutes after completion of spreading. Final compaction of any volume of soil cement shall be completed within one hour of the time at which water was introduced into that volume of soil cement mixture at the mixing plant.

C. Subgrade Preparation

Before placing soil cement, the subgrade shall be prepared as described in ***Section 203, "Excavation and Embankment."*** Immediately prior to the placement of the bedding mix, the receiving surfaces shall be in a moist condition. Contractor shall not cover exposed slopes with bedding mix until the area has been approved by the Engineer.

D. Slope Preparation

Before placing soil cement, the embankment slope face shall be uniform, dense and free of loose ravels or otherwise unsuitable materials. Density of the slope face shall be equal to the density specified for embankment construction. Immediately prior to the placement of soil cement, the receiving surfaces shall be in a moist condition.

E. Embedments

All embedments such as weep hole drain conduits shall be accurately positioned and securely anchored in place. Embedment surfaces shall be clean when installed.

F. Transporting

Soil Cement shall be transported from mixer to placement area as rapidly as practicable by methods which minimize segregation, contamination and drying. Trucks, conveyors, or other equipment acceptable to the Engineer may be used to transport soil cement to the placement area.

Soil cement may be hauled using trucks, large front-end loaders, or scrapers to various locations on the placement area. Tracked haul vehicles will not be permitted. Contractor shall use bottom-dump haul vehicles, end dump trucks with special tail gates or drop control methods that demonstrate an ability to handle dumping without excessive segregation, and/or front-end loaders. The haul vehicles must be free of deleterious materials including, but not limited to, oil, grease, loose, deteriorated, or dry soil cement and soil. The maximum free fall drop height from hauling vehicles is 5 feet.

Equipment will not be allowed to track mud or other contamination onto previously placed soil cement. This may require using clean crushed rock on haul roads, washing tires of vehicles prior to driving onto the soil cement prior to placing the next lift, or other special measures. Any segregated soil cement that results from using haul vehicles shall be removed by hand or re-blended. Haul vehicles shall be operated in a manner that precludes tight turns, sudden stops, or other procedures by vehicle operations (oil spills, etc.), it shall be cleaned or the damaged material shall be removed.

G. Conveying

Conveyor belt systems or mobile crane conveyors may be used for final deposition of the soil cement into place for spreading and compaction. The conveyor system and soil cement shall be designed and manufactured by personnel fully experienced with conveyor belt delivery of low slump mass concrete and shall be designed specifically for continuous operation at speeds that meet production requirements and do not segregate materials.

Conveyors shall be equipped with protection devices as necessary to prevent leakage of lubricants or other foreign materials onto the belts or onto the soil cement surfaces below. Conveying equipment shall be outfitted with suitable hoppers at all transfer points if soil cement is transported to the conveyor by truck or other vehicular equipment. If necessary Contractor shall provide baffles at the end of conveyors and within hoppers to limit free fall heights to 5-feet and at other locations that otherwise cause excessive segregation.

H. Placing and Spreading

(1) General

The Contractor is cautioned to understand and apply applicable fall protection requirements to all work on the site. The Contractor is responsible for all health and safety requirements at the site.

(2) Layout of the Placement Area

It is the intent of this specification to raise the soil cement at essentially the same level across its entire area. As nearly as is practical, expose no more than two lift surfaces at one time. One additional layer may be exposed under special circumstances such as crossing conduits or other features. Maintain lift grade control by using grade stakes and/or laser-guided equipment, or other surveying methods. Whenever a cold joint at any edge of any lift occurs, locate it at least 10 feet horizontally from the location of other cold joints that may have occurred previously. Prepare the joint as required by ***Subsection 310.03.07, "Joints Lift and Construction Joints"*** of these specifications for "cold joints" prior to resumption of soil cement placement.

(3) Depositing

Deposit soil cement at the location at which it is to be spread. Where haul vehicle delivery is used, depositing will generally be accomplished with a dump-spread action while the vehicle is moving. When stationary end dumping is necessary, deposit the material on top of the fresh soil cement layer being advanced, not on the previously compacted layer. Do not place material in piles higher than 3 feet. For belt delivery, limit pile heights to 3 feet and discharge from the belts in a manner that does not cause segregation. If trucks are used to deliver soil cement, do not discharge material directly against any formwork. At isolated or confined placement locations, the Engineer may permit pushing the soil cement up to 50 feet with spreading equipment, provided that segregation does not occur. Modify operations if the Engineer determines that excessive segregation is occurring.

(4) Spreading

Within 10 minutes after depositing, the mix shall be spread into an even layer that will, after compaction, be 12-inches thick, unless another lift thickness is satisfactorily demonstrated and approved during the trial placement. (Do not place soil cement in compacted lifts unless they are 4-inches thick.) Where soil cement is spread onto or into a bedding mortar, spreading shall be accomplished before the bedding has begun to set, but no more than 90 minutes from the time the bedding mix was batched and within 45 minutes of when the bedding mix was first deposited.

Spreading shall be accomplished with low contact pressure equipment, such as a track-type dozer and must be capable of placing the soil cement in uniform lifts and without segregation. The suitability and acceptance of any spreading equipment will be based on the results of the test section. Do not operate tracked spreading equipment on compacted soil cement unless tracks with flat rubber pads are used or rubber mats are placed between the compacted surface and the dozer tracks. Remove any loose material resulting from operation of equipment on compacted surfaces prior to placing the next lift. Have a front-end loader with operator available to assist with depositing and spreading of material in confined areas, at irregular foundation conditions, and at other locations as needed. Accomplish spreading in a manner that does not cause segregation. If large aggregate rolls or segregates to the outside edge of a spread layer of soil cement, reblend it into the soil cement or remove it. Maintain all equipment in good operating condition so that it does not leak or drip oil, grease, or other obvious visible contamination onto the soil cement. Do not place concrete on a previous layer which is suspect and is being considered for testing, retesting, or rejection, or has not been completely compacted.

Soil cement may be placed with an approved tamping paver. Adjust the paver and regulate the speed to prevent segregation. Do not exceed a paver speed of 10 feet per minute unless it can be demonstrated to the satisfaction of the Engineer that higher speeds do not cause problems. Operate the paver with a constant supply of soil cement in the hopper.

I. Compaction

(1) Compaction Procedures

At the start of compaction, the mixture shall be in a uniform, loose condition throughout the full depth, and at the specified optimum moisture content. The specified moisture content shall be maintained uniformly throughout the layer of material being compacted. Concrete lifts shall not be left undisturbed for longer than 30 minutes during compaction operations.

If necessary, moisture shall be added during the compaction operation to maintain the uncompacted mixture at its optimum moisture content.

(2) Compaction

Compact each 12-inch layer of soil cement with a minimum of 4 passes of a self-propelled double drum or 8 passes of a self-propelled, single-drum vibratory compactor. (A round trip is 2 passes). Use the largest size equipment specified below that is capable of physical and practical operation in the area to be compacted. Use small walk-behind vibratory rollers and/or hand-guided power tampers for compaction in any areas that cannot be reached with the drum of a large vibratory roller. Do not operate rollers in the vibratory mode until they are moving. Maintain all compaction equipment in good operating condition at all times and do not allow it to drip or spill oil or other obvious visible contamination onto the soil cement. Break down, trim, and compact the edge of all compacted layers against which adjacent soil cement is not placed within 30 minutes so that the edge is thoroughly compacted and does not contain loose segregated aggregate. Spread and roll so that a flat surface results with minimum roller marks from the edge of the drum, and so that the drum does not bridge over any of the surface beneath the roller drum after the last pass. Operate rollers at speeds not exceeding 160 feet per minute.

(3) Acceptance

Compacted soil cement shall be within 2 percent of optimum moisture content. No individual compaction density test shall be less than 95% of the optimum compaction density value. Determine the average wet density from the average of two readings taken with the gauge probe at a depth 2 inches from the bottom of the lift. If the two readings vary by more than 2%, repeat the density test. If it is demonstrated early in production that the two readings are consistently within 2%, the two readings can be reduced to one. Also measure densities with the gauge probe at 6 inches; however, this reading will not be used to compute the average density.

(4) Additional Compaction

If, after testing, the soil cement does not meet the required density, it may be compacted with additional roller passes, provided that the time limit in Subsection 310.03.06B has not been exceeded.

(5) Removal of Material

If the time limit specified in Subsection 310.03.06B has been exceeded and the soil cement has not achieved the required density, or if the mixture is wetted by rain so that the average moisture content exceeds the specified moisture requirements before achieving compaction, remove the soil cement full depth and replace it at no cost to the Owner. Clean the underlying surface and treat as a lift surface cold joint prior to replacing the removed soil cement with new material.

(6) Compaction Requirements

The Contractor will determine the optimum compaction density value during the trial placement. The optimum compaction density value is the highest density attainable using the specified soil cement mix proportions and the equipment approved for soil cement construction. Nuclear density readings are taken after two roller passes in the trial placement until there is no increase in density or the increase is less than 0.1 lb./pass. Final evaluation of density results for the determination of the optimum compaction density value will be made only after all major field adjustments have been made and the mix design is considered to represent soil cement that has suitable placement, spreading, and compaction characteristics, and provides the required strength and porosity values. Small field adjustments to the optimum compaction density value may be made throughout construction based upon the running average density value. Such changes may be made based on slight changes or long-term drift of density values resulting from field mix design adjustments.

(7) Compaction Equipment

Large-width, self-propelled vibratory rollers shall be used in open areas; small vibratory rollers shall be used within 3 feet of the cast-in-place concrete and at irregular areas; and hand-guided power tampers shall be used for compaction in any areas that cannot be reached with the drum of a vibratory roller. Rollers shall not be operated in the vibratory mode until they are moving. All compacting equipment shall be kept in good operating condition at all times and will not be allowed to drip or spill oil or other visible contamination onto the soil cement.

Self-Propelled Rollers: Contractor shall provide single or double drum, self-propelled vibratory rollers that transmit a dynamic impact to the surface through a smooth steel drum by means of

revolving weights, eccentric shafts, or other equivalent methods. Use compactors with gross weights of not less than 21,000 lb., minimum dynamic force of at least 475 lb. per inch of drum width at the operating frequency used during construction, vibrating frequency of at least 1500 cpm (cycles per minute), drum diameter between 4 and 6 feet, drum width of 5 to 8 feet, and engine horsepower of at least 125. The roller shall be operated at speeds not exceeding 1.5 miles per hour. Within the range of the operational capability of the equipment, the Engineer may direct or allow variations to the frequency and speed of operation which result in maximum density at the fastest production rate. Any other compaction equipment proposed must demonstrate that it is capable of compacting the soil cement full depth to the specified density prior to soil cement production. Provide at least one fully operable, self-propelled vibratory roller on the placement area at all times during production placement. Standby replacement equipment shall be available within an hour, if needed.

Power Tampers and Small Vibratory Rollers: Contractor shall use small vibratory rollers that can operate within a few inches of a vertical face to compact the soil cement adjacent to formwork, precast panels conventional concrete structures, abutment slopes, and at other areas where the large vibratory rollers specified above cannot maneuver. Contractor shall provide rollers with a dynamic force of at least 150 lb./in of drum width for each drum of a double drum unit and at least 300 lb./in of drum width for a single drum unit. Provide at least one fully operable, small roller at the site during soil cement placement.

Contractor shall provide tampers, plates, and rammers that develop a force per blow of at least 3500 lb. per square foot. Contractor shall maintain at least two tampers, plates, or rammers in good operating condition at the site during soil cement placement.

The amount of rolling and tamping required shall be whatever is necessary for the particular equipment to provide the specified degree of compaction. Contractor shall reduce the lift thickness as required to achieve the specified compaction in locations where power tampers and small vibratory rollers are used. Contractor shall conduct field tests with proposed equipment of rolling and tamping as required to comply with specifications. Standby replacement equipment shall be available as needed.

310.03.07 JOINTS LIFT AND CONSTRUCTION JOINTS

A. General

It is the intent of this specification to place the entire soil cement mass with sufficient continuity so that it hardens and acts as a monolithic block without discontinuous joints or potential planes of separation. The length of time between placement of successive layers of soil cement that can be tolerated is dependent upon temperature. Joint quality is also dependent upon cleanliness, surface moisture and whether a bedding mix is applied. When the limits between successive lifts of soil cement layers exceed those specified herein, a cold joint will be considered to have occurred, and the procedures described for cold joints in this section.

Routine Lift Surface Treatment: Keep joint surfaces in a clean, uncontaminated, and continuously moist condition until placement of the succeeding soil cement. At a minimum, the Contractor should anticipate blowing every lift surface with compressed air if loose material and contamination are present. Employ a system to continuously maintain lift surfaces in a moist, but not wet, condition. The system may consist of, or be supplemented as necessary by, mists and

light sprays from hand-held hoses to reach all areas of each lift. Heavy sprays from water trucks provide too much water and are not acceptable. Water trucks may be used if they can provide a fine spray or mist. Do not apply the mist or spray in a channeled or pressurized manner that may erode the fresh soil cement surface or at a rate that causes ponding on the surface. Have one person on duty during the soil cement placement operation with the sole responsibility of operating the water system to keep the entire surface moist but not over-watered. He may be allowed to perform routine maintenance of nozzles and move hoses only if these activities do not prevent him from keeping the entire exposed surface in a continuously damp condition. During non-placement hours the soil cement shall be maintained in a moist condition either by on-site personnel or by covering the lift with tarps or plastic.

B. Lift Surface Cold Joints

A cold joint on a lift surface will be considered to have occurred when a period of more than 4 hours has elapsed (from May to September), and a period of more than 8 hours has elapsed (from October to April) before placement of the successive lift. Prepare cold joints for the subsequent lift by removing all laitance, loose debris, and contaminants from the entire surface. Expose, but do not undercut the aggregate with the cleaning procedure. At this stage of maturity, use water jetting if air alone does not satisfactorily prepare the surface. After preparation, maintain the surface in a damp condition and place a layer of bedding mix with an average thickness as specified in ***Subsection 310.02.05, "Bedding Mix."***

C. Lift Edge Cold Joints

A cold joint on a lift edge will be considered to have occurred when more than 30 minutes has elapsed since placement of the material at the lift edge. Treat the cold joint prior to resuming soil cement placement by cutting back into the compacted cement providing a vertical full depth joint. The cold joint shall be transverse to the layer direction and located a minimum 6" inside the lift edge. Joints shall be staggered to inhibit cracking. Prior to subsequent lift, clean joint of laitance, loose debris and contaminates from the joint edge.

D. Lining Joints at Structures

The joints between the soil cement lining and concrete structures shall be 1-inch premolded elastomeric joint filler.

310.03.08 FINISH TREATMENTS AND TOLERANCES

The finish treatment and tolerances for soil cement shall be as specified herein.

A. Facing Finish Treatment

(1) Forming: Construct the exposed face of the soil cement as shown on the drawings and as specified herein. Select a forming system and demonstrate at the soil cement test section that it will provide soil cement surfaces within the specified tolerances and acceptable texture.

(2) Forms: Form the steps and any other exposed soil cement face to provide the finished surfaces shown on the drawings. Construct all formwork as specified. The Contractor is

responsible for the design of the formwork, as well as its construction in ***Section 502, "Concrete Structures."*** Provide and construct forms with sufficient strength to withstand the pressure resulting from placement and compaction of the soil cement and with sufficient rigidity to maintain specified tolerances. Forms need not be mortar tight if bedding mix is not used.

(3) Repairs: It is the intent of these specifications to require forms and soil cement workmanship be such that soil cement surfaces will require no repairs after form removal. The workability of the soil cement may need to be adjusted such that the concrete can be fully consolidated against the forms. It is anticipated that form work will have to be strengthened to resist lateral forces exerted by compaction equipment. As soon as the forms have been stripped and the formed surfaces exposed, the Engineer will inspect the formed surface to determine if there is adequate consolidation, excessive honeycomb, or other defects. The soil cement test section shall be used as a "Paint Chip" as to what texture and degree of honeycombing is acceptable and what is not. If the defects are excessive, clean the defective areas of loose or unconsolidated material and repair with conventional concrete at no cost to the Owner.

(4) Compaction: Compact the soil cement as specified in ***Subsection 310.03.06, "*Soil Cement Transporting, Placing, Spreading, and Compacting*."***

(5) Tolerances: See Subsection 310.03.08B.

B. Structural Tolerances

(1) General: Construct within the tolerances specified in ***Section 502, "Concrete Structures"*** except as supplemented or modified below.

(2) Specific Requirements:

a. Limit overbuild of the downstream face of the soil cement to 1 inches. Underbuild will not be allowed.

b. Do not vary the downstream edge of any soil cement lift by more than 1 inches in 100 feet.

c. Construct the thickness of individual compacted layers of soil cement within plus or minus 2 inches of that stipulated.

d. Keep the elevation of the surfaces of roller-compacted concrete layers upon which subsequent concrete is placed within 5 inches from the design elevation. Additionally, keep the elevation of the top three lifts within 2 inches of that shown on the drawings.

e. Do not vary the upstream and downstream edges of the finished top of structure by more than 2 inches in 10 feet. Do not exceed the plan width by more than 2 inches. Place the top lift such that the final elevation of the top soil cement layer is within 2 inches of that shown on the drawings and does not vary more than 1 inch in 10 feet. Underbuild will not be allowed.

f. Surface irregularities are solely the responsibility of the contractor.

310.03.09 REQUIREMENT AND LIMITATIONS

Contractor may be required to alter soil cement placement operations, or halt placement operations, to minimize the detrimental effects of adverse weather on the soil cement.

A. Hot Weather Soil Cement Placement

The Contractor shall protect the soil cement from moisture loss during hot weather. Soil cement placement shall be suspended if high ambient temperatures and/or wind dry the uncompacted soil cement mixture so that adequate compaction is not possible. The surface of soil cement upon which subsequent soil cement will be placed shall be kept continuously damp. During daylight hours the maximum temperature of the soil cement mixture immediately prior to compaction shall not exceed 85°F. If the Contractor places soil cement during the night between 8:00 p.m. to 8:00 a.m., the maximum temperature of the soil cement mixture immediately prior to compaction shall not exceed 90°F. The temperature will be measured at the point where the soil cement is delivered to the lift surface. Contractor shall take all precautions necessary to control the placement temperature of soil cement including, but not limited to, sprinkling stockpiles, use of chilled water or liquid nitrogen, use of sun screens, or nighttime placement.

B. Cold Weather Soil Cement Placement

Soil cement shall not be placed when ambient air temperatures drop below 32°F. In the event ambient temperatures drop below 32°F and the temperature of the soil cement mixture stays above 35°F, the Engineer may permit placing of soil cement for temporary periods provided the ambient temperature remains above 25°F. If the ambient temperature drops below 32°F or the surface of any soil cement less than 7 days old drops to 35°F, cover the surface with heavy tarps, blankets, straw, or other acceptable temporary protection until the ambient temperature rises above 35°F. Remove all soil cement that is less than 7 days old and is exposed to temperatures less than 32°F.

C. Rainfall

Soil Cement shall not be placed during heavy rain which is more than 0.20 inches per hour, or 0.03 inches in 6 minutes, as defined by the Weather Bureau Glossary of Meteorology. Contractor shall suspend production when free surface water begins to accumulate on the compacted soil cement when excessive pumping, tracking, or other unacceptable damage begins to develop, or when, in the opinion of the Engineer, rain is adversely affecting any aspect of quality. Contractor shall remove any uncompacted soil cement exposed to precipitation that, in the opinion of the Engineer, makes it unsuitable.

310.03.10 CURING AND PROTECTION

A. Cold Weather Protection

Keep the surface of all soil cement lift layers continuously damp and at a temperature above 35° F until it is covered with the next layer of soil cement. Comply with the temperature restrictions in ***Subsection 310.03.09B, "Cold Weather Soil Cement Placement."*** Measure the soil cement temperature with a digital thermometer equipped with a surface probe. Protect from erosion by

heavy rain and damage by water trucks all surfaces of soil cement layers upon which subsequent layers will be placed. Clean any surface damaged by erosion that undercuts coarse aggregates, and cover with bedding mix prior to placing next soil cement layer.

B. Moist Curing Requirements

Moist Curing Requirements: Keep the surface of all soil cement lift layers continuously damp until each is covered by the next layer or for a period of 14 days.

C. Use of Curing Compounds

Curing compounds will not be permitted on the soil cement.

310.03.11 QUALITY CONTROL AND TESTING

A. General

(1) Contractor shall establish and maintain an effective, on-site, quality control program in cooperation with the Owner and the Engineer for the soil cement concrete. The soil cement quality control program will be the means for ensuring compliance with contract requirements and for maintaining records of control, including all tests and inspections, their findings, and remedial actions taken when necessary. All testing and inspections described herein will be the responsibility of the Contractor. Density test results shall be made immediately available to the Owner and the Engineer. All lab test results will be provided to the Owner and the Engineer no more than 24 hours after test completion.

(2) Contractor shall establish and execute the quality control program under the supervision of a Soil Cement Quality Control Manager who will review and approve all activities concerning the production of materials, planning and scheduling of construction activities for placing soil cement, and the execution and evaluation of soil cement tests. Work closely with the Engineer and keep the Engineer advised of planned construction procedures, the placing schedule, the testing schedule, and results obtained from tests. Designate a Soil Cement Quality Control Manager for each shift. Several personnel may be required in the various areas of monitoring, testing, and reporting during the placement period. Make all information and test results available to the Engineer. Permit the Engineer full access to all construction and Contractor quality control activities.

(3) At a minimum, include the following processes in the soil cement Quality Control Program: Aggregate stockpiling and handling, aggregate testing, mixing requirements and mix proportions at the soil cement mixing plant, mix delivery, compaction, lift joints, material quality control, and all other tests and inspections required by these specifications. Establish the program as described in the following paragraphs.

B. Aggregate Gradation:

(1) Testing: At least once during each shift that soil cement is placed, and once during each shift that aggregates are delivered, test gradations and for the combined gradation of all aggregates mixed at the designated proportions. A retest sample is required for any gradation test out of specifications. The location where samples are taken will be selected

by the Engineer. Make provisions for accurate sampling of aggregates on feed belts to the soil cement mixing plant.

(2) Action Required: When a test result is outside of the specification limits, take a retest sample. If the retest sample is outside of the specification limits, suspend soil cement production until the problem is corrected. The Contractor will be responsible for all costs incurred as a result of soil cement placement suspension resulting from out-of specification materials.

C. Aggregate Moisture Determination

(1) Testing: At least once during each shift of soil cement placement for each aggregate size used, test the moisture in accordance with ASTM C566. The location where the sample is selected may be determined by the Contractor provided that it is typical of materials entering the mixer. The frequency of testing may be increased or decreased depending on moisture uniformity or variability as a project record is developed.

(2) Action Required: When moisture content determinations indicate a change in water entering the mix with the aggregates, contact the placement foreman to see if a corresponding adjustment in water added at the mixer is necessary to obtain adequate compaction and meet consistency requirements at the placement site.

D. Material Finer than the No. 200 Sieve

(1) Testing: During the first two weeks of aggregate stockpiling, perform tests every other day in accordance with ASTM C 117 to determine the amount of material passing the No. 200 sieve for the aggregate. After it has been established that a problem does not exist, and if production remains constant, continued testing will be required only once per week.

(2) Action: When test results for material finer that the No. 200 sieve are outside of the specification limits, take action to correct the deficiency. Suspend soil cement production until the problem is corrected. Materials produced "out of spec" may be blended with materials "in spec" so that the composite as used in soil cement meets specification requirements.

E. Aggregate Quantities

Accurately monitor and record the quantity of each aggregate produced, delivered, stockpiled, and used during each shift. Maintain a cumulative record of the amount of each aggregate produced or delivered, used in the permanent work, and wasted. Base quantities on saturated surface-dry (SSD) moisture conditions. Also record the moisture content.

F. Cement and Pozzolan Quantities

Accurately monitor and record the quantity of each material delivered and used during each shift and the quantities of materials stored onsite. Maintain a cumulative record of the amount of each material delivered, used in the permanent work, and wasted.

G. Soil Cement Mixing Plant Control

When the soil cement mixing plant is operating, continuously control the amount of all constituent materials including cement, Pozzolan, each size of aggregate, water and admixtures. Adjust the mixture proportions to compensate for free moisture in the aggregates as necessary. Prepare a daily report and submit to the Engineer before the start of the next shift indicating the type and source of cement used during that day, aggregate size groups and percentage used, required mix proportions per cubic yard for each mix design used, the amount of water as free moisture (above SSD) in each size of aggregate, and the aggregate weights per cubic yard of soil cement produced during plant operation. Also include in the report the total amount of each material used per shift. Include in the daily report the proportions for each batch, for batch plants, and for each one hour interval for a continuous plant.

H. Scales for Weight Batching

(1) Tests and Checking: Check the accuracy of scales with test weights prior to the startup of concreting operations. Retest the scales at least every month of operation thereafter. In addition, retest whenever there are variations in properties of the soil cement that could be the result of proportioning errors. When weight-batching procedures are used, frequently check the accuracy of each batching device during the startup of operations by noting and recording the required weight and the weight actually batched.

(2) Action Required: When either the weighing accuracy or batching accuracy is found not to comply with specification requirements, do not operate the plant until necessary adjustments or repairs have been made.

I. Volumetric Feed Calibrations

Check the accuracy of volumetric feeds by collecting all material delivered to the mixer during a unit of time. Provide suitable methods and equipment for obtaining and handling samples at the soil cement mixing plant. Determine the weight of material delivered to the mixer during a time interval between 5 to 15 minutes as determined by the Engineer, and calculate the resulting proportions of materials per cubic yard. Determine the accuracy of volumetric feeds at least three times during checkout of the soil cement mixing plant prior to production operations and soil cement placement. Recalibrate plant at least every 30 shifts or 5,000 cubic yards thereafter and whenever there are variations in the properties or control of the soil cement that could be the result of volumetric feed errors. Use samples of sufficient size to give accurate determinations. This may require sample weights in excess of 500 pounds per item checked.

J. Testing Soil Cement Mixers

(1) General: Sample and test fresh concrete for compliance with the specifications at the placing location. Provide a method of readily obtaining representative soil cement samples from the placement, the plant and gob hopper locations. Approximately 400 pounds of material will be required for each sample.

(2) Mixer Performance: A mixer performance test is required on a continuous pugmill plant only if the plant has not produced soil cement of similar proportions in the past. The tests may be required if the soil cement shows signs of nonuniformity or inconsistency in test results. In the event the test results show nonconformance with specifications, the Contractor shall

adjust mixer to meet specification, or replace with mixer that complies at Contractor's sole cost.

K. Temperature

(1) Testing: Measure and record the soil cement temperature on an hourly basis at the placement location. Perform additional tests when rapid set time or workability loss is reported by the placing foreman or Engineer, or during periods of hot weather. Record the temperature of the air and the soil cement during the period of cure and cold weather protection when those restrictions are applicable.

(2) Action Required: When soil cement temperature is outside the specification limits, suspend soil cement placement until the problem is corrected. Include temperatures as standard data in the quality control reports.

L. Moisture Content

(1) Tests and Checking: Determine the moisture content of the soil cement mix each time a density reading is taken with the nuclear gauge. Determine moisture content at the placement using a nuclear gauge in the backscatter mode immediately after compaction. Drive the probe to a depth of 2 inches above bottom of the lift for each reading. Calibrate the gauge against oven-dry samples of the mix design used. Verify the calibration to oven dry materials at least once per five shifts. Perform at least three tests in different areas of each layer of soil cement placed. Continuously monitor the apparent effectiveness of compaction equipment from a visual standpoint, and notify the mixing plant whenever the soil cement mix becomes too dry or too wet.

(2) Action Required: When moisture content tests indicate a significant change from what has been established as the optimum mixing and placing moisture, notify the placing foreman who will check the behavior of the mix under conditions at that time. When the placing foreman observes a condition of moisture that begins to consistently allow the vibratory rollers to sink excessively in the mix, cause excessive paste to develop at the surface, or leave an open, unconsolidated appearing surface, make an adjustment to the mix water added at the plant and record the adjustment.

M. Cement and Pozzolan

Visually monitor the cement and Pozzolan feed to the soil cement mix on a continuous basis throughout the operation of the soil cement mixing plant. In addition, directly measure and record the cement and Pozzolan contents of the soil cement, at 30-minute intervals and each time the silos are filled. Use a belt scale to measure the soil cement produced between mixing and loading. A load cell placed under the silos or volumetric measurement of the cement and Pozzolan used since the last silo filling will be acceptable methods of measuring the cement and Pozzolan usage. Report the cement and Pozzolan contents to the Engineer each time measurements are taken.

N. Soil Cement Specimens for Compression Tests

Forms for cylinders will be rigid reusable type with disposable liners. The Contractor shall prepare eight cylinders for testing per ASTM C39 for high strength soil cement and ASTM C42 for low

strength soil cement when requested by the Engineer (twice per shift). The Contractor will make, transport, cure, and test all samples (per ASTM C1435 and ASTM D558).

O. Density

(1) Nuclear gauge must be recently calibrated or during the trial placement, construct a soil cement block for nuclear gauge calibration. Make the block with a newly fabricated 30-inch diameter steel mold. Weigh the mold before, and after, filling with soil cement. Compute the density of the soil cement block and use this computed density to calibrate/check the nuclear density gauges.

(2) Tests and Checking: At least once every hour during placement, determine the density of the soil cement after compaction with a calibrated nuclear density gauge. Have at least one gauge on the placement area at all times. Test each layer of soil cement with the nuclear gauge every hour or 250 cubic yards, whichever is less, in at least 3 separate locations for wet density. Use the direct transmission mode. The Engineer may perform supplemental density testing with his own gauges.

(3) Action Required: When the nuclear gauge indicates a wet density less than required, perform a retest. If the retest indicates incomplete compaction, immediately provide additional rolling provided the time limits in ***Subsection 310.03.06B, "Time Requirements"*** are met, and determine whether the lower density resulted from insufficient passes of the roller, a change in the mix properties, or segregation at the bottom of the lift. If the mix properties have changed, suspend placement until the problem is corrected. If the problem persists and if the lower density is the result of inadequate rolling, notify the soil cement foreman. The Engineer may require full depth removal of the inadequately compacted material.

P. Compaction Equipment

(1) Tests and Checking: Before any compactor is used in soil cement construction, check it for correct dimensions, weight, vibratory frequency and amplitude; and cleanliness. At least once per 12 shifts of use, retest the frequency.

(2) Action Required: Remove compaction equipment not meeting the physical dimensions and weights required from the project. Correct any roller having improper frequency for soil cement compaction. Immediately notify roller operators running at speeds in excess of specification requirements or using improper compaction practices. Correct the problem or, if necessary, replace the operator.

Q. Dumping and Spreading

(1) Tests and Checking: Continually observe and monitor dumping and spreading operations to ensure that they are done in a manner that minimizes segregation. Routinely check each layer of soil cement in its spread condition for evenness and thickness, so that level, well-compacted layers within the specified thickness tolerance result after compaction. Determine the levelness, thickness, and elevation of each layer.

(2) Action Required: When thickness checks on uncompacted soil cement indicate an excess or shortage of material, immediately blade off or supplement the layer as needed. Whenever the thickness or elevation exceeds the allowable tolerances, notify the Engineer and he will determine what corrective action, if any, is necessary.

R. Preparation for Soil Cement Placement

Where applicable, inspect foundations, construction joints, forms, and embedded items in sufficient time prior to soil cement placement to assure that the area is ready to receive concrete. Check forms and facing panels for condition, support, alignment, and dimensions. The placing foreman will be the first level of supervision for all placing operations. The soil cement Quality Control Supervisor will determine if the specified mix is placed in the proper location, measure and record concrete temperatures, ambient temperatures, weather conditions, time of placement, yardage placed, and method of placement. Do not permit soil cement placement to begin until an adequate number of vibratory rollers and spreading equipment of the appropriate size, in working order, and with competent operators are available.

S. Curing and Surface Protection

(1) Continuous Moist Curing: At least every 2 hours, 7 days per week, inspect all areas subject to moist curing and lift surface protection. Record the surface moisture condition at that time. If any area has been allowed to dry, it will be considered as improperly cured.

(2) Action Required: Clean any area that has been allowed to dry more than 4 hours with a high-pressure water jet (3000 psi). Allow the surface to dry to a saturated surface dry condition and spread bedding mix prior to placing soil cement. If any area was allowed to dry less than 4 hours, clean it using a low-pressure water jet (500 psi) and prepare the surface as described above. The Engineer may require the Contractor to remove improperly cured soil cement.

(3) Protection: At least every 8 hours around the clock, 7 days per week, inspect all areas subject to cold-weather protection or protection against damage. Record any deficiencies. During removal of cold weather protection, measure concrete and ambient temperature at least every 2 hours. Record and provide temperature measurements to the Engineer on a daily basis.

T. Soil Cement Coring

The Contractor shall obtain 4-inch diameter cores at the locations directed by the Engineer. Obtain cores for the full depth of the soil cement placement and a minimum of 1-foot into the foundation rock (if placed on a rock foundation). Exercise special care to obtain cores in good condition from all holes. Place each core run in core boxes in the correct sequence. Separate the core runs with wooden blocks marked according to the measured depth at the end of each core run. If core loss occurs, place blocks with a similar diameter and a length equal to the core loss in the core box at the location of the core loss. Label the blocks with the amount of the core loss. If the loss area is not known, show the amount of loss on a wooden block with the letters D.O.R., "Distributed Over Run," marked on it and place the block just ahead of the "End of Run" block. Do not place cores from more than one hole in any box. Using a waterproof marker, label the inside of the lid and all four sides of the outside of the box with the hole number, box number, and depth

interval. Fasten the covers securely to the core box and deliver the box to the on-site core storage area. All testing of cores will be at the expense of the Contractor.

U. Thickness Testing

The engineer may request a thickness test text at any time to verity the placed thickness of soil cement. If a section of placed soil cement fails to meet the required thickness, additional tests will be done to determine the area that fails to meet these specifications. Areas that do not meet the required thickness as determined by the Engineer shall be subject to replacement:

V. Acceptance of Soil Cement – Acceptance and penalties for placed concrete shall be determined by the results of the 28 day compressive strength. Soil cement represented by the compressive strength tests which do not meet the minimum strength specified, will be subject to replacement. All soil cement represented by compressive strength test which do not provide at least 75 percent of the specified strength shall be removed and replaced unless allowed to remain in place by the Engineer.

The Contractor, at his own expense, can submit evidence that will indicate to the Engineer that the strength and quality of the soil cement is such that the concrete should be considered acceptable. The owner can perform its own individual testing to verify contractor testing.

If such evidence consists of concrete cores, the Contractor shall obtain three cores from the concrete represented by the failing strength test and deliver them to the Engineer in time to allow complete testing of such cores within 42 days after the placement of the concrete. All cores shall be obtained and tested in accordance with the requirements of AASHTO T-24. The concrete represented by the cores will be considered acceptable if the numerical average of three tests is 75 percent of the required 28-day compressive strength. If the average compressive strength does not meet this requirement, all concrete so represented shall be removed and replaced unless permitted to remain in place by the Engineer.

END OF SECTION 310

SECTION 409 – PORTLAND CEMENT CONCRETE PAVEMENT

DESCRIPTION

409.01.01 GENERAL

A. This work shall consist of a pavement composed of Portland cement concrete, with or without reinforcement as specified, constructed on a prepared subgrade or base course in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer.

B. At the option of the Contractor, concrete pavement may be constructed with equipment utilizing stationary side forms or by the use of slip-form paving equipment.

MATERIALS

409.02.01 MATERIALS

A. Materials shall conform to the requirements of the following sections and subsections:

Materials	Section/Subsection
Fine Aggregate	***706.03.03***
Coarse Aggregate	***706.03.01***
Hydraulic Cement	***701***
Water	***722***
Air-Entraining Admixtures	***702.03.02***
Joint Filler	***707.03.04***
Curing Materials	***702.03.01***
Reinforcement	***713***

B. An inadequate water supply shall be considered sufficient cause for delaying or stopping mixing operations. In case of a deficiency of water, the requirements for subgrade and curing concrete previously placed shall have priority over mixing.

409.02.02 GRADATION REQUIREMENTS

A. Gradation shall comply with ***Subsection 501.02.02, "Gradation Requirements."***

409.02.03 CONCRETE PROPERTIES AND TESTS

A. Portland cement concrete pavement shall be subject to the following requirements and test methods:

Test	Test Designation	Requirements
Flexural Strength of Concrete	ASTM C293	Minimum Modulus of Rupture: 450 psi

CONSTRUCTION

409.03.01 CLASSIFICATION AND PROPORTIONS

A. The Contractor shall notify the Engineer not less than 32 calendar days in advance of use of the proposed sources of materials and shall make arrangements for the Engineer to obtain samples as required for testing purposes.

1. When requested by the Contractor and allowed in writing by the Engineer, samples will not be required from aggregate sources previously tested within the past year.
2. Samples shall not exceed 500 pounds for each separate grading.
3. The Contractor shall furnish a written statement giving the cement factor in sacks per cubic yard; the proportions of cement, water, and each size of aggregate in saturated surface dry (SSD) condition; and the percentage of air in the concrete proposed for use in the work.
4. If the Contractor proposes to use an admixture other than an air-entraining agent, the Contractor shall state admixture's complete brand name and the quantity proposed to be used per sack of cement.
5. The Engineer, after making such tests as the Engineer deems advisable, will either accept the proposed materials and proportions or suggest modifications needed for acceptance.
6. After acceptance by the Engineer of batch proportions and materials, batch proportions and materials shall not be altered during the course of the work except as found necessary to maintain yield, cement factor, and unit weight within specification requirements.

B. Portland cement concrete shall be proportioned using the aggregates tested such that the requirements in Table 1 of this subsection will be satisfied without falling below the minimum or exceeding the maximum values given.

1. The cement factor of any individual batch placed in the work shall not be more than 0.15 sack per cubic yard less, nor more than 0.25 sack per cubic yard greater than the designated factor (sacks of cement per cubic yard).
2. Aggregates shall be batched and reported to the Engineer.
3. The weights used may be varied as necessary to comply with the above tolerances in cement factor and unit weight.
4. Coarse and fine aggregate in each batch of concrete shall be combined in proportions that will produce a mixture within the grading limits for combined aggregates specified as follows:

GRADING LIMITS OF COMBINED AGGREGATES

Sieve Sizes	Percentage Passing
2-inch	100
1-1/2-inch	90-100
1-inch	50-86
3/4-inch	45-75
3/8-inch	38-55
No. 4	30-45
No. 8	23-38
No. 16	15-33
No. 30	8-22
No. 50	4-13
No. 100	1-5
No. 200	0-3

TABLE 1 - CONCRETE PROPORTIONS

Class of Concrete	Sacks of Cement Per Cubic Yard		Coarse Aggregate Size No.	Maximum Water Gallons Per Sack Cement*	Slump Range Inches	Air Range %	Unit Weight Variation Pounds
	Min.	Max.					
P.C.A.	5.5	7	467	5.5	0-3**	4±1	±3
P.C.A.A.	6	7.5	467	5.5	0-3**	5±1	±3

*Based on aggregate in a saturated surface dry condition (SSD).

**The nominal slump in inches shall be 3 inches, the maximum slump shall be 3-1/2 inches. When the slump of concrete is found to exceed the nominal slump, the mixture shall be adjusted as directed by the Engineer to reduce slump to a value within the specified range. Four slump tests will be considered sufficient to determine nominal slump. The difference in slump, determined by comparing slump tests on 2 samples of mixed concrete for each individual batch tested, shall not exceed 1 inch. When the difference in slump does exceed 1 inch, procedure and equipment used in producing the concrete shall be adjusted to reduce the difference in slump to not more than 1 inch.

409.03.02 EQUIPMENT

A. **General:**

1. Equipment and tools necessary for handling materials and performing all parts of the work shall meet the approval of the Engineer as to design, capacity, and mechanical condition.
    a. This equipment shall be on the site and available for inspection, testing, and approval before paving operations are started.
    b. All equipment, tools, and machinery shall be maintained in a satisfactory working condition.
2. The Contractor shall provide equipment of such capacity that the paver will operate continuously or at a constant rate of production insofar as feasible. In the event that any piece of equipment does not have sufficient capacity to keep pace with the other operations, the Engineer may limit the size of the batch or otherwise limit the rate of production to prevent poor workmanship, overloading of equipment, or frequent delays.
3. Any equipment operating entirely or partially on the pavement, regardless of the age of the pavement, shall be equipped so that only rubber-tired wheels will come in contact with the pavement.
4. Aggregates and cement shall be proportioned by weight, except that when the amount of concrete required for any 1 contract is 10 cubic yards or less, the materials may be measured by volume. Materials that are proportioned by volume shall be measured in containers of known capacity.
5. Proportioning shall consist of combining the aggregates, each stored in a separate bin in the various gradations prescribed in ***Subsection 706.03.01, "Coarse Aggregate,"*** with cement and water.
    a. Weigh hoppers shall be charged from bins located directly over the hoppers or from conveyor belts.
    b. When conveyor belts are used, there shall be a separate belt for each size aggregate.
    c. There shall be an approved moisture meter installed to indicate the moisture in the sand.
6. Bulk cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge. The cement hopper shall be attached to a separate scale for individual weighing.
7. The amount of water to be added to the mixture shall be measured and discharged rapidly into the mixing drum through a valve with a positive cut-off. When water is measured by weight, the water shall be weighed on a separate scale.
8. All weighing or metering devices, except moisture meters used for proportioning materials, shall be accurate to within 1 percent.
    a. The devices shall be sealed and certified by the Nevada State Department of Weights and Measures.

b. These certifications shall be dated within the past 12 months and shall be renewed whenever required by the Engineer.

c. The moisture meter shall be accurate to within 1/2 of 1 percent.

d. Whenever portable bunkers are set up at a new location, the scale assemblies shall be inspected and certified regardless of the date the scales were last tested.

9. Scales used in proportioning shall be either springless dial or multiple beam type.

   a. Scale gradations shall be no greater than the following:

      1) Aggregate Scales: 25 pounds

      2) Cement Scales: 5 pounds

      3) Water Scales: 5 pounds

   b. All scales shall be of such size and so arranged that the scales may be read easily from the operator's platform.

   c. If a multiple beam type scale is used, the scale shall be provided with an indicator operated by the main beam that will give positive visible evidence of over or under weight.

   d. The indicator shall be designed to operate during the addition of the last 400 pounds of any weighing.

   e. The over travel of the indicator hand shall be at least 1/3 of the loading travel.

   f. Indicators shall be enclosed against moisture and dust.

10. Weighing equipment shall be insulated against vibration and movement of other operating equipment in the plant. When the entire plant is running, the scale reading at cut-off shall not vary from the weight designated by the Engineer by more than 1 percent for cement, 1 percent for water, 1-1/2 percent for any size of aggregate, or 1 percent for the total aggregate in any batch.

11. Machine mixing will be required in all cases other than those in which the mixing would obviously prove to be impractical, in which event hand mixing will be permitted. Mixing shall be commenced as soon as possible after the cement is placed in contact with the aggregates, but in no event shall the intervening period exceed 30 minutes.

12. All concrete mixers shall be of such design and construction and so operated as to provide a thoroughly and properly mixed concrete in which the ingredients are uniformly distributed.

    a. Mixers shall be maintained in proper and serviceable working condition and any part or portion thereof that is out of order, or becomes worn to such extent as to detrimentally affect the quality of mixing, shall be promptly repaired or replaced.

    b. Mixers shall not have any aluminum parts which will have direct contact with concrete.

B. **Concrete Consistency:**

1. The amount of water added at the mixer shall be regulated to take into account the free water in the aggregates. Free water is defined as the total water minus the water absorbed by the aggregate in a saturated surface dry condition.

2. The amount of water used in the mixture shall not exceed the minimum amount necessary to permit practical placement and consolidation of the concrete, and unless otherwise authorized by the Engineer, shall be that required to produce concrete with a slump within the range shown as nominal in the following table:

Type of Work	Nominal Slump Inches	Maximum Slump Inches
Concrete Pavement	0-3	3.5

3. The concrete used in the work shall not have a slump greater than that shown as maximum above, nor a free water content greater than 312 pounds per cubic yard of concrete.

4. The consistency of concrete shall be determined in accordance with ASTM C143.

5. If slump tests of individual samples taken at approximately the 1/4 and 3/4 points of the discharge differ by more than 2 inches, the mixer will not be acceptable for further use until the condition is corrected.

C. **Paving and Stationary Mixers:**

1. Paving and stationary mixers shall be equipped with an accurate automatic timing device so designed and constructed as to lock the discharge lever before aggregate and cement enter the drum, and release the lever only after the specified mixing time has elapsed. The regulation of the setting of the device shall be under the supervision of the Engineer. Water control equipment shall also be provided with each concrete mixer.

2. The proper proportions of aggregate, cement, and water for each batch of concrete shall be placed in the mixer, and shall be mixed for a period of not less than 1 minute after all materials are in the drum. The minimum mixing time, however, shall not be less than 1-1/2 minutes.

3. The rotating speed at which the mixer shall be operated shall conform to that recommended by the manufacturer.

4. The total volume of materials mixed in any 1 batch shall exceed neither the water level capacity of the mixer nor the manufacturer's guaranteed capacity of the mixer.

D. **Transit Mixers:**

1. The type, capacity, and manner of operation of the mixing and transporting equipment for ready-mix concrete shall conform to the current "Standards for Operation of Truck Mixers and Agitators of the National Ready-Mixed Concrete Association" and the "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau."

   a. Transit mix concrete trucks shall be equipped with an automatic device for recording the number of revolutions of the drum during the mixing period.

b. Each mixer and agitator shall have attached thereto, in a prominent place, a metal plate or plates installed by the manufacturer on which is plainly marked the capacity of the drum in terms of the volume of mixed concrete and the speed of rotation for the agitating and mixing speeds of the mixing drum or blades.

2. Each mixer shall have an identification number painted in a location on the truck that can be easily read from the batching platform.

3. The total volume of materials introduced into the mixer shall not exceed the manufacturer's guaranteed mixing capacity.

   a. If the concrete so mixed does not meet the uniformity requirements of this subsection, the amount of materials charged into the mixer shall be reduced.

   b. The drum of the mixer shall be completely emptied of previously mixed load.

   c. The proper proportions of aggregate, cement, and water for each load of concrete shall be placed in the mixer and shall be mixed therein for not less than 70 nor more than 100 revolutions of the drum or blades at the speed designated by the manufacturer of the equipment as mixing speed.

   d. Additional revolutions of the drum shall be at the speed designated by the manufacturer of the equipment as agitating speed.

   e. The revolving of the drum shall be continuous until the concrete is completely emptied from the drum.

4. When concrete is being placed for pavement structures, all wash water shall be emptied from the mixer before any portion of the succeeding load is placed therein. For all other work, the mixer shall be empty or may carry 10 gallons of water in the drum.

   a. Adequate control of ready-mixed concrete will normally require that additional water be added and mixed into the batch at the point of discharge.

   b. Water so added shall be mixed into the load for a minimum mixing time of 3 minutes.

   c. Water shall not be added to the load during transit.

   d. The total elapsed time between the addition of water at the batch plant and discharging the completed mix shall not exceed 60 minutes. Under conditions contributing to quick setting, the total elapsed time permitted may be reduced by the Engineer.

5. The Engineer shall be provided with a legible certified weighmaster's certificate at the job site for each load which shall contain the following information:

   a. Name of Vendor

   b. Name of Contractor

   c. Number of Cubic Yards in the Load

   d. Actual Weights of Cement and of Each Size of Aggregate

   e. Amount of Water Added at the Plant

   f. Amount of Water in the Aggregate

   g. Brand and Type of Cement

h. Brand and Amount of Admixture

i. Time and Date of Batching

6. When mix proportions have been designated for a project and are identified by number, the Engineer may waive the foregoing and accept a legible certified weighmaster's certificate which shall contain the following information:

a. Name of Vendor

b. Name of Contractor

c. Number of Cubic Yards in the Load

d. Mix Designation Number

e. Amount of Water Added at the Plant (including Water in Aggregate)

f. Time and Date of Batching

7. Space shall be provided on the certificate so that amount of water added on the job may be indicated.

E. **Forms and Headers:**

1. Forms and headers shall be either wood or metal, and shall be:

a. Set plumb and true to line and grade, with the upper edge thereof set to the grade of the pavement to be constructed.

b. Rigidly installed on a true alignment and so maintained for a distance in advance of placing the pavement to provide for at least a 1-day run of concrete.

2. Headers shall rest firmly on the subgrade or base. They shall be oiled immediately prior to the placing of the concrete and shall remain in place at least 12 hours after concrete has been placed.

3. Forms and headers shall be removed before the work will be accepted.

F. **Wooden Forms:**

1. Wooden forms shall be constructed of 3-inch nominal lumber in pieces not less than 16 feet long except where changes in alignment or grade necessitate the use of material of smaller dimensions. The lumber used shall:

a. Be free from warp and other imperfections that would impair the strength for the use intended.

b. Have square edges (which may be slightly beveled) and square ends.

c. Be surfaced on the upper edge.

d. Not be more than 1/2 inch less in depth than the specified thickness of the edge of the pavement.

2. Wooden forms shall be secured by nailing to side stakes spaced not more than 4 feet apart, driven into the subgrade vertically to a depth not less than 12 inches, and so that the tops will be below the upper edge of the header. The stakes shall be sufficient length and cross-sectional area to adequately resist lateral displacement of the headers during the paving operations.

3. Wooden headers shall be spliced by nailing a board to the outside of the headers. The board shall be at least 4 feet long, 1 inch thick, and at least 6 inches wide (or the depth of the header, whichever is less), and shall be centered on the joint.

G. **Metal Forms:**

1. Metal forms shall be free from warp, have sufficient rigidity to resist springing during the paving operations, and shall be not less in depth than the specified thickness of the edge of the pavement being constructed.

2. The forms shall be secured with metal stakes spaced not more than 5 feet apart and driven below the top of the forms.

3. The stakes shall be designed so as to be driven through openings in the forms to lock the forms in position.

H. **Slip Form Construction:**

1. At the option of the Contractor, and with the approval of the Engineer, concrete pavement may be constructed by the use of slip form paving equipment.

2. Slip form paving equipment shall be provided with traveling side forms of sufficient dimensions, shape, and strength to support the concrete laterally for a sufficient length of time during placement to produce pavement of the required cross section, and the equipment shall spread, consolidate, screed, and float-finish the freshly placed concrete to provide a dense and homogenous pavement.

3. The concrete shall be distributed uniformly into final position by the slip form paver and the horizontal deviation in alignment of the edges shall not exceed 1-1/4 inches from the alignment established by the Engineer.

4. The concrete, for the full paving width, shall be effectively consolidated by internal vibration, with transverse vibrating units, or with a series of longitudinal vibrating units. Internal vibration shall mean vibration by means of vibrating units located within the specified thickness of pavement section and at a minimum distance ahead of the screed equal to the pavement thickness.

5. When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels, offset to run a sufficient distance from the edge of the pavement to avoid breaking or cracking the pavement edge.

6. After the concrete has been given a preliminary finish by finishing devices incorporated in the slip form paving equipment, the surface of the fresh concrete shall be checked by the Contractor with a straightedge to the tolerance and finish required in ***Subsection 409.03.08, "Spreading, Compacting, and Shaping."***

7. The subgrade shall be moist at the time of placing concrete.

   a. The subgrade shall be thoroughly wet the night before or at least 6 hours prior to placing the concrete, and again sprinkled immediately before the concrete is placed on it.

   b. Sprinkling shall be such that mud and pools of water will not be formed.

   c. At the time of placing the concrete, the grade shall not be muddy, soft, or frozen.

409.03.05 REINFORCEMENT

A. Concrete pavement shall be reinforced at structure approaches and other locations as shown on the plans or directed by the Engineer, and as specified in this section.

B. Bar reinforcement shall conform to the provisions in ***Section 505, "Reinforcing Steel."***

C. Bar reinforcement shall be held accurately and firmly in position during the placing and compacting of the concrete without sagging by means of supporting devices which shall be left in place.

D. The supports shall be specially manufactured for the purpose and each support shall be capable of supporting a vertical load of 200 pounds.

409.03.07 PLACING CONCRETE

A. The Contractor shall make adequate advance arrangements for preventing delay in delivery and placing of the concrete.

1. An interval of more than 45 minutes between placing of any 2 consecutive batches or loads shall constitute cause for stopping paving operations.

2. The Contractor shall make a contact joint, at no additional cost to the Contracting Agency, at the location and of the type directed by the Engineer, in the concrete already placed.

B. Unless otherwise specified, concrete pavement shall be placed in 12-foot traffic lane widths separated by contact joints as shown on the plans, or, at the option of the Contractor, the concrete pavement may be placed monolithically 2 or more lanes wide without a contact joint, but with a longitudinal weakened plane joint at each traffic lane line.

C. All concrete shall be used while fresh. The use of water for retempering any concrete will not be permitted.

D. Any concrete showing improper proportions of materials, including water, shall not be used in the pavement and any such unsatisfactory concrete shall be removed and disposed of by the Contractor at no additional cost to the Contracting Agency.

E. The Contractor shall protect freshly placed concrete from damage by any cause and any damage shall be repaired by the Contractor at no additional cost to the Contracting Agency.

F. Expansion joint material shall be protected while depositing fresh concrete adjacent thereto.

G. Concrete work shall be adequately barricaded in all directions to protect the work.

409.03.08 SPREADING, COMPACTING, AND SHAPING

A. The concrete shall be consolidated and the surface finished true to grade and cross section.

1. Upon completion, the surface shall be free of any unevenness greater than 1/8 inch when checked with a 10-foot straightedge placed on the surface of the pavement.

2. The 10-foot straightedge shall be furnished by the Contractor and shall be at the site of the work prior to commencing concrete placement.

B. **Tamping:**

1. The concrete shall be distributed uniformly between the side forms as soon as the concrete is placed, after which the concrete shall be struck off and tamped with a mechanical tamper.

2. The tamper shall be operated at right angles to the centerline of the pavement, and tamping continued until the concrete is thoroughly consolidated to the specified cross section and sufficient mortar for finishing purposes has been brought to the surface.

3. Steel-shod hand tampers or vibrating bars may be substituted in those cases where the use of mechanical spreader and tamper would be obviously impracticable.

4. Approved concrete vibrating equipment shall be used in conjunction with the mechanical tamper to consolidate the concrete adjacent to the forms or existing pavement.

C. **Floating:**

1. After tamping, the surface of the concrete shall be floated by either the finishing machine method or the transverse float method described below.

2. Bridge decks may be floated by the longitudinal float method.

3. **Finishing Machine Method:** The concrete shall be floated smooth and true to grade with an approved finishing machine.

4. **Transverse Float Method:**

   a. The concrete shall be floated at least twice with a long-handled float at least 5 feet wide, after which the surface of the concrete shall be finished smooth and true to grade with a wooden float 16 feet long, 2 inches thick, and 6 inches wide.

   b. The float shall be rigidly ribbed and with adjustable screws between the rib and float board to ensure a true and flat surface on the underside at all times.

   c. The float shall be operated from the side of the pavement, and parallel with the centerline.

   d. The edge of the float shall be used to cut down all high areas, and the material so removed shall be floated into the depressions until a true surface is obtained.

   e. Each successive pass of the float shall halflap the previous pass.

   f. The float shall be operated as far behind the tamping machine as the workability of the concrete will permit before its initial set.

5. **Longitudinal Float Method:**

   a. The concrete shall first be floated with a double-handled longitudinal float not less than 16 feet nor more than 20 feet in length, having a trowelling surface not less than 8 inches nor more than 10 inches wide.

   b. The float shall be operated from bridges over the pavement with its length parallel to the centerline of the improvement, and shall be worked back and forth transversely across the slab, planing off high spots and filling depressions.

c. Floating shall continue until the surface is reasonably smooth, after which the bridges may be advanced not to exceed 2/3 the length of the surface so floated, and the operation continued.

D. After being finished by one of the above methods, the outside edges of pavement shall be rounded to a 1/2-inch radius; and transverse contact joints, expansion joints, and joints adjacent to an existing pavement shall be rounded to a 1/4-inch radius.

E. A strip of wetted burlap shall be provided, of a length not less than the width of the pavement slab.

1. The burlap shall be attached by 1 edge to a rigid frame supported over the pavement so that the free edge of the burlap will rest or drag on the surface of the concrete.

2. The burlap shall be dragged back and forth longitudinally along the pavement until the surface of the slab is of uniform texture appearance throughout its entire length.

409.03.09 JOINTS

A. Joints in concrete pavement will be designated as longitudinal and transverse contact joints, transverse expansion joints, and longitudinal and transverse weakened plane joints. Unless otherwise specified:

1. Transverse joints shall be constructed perpendicular to the centerline of the pavement.

2. Longitudinal joints shall be constructed parallel to the centerline of the pavement.

3. The faces of all joints shall be perpendicular to the finished surface of the pavement.

B. Joint filler, when required, will be as designated on the plans or in the Special Provisions.

C. **Contact Joints:**

1. Contact joints are those made by placing fresh concrete against hardened concrete at planned locations. Contact joints shall be constructed at the locations and in the manner shown on the plans.

2. Longitudinal contact joints shall be constructed by one of the following methods: A plain face, the use of tie bars, or the construction of keyways. Tie bars or keyways will be as designated on the plans or in the Special Provisions.

D. **Transverse Expansion Joints:**

1. Transverse expansion joints shall be installed at locations shown on the plans.

2. Expansion joint filler material shall have a minimum thickness of 1/2 inch, a maximum thickness of 3/4 inch, and a depth equal to the thickness of the pavement, and shall be composed of materials as specified in the Special Provisions or approved by the Engineer.

3. After the concrete has been finished, an edger of 1/4-inch radius shall be used on each side of the expansion joint filler. The expansion joint filler shall be cleaned of all concrete mortar.

E. **Weakened Plane Joints:**

1. Weakened plane joints shall be constructed at the locations shown on the plans and shall be formed by cutting a groove in the pavement with a power driven saw.

a. The groove for a transverse joint shall be cut to a minimum depth of 1-1/2 inches or 1/6 of the pavement thickness, whichever is greater; the groove for a longitudinal joint shall be cut to a depth of 1/4 of the pavement thickness; and the width shall be a minimum width possible with the saw being used, but in no case shall the width exceed 1/4 inch.

b. Any portion of the sealing compound which has been disturbed by sawing operations shall be restored by spraying the areas with additional sealing compound.

c. In the initial lane of concrete, the first transverse weakened plane joint immediately following a transverse contact joint, and every fourth weakened plane joint thereafter, shall be sawed within 10 to 24 hours after the concrete has been placed.

d. The time lapse will be subject to the approval of the Engineer.

e. Every second transverse weakened plane joint shall be sawed within 24 hours after the concrete is placed, and the remaining weakened plane joints may be sawed at such time as the Contractor may elect; except that in any lane, all weakened plane joints shall be sawed before concrete is placed in succeeding adjacent lanes and before any traffic whatsoever is permitted to use the pavement.

2. In succeeding adjacent lanes of concrete pavement, transverse weakened plane joints opposite those which have been sawed in the initial lane shall be sawed within 10 to 24 hours after the concrete has been placed.

a. The time lapse will be subject to the approval of the Engineer.

b. In all cases, no more than three consecutive transverse weakened plane joints shall be bypassed.

3. At the option of the Contractor, longitudinal weakened plane joints may be used at traffic lane lines in multi-lane monolithic concrete pavement in lieu of longitudinal contact joints. Dowel requirements will be as designated on the plans or in the Special Provisions.

409.03.10 CURING

A. **General:**

1. All Portland cement concrete pavement shall be cured for 72 hours by the methods specified in this section, subject to the conditions set forth in ***Subsection 501.03.09.A.1, "General."***

2. In case of low temperatures, the curing period will be increased according to the provisions of ***Subsection 501.03.10.B, "Cold Weather - General."***

B. **Curing Compound Method:**

1. Curing by use of curing compound shall be as specified in ***Subsection 501.03.09.A.3, "Curing Compound Method."*** The curing compound shall not be applied until all patching and surface finishing, except grinding, have been completed.

2. When deemed necessary by the Engineer during periods of hot weather, fogging of the concrete with water shall be continued after curing compound is applied or until the Engineer determines that a cooling effect is no longer required.

C. **Waterproof Membrane Method:** Curing by use of waterproof membrane material shall be as specified in ***Subsection 501.03.09.A.4, "Waterproof Membrane."***

409.03.11 PROTECTION OF PAVEMENT

A. Concrete shall not be placed on frozen ground nor shall concrete be mixed or placed while the atmospheric temperature is below 35 degrees F unless adequate means are employed to heat the aggregates and water, and provision satisfactory to the Engineer has been made for protecting the work.

B. Placing the concrete shall be stopped before rainfall is sufficient to cause a flow or wash the surface.

C. Upon written notice from the Engineer, all concrete which has been damaged shall be replaced by the Contractor at no additional cost to the Contracting Agency.

D. All concrete in pavement shall be protected from freezing or frost for a period of 5 days after placing. The temperature of the surface of the concrete shall not be allowed to drop below 40 degrees F for this period of 5 days.

E. When ordered by the Engineer or shown in the contract documents, pavement crossings shall be constructed for the convenience of public traffic.

1. The material and work necessary for the construction of these ramps, and subsequent removal and disposal of the ramps, will be paid for at the contract unit prices for the items of work involved.

2. BLANK

3. Where public traffic will be required to cross over the new pavement, Type III Portland cement shall be used in concrete.

4. When Type III Portland cement is used in concrete, and if permitted in writing by the Engineer, the pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 450 psi.

F. No traffic or Contractor's equipment, except for subgrading equipment, will be permitted on the pavement before a period of 10 calendar days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 450 psi, as determined by Test Method ASTM C293. Concrete that fails to attain a modulus of rupture of 450 psi within 10 days shall not be opened to traffic until directed by the Engineer.

G. Equipment used to prepare subgrade may be permitted to ride upon one edge of the previously placed concrete at the end of 72 hours, provided, however, that no damage is done to the pavement edge by reason of such operation. Any damage to the pavement resulting from such operations shall be repaired by the Contractor at no additional cost to the Contracting Agency prior to placing the adjacent lane.

END OF SECTION 409

SECTION 501 – PORTLAND CEMENT CONCRETE

DESCRIPTION

501.01.01 GENERAL

A. This work shall consist of Portland cement, fine aggregate, coarse aggregate, water and when specified, an air entraining admixture, proportioned, mixed, placed, and cured as herein specified. All concrete shall meet the most current requirements of American Concrete Institute (ACI) with the following additions and/or exceptions indicated in this specification.

B. As used in this section, the term Portland Cement shall be considered synonymous with the term Hydraulic Cement.

C. The use of mobile mix concrete as specified herein shall require prior written approval by the Contracting Agency. All cement used on the work shall be standard brand Portland cement conforming to the "Specifications for Portland Cement" (ASTM C150), Type V, in accordance with requirements contained in Section 701.

501.01.02 QUALITY CONTROL TESTING AND INSPECTION

A. The testing and inspection of Portland cement concrete shall comply with this specification. The inspection of the mixing plant shall comply with the ACI 311, Chapter 2. In Clark County unincorporated areas and if required by other Contracting Agencies, all field and laboratory sampling and testing for project control shall be performed by NAQTC or ACI certified technicians in an AASHTO Materials Reference Laboratory (AMRL) and Cement and Concrete Reference Laboratory (CCRL), or Construction Materials Engineering Council (CMEC) R-18 AASHTO accredited laboratory. The accreditation shall extend to the test method used on the particular project. The accreditation shall include ASTM C1077. The concrete designs shall comply with Tables 1 and 2 and the IQAC website http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx or comply with Contracting Agency requirements.

B. Testing reports shall be promptly distributed to the owner, licensed design professional responsible for the design, Contractor, appropriate subcontractors, appropriate suppliers, and building official to allow timely identification of either compliance or the need for corrective action.

C. For non-structural mobile mix concrete, the testing shall be a minimum of one set per week. The testing type and frequency shall conform to the tables on the IQAC website.

MATERIALS

501.02.01 GENERAL

A. Materials shall meet the requirements of the following sections and subsections:

Materials	Section
Aggregate for Portland Cement Products	***706***
Concrete Curing Materials and Admixtures	***702***
Hydraulic Cement	***701***
Water	***722***

501.02.02 GRADATION REQUIREMENTS

A. Refer to ACI 304R Chapters 2.1 and 2.2, and comply with the gradation requirements specified in ***Section 706, "Aggregates for Portland Cement Products,"*** and the following:

1. The gradation requirements represent the extreme limits in determining the suitability of material. The gradation from any one source shall maintain a uniformity such that variations in the fineness modulus will not exceed 0.2 from the "Base Fineness Modulus."

    a. The "Base Fineness Modulus" shall be the average of the most recent 10 fineness modulus values (or the average of all preceding values if less than 10 have been completed) from any one source.
    b. Fine aggregate from any one source having a variation in fineness modulus exceeding ±0.2 as prescribed above will be rejected, or at the discretion of the Engineer, may be accepted subject to approved changes.
    c. The fineness modulus of fine aggregate shall be determined by adding the cumulative percentages, by weight, of material retained on each of U.S. Standard sieves No. 4, No. 8, No. 16, No. 30, No. 50, and No. 100, and dividing by 100.

2. Fine aggregates from different sources of supply shall not be mixed or stored in the same stockpile and shall not be used alternately in the same class of construction or job mix without written permission. Such permission will be contingent on amending the job mix and batch masses as necessary to protect the quality of the concrete produced.

3. If the fine aggregate for a job mix is to be a composite material from 2 or more sources, material from respective sources shall be blended by methods that will maintain the degree of uniformity of gradation required by these specifications.

4. Adequate supplies of aggregate shall be produced and stockpiled sufficiently in advance of construction operations to permit sampling and testing before use.

5. Coarse aggregates which vary in gradation shall be placed in separate stockpiles or bins and recombined in approved proportions. Different sizes of aggregates shall be stored in stockpiles sufficiently removed from each other to prevent the materials from becoming intermixed.

6. If the Contractor changes the source of any size of aggregate, a new mix design shall be submitted to the Engineer for approval.

501.02.03 ADMIXTURES

A. Refer to ACI 212. Air-entraining admixtures and water reducers and retarders shall conform to the requirements of ***Subsection 702.03.02, "Air-Entraining Admixtures,"*** and ***Subsection 702.03.03, "Admixtures Other Than Air-Entraining."***

B. Admixtures that are not listed in the mix design shall not be used without written permission from the Engineer, except as otherwise provided in these specifications or in the Special Provisions.

C. Admixtures used in Class EA Concrete, Modified shall be an approved chemical admixture for concrete, meeting the requirements of ASTM C494. Use Type “A” admixture when the anticipated high temperature for the day is 80 degrees F or below. Type “D” admixture shall be used when the anticipated high temperature is above 80 degrees F. The water-cement ratio shall not be adjusted once the chemical admixture has been incorporated into the mix.

D. Admixtures shall not be used to replace cement. Admixtures containing chlorides as Cl- in excess of 1 percent by weight shall not be used in prestressed concrete. If admixtures are used to entrain air, to reduce the water-cement ratio, to retard or accelerate setting time, or to accelerate the development of strength, the admixtures shall be used at the dosage specified in the mix design, or in the contract documents, or as provided by the Engineer.

E. When the use of an air-entraining agent is specified, it shall be added in a quantity conforming to Table 2 in ***Subsection 501.03.04, "Classifications and Proportions."*** It shall be measured into each batch by equipment and methods approved by the Engineer. Adjustments shall be made in the weights of the aggregates used per batch to compensate for increased yield due to air-entrainment so that the quantities of cement per cubic yard of concrete remain constant. Such adjustments shall be made by decreasing the weight of fine aggregate without changing the weight of coarse aggregate unless otherwise approved by the Engineer.

F. When a High Range Water Reducing admixture is used, the initial slump is waived and the slump of the concrete after the admixture is added shall not exceed 8 inches.

G. Admixtures shall be measured accurately into each batch by methods approved by the Engineer.

H. Except as otherwise provided for air-entraining agents, samples of admixtures proposed for use shall be submitted by the Contractor to the Engineer in advance of intended use to permit tests to be made to determine compliance with claimed properties.

I. Any type of admixture shall be uniform throughout its use in the work. Should it be found that the admixture as furnished is not uniform, its use shall be discontinued.

J. Admixtures shall be dispensed in liquid form. Dispensers for admixtures shall have sufficient capacity to measure at one time the full quantity required for each batch. Unless admixtures are added to premeasured water for the batch, their discharge into the batch

shall be arranged to flow uniformly into the stream of water. Dosages of admixtures shall not vary from the dosage indicated in the mix design or as approved by the Engineer by more than 5 percent, with the exception of air entraining admixtures where the dosage is required to achieve the specified range. Equipment for measurement shall be designed for convenient confirmation of the accuracy of measurement. If more than one admixture is used, each shall be dispensed by separate equipment unless otherwise permitted in writing by the Engineer.

K. When water-reducing agents or water-reducing retarders are used, the permitted dosage of the admixture shall not exceed that which will result in an increase in the drying shrinkage of the concrete of 20 percent when used in precast, prestressed concrete; 10 percent when used in cast-in-place prestressed concrete; 10 percent when used in cast-in-place reinforced concrete; or 3 percent when used in non-reinforced concrete pavements.

L. Water reducers shall reduce the water demand of concrete for a given slump at least 7 percent when used at the maximum dosage recommended by the manufacturer. Set retarders shall not be used in greater dosages than those recommended by the manufacturer, nor more than that needed to obtain the desired retardation. The strength of the concrete containing the admixture in the amount approved by the Engineer shall at the age of 48 hours and longer, be not less than that of similar concrete without the admixture.

M. When the Contractor proposes to use an air-entraining admixture which has been previously approved, the Contractor shall submit a certification stating that the admixture is the same as that previously approved.

N. If an admixture offered for use is essentially the same (with only minor differences in concentration) as another previously approved material, a certification will be required stating that the product is essentially the same as the approved admixture and that no other admixture or chemical agent is present.

O. Before or during construction, the Engineer may require that the admixture selected be further tested to determine its effect upon the strength of the concrete. The 7-day compressive strength of concrete containing the admixture under test shall not be less than 88 percent of the strength of concrete made with the same materials, the same cement content, and consistency, but without the admixtures.

p. Subject to the following conditions, pozzolan conforming to ***Subsection 702.03.04, "Pozzolans (Fly Ash),"*** shall be used to a minimum of 20 percent and a maximum of 35 percent, by weight, of the required Portland cement in concrete, or as required by the Engineer.

1. The replacement of cement with pozzolan shall be at a rate of 1 pound of pozzolan for each pound of Portland cement.

2. Silica fume may be used to replace 3 percent to 7 percent, by weight, of the total cementitious material.

3. Store pozzolan in separate weather-tight facilities.

Q. The use of calcium chloride shall not be permitted.

501.02.04 CONCRETE MAKING PROPERTIES

A. The mix design procedure shall comply with the method indicated on the IQAC website (see ***Subsection 501.01.02, "Quality Control Testing and Inspection"***). The type of cement permitted, the minimum sacks of cement required, and the maximum water/cement ratio shall be as shown in Table 1.

Table 1 - Cements Permitted, Sack Requirements, and W/C Ratio

Type of Cement Permitted	Minimum Sacks of Cement Per Cubic Yard [3]	Maximum Water/Cement Ratio
Type II & Fly Ash	6.5 [2, 3]	0.45
Type MS & Fly Ash	6.5 [1, 2]	0.45
Type 1-P (MS)	6.5	0.45
Type V	6.5 [3]	0.45
Type HS	6.5 [2]	0.45
Type V & Fly Ash	6.0 [2, 3]	0.45
Type HS & Fly Ash	6.0 [1, 3]	0.45

B. The testing frequency shall comply with the Contracting Agency requirements or the special provisions.

C. Prior to mix design approval, the Contracting Agency reserves the right to verify the mix design test results, using the sources and proportions of materials as indicated by the mix design.

D. The mix design submittal shall include the information indicated in the concrete design report form on the IQAC website. For mobile mix trucks, the design shall include the model of the mixer with serial number. Each truck shall have a mix design.

501.02.05 ZERO SLUMP CONCRETE FOR THE MANUFACTURING OF PRECAST CONCRETE PRODUCTS

A. Concrete products manufactured by the zero slump method shall comply with ***Subsection 501.02.03, "Admixtures"*** and ***Subsection 501.02.04, "Concrete Making Properties."*** Zero slump concrete shall also exhibit design and performance requirements meeting IQAC and relevant ASTM specifications. Air entrainment is not required in a dry cast manufacturing process.

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[1] Maximum of 8 sacks.
[2] Sacks per cubic yard before replacement with fly ash.
[3] 5.0 sacks per cubic yard for precast products, pipe and box, with zero slump mix design.

B. For zero slump concrete, all other parts of this section do not apply.

501.02.06 LOW SLUMP CONCRETE FOR THE MANUFACTURING OF EXTRUDED SLIP FROM CONCRETE

A. Extruded slip form concrete shall comply with material requirements contained in Table 1, above, and with design and performance requirements meeting IQAC and relevant ACI specifications. The plastic properties may be adjusted on-site with an appropriate type admixture to ensure compliance with ***Subsection 501.03.04, "Classification and Proportions,"*** and to aid Contractor in placement and finishing of low slump slip form concrete.

501.02.07 SELF-CONSOLIDATING CONCRETE

A. The Contractor's use of self-consolidating concrete shall require the approval of the Engineer and shall be subject to the following requirements:

1. Substitutions. Class S concrete may be substituted for selected applications for classes A, D, Modified A, and Modified D; and Class SA concrete may be substituted for selected applications for classes AA, DA, PAA, Modified AA, and Modified DA, as approved by the Engineer.

2. Trial Placement.

   a. The Contractor shall submit details of a representative test section (mockup) for approval.
   b. Produce a trial batch of classes S and SA concrete, conforming to the proposed mix design.
   c. As part of the concrete placement demonstration, provide the labor, equipment, and materials to test the concrete. Evaluate the mixture for strength, air content, slump flow, visual stability index, J-ring value, and hardened visual stability index.
   d. Place a test section when the atmospheric conditions approximate the conditions anticipated for placing the final work. Finish and cure the mockup according to this section.
   e. If it is determined that the trial batch is not workable or not able to be properly placed or finished, modify the mix design or batching sequence. Submit the revised mix design and batching sequence to the Engineer, and place another test section. Repeat the submittal and trial pour process until a workable and finished trial batch is produced.
   f. Do not place any Class S and SA concrete until the Engineer accepts the mockup pour.
   g. A new mix design and a new trial pour will be required whenever there is a change in the source of any component material.
   h. Segregated concrete, as determined by NV Test Method SCC-2, shall not be incorporated into any component of the anticipated concrete work.
   i. When a truck mixer or agitator is used for transporting concrete, deliver the concrete to the site of the work and complete discharge within 60 minutes after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. In hot weather, or under conditions

contributing to quick stiffening of the concrete, a mixing and delivery time of less than 60 minutes may be required. A mixing and delivery time exceeding 60 minutes may be approved by the Engineer if a trial pour is performed with satisfactory results.

j. lace each successive batch within a maximum time interval of 20 minutes. Place the concrete in continuous layers. When it is necessary by reason of emergency or other delay, to place less than a complete horizontal layer in one operation, terminate each layer by using a vertical bulkhead. Do not rod or vibrate the concrete to attempt restoring the fluidity to the mix. Plan and regulate the delivery of concrete so that minor interruptions due to form repair, material testing, etc. will not impact the required 20-minute time interval between successive placements.

3. Concrete Slump Requirements. Except for concrete used in drilled shafts, the requirements of NV Test Method T438 will be performed at 2 hours, 3 hours, or for extended times depending on the concrete placement duration.

4. Drilled Shafts. Use Class S or SA concrete for drilled shaft construction. Upper portions of drilled shafts (top of shaft down to bottom of embedded vertical column reinforcing) may be constructed using the column concrete mix.

CONSTRUCTION

501.03.01 EQUIPMENT

A. With the exception of items indicated in ***Subsection 501.03.05, "Proportioning Methods,"*** and ***Subsection 501.03.06, "Machine Mixing,"*** the measurement of materials and batching shall comply to the ACI 304R, Chapters 3 and 4 recommendations and those in this section or as approved by the Engineer.

1. Certify concrete production facilities and delivery equipment by complying with National Ready-Mix Concrete Association certification requirements.

2. Methods employed in performing the work and all equipment, tools, and machinery used for handling materials and executing any part of the work shall be subject to the approval of the Engineer.

3. All equipment necessary shall be on hand and approved before concrete operations are begun by the Contractor.

B. Provide adequate internal vibrating equipment, including power, to enable the Engineer to fabricate concrete cylinders for testing purposes.

C. Furnish internal vibrators with rigid or flexible shafts, preferably powered by electric motors, capable of operating at a frequency of 7,000 vibrations per minute or greater.

1. The outside diameter or the side dimensions of the vibrating element shall be at least 3/4 inch and not greater than 1-1/2 inches.

2. The length of the shaft shall be at least 24 inches.

D. The Contractor shall maintain the equipment in good condition and adjustment. Concrete mixers and other equipment which are not adequate or suitable for the work shall be removed and suitable equipment shall be provided by the Contractor.

501.03.02 PROTECTING AND SAMPLING CEMENT

A. Suitable means of storing and protecting the cement against moisture or other injurious effects shall be provided by the Contractor. Sacked or bulk cement which, for any reason, has become partially set or which contains lumps of caked cement shall be rejected and shall be immediately removed from the worksite.

B. Different brands of cement shall not be mixed during use or in storage, nor shall different brands be used alternately in any one structure. The same brand and kind of cement shall be used in a given structure above the ground line. A change in brand of cement will require a new mix design.

C. The sacked cement shall be so piled as to permit access for tally, inspection, and identification of each shipment.

D. The Contractor shall obtain from the cement company from which the cement is purchased, a certificate stating that the cement delivered to the work complies with the specifications for the type of cement specified for use, with tests pertaining to the delivered lot. The certificate shall be dated, signed, and indicate the quantity of shipment. Two copies shall be delivered directly to the Engineer.

E. Upon receipt of the certificate of compliance, the Engineer may permit the use of the cement. When a certificate of compliance is not furnished to the Engineer, the cement shall not be used in the work until a release for its use has been received by the Contractor from the Engineer.

F. Whenever it is determined by a laboratory test of mill or field samples that the cement does not comply with the specifications, the use of that cement will be suspended until tests by a third party paid for by the Contractor can be made and the test results are approved by the Engineer.

G. All cement not conforming to the specifications and all cement damaged by exposure to moisture shall be removed immediately and permanently from the work.

501.03.03 STORAGE OF AGGREGATES

A. Refer to ACI 304R, Chapter 2.2.3. The handling and storage of aggregates shall be such as to prevent segregation or contamination by foreign materials.

B. Maintain aggregate stockpiles in saturated surface dry condition.

C. In placing materials in storage or in moving materials from storage to the mixer, any method which may cause the segregation, degradation, or the combining of material of

different gradings which will result in any stockpile or bunker material failing to meet specified requirements shall be discontinued and the materials shall be reprocessed or wasted.

501.03.04 CLASSIFICATION AND PROPORTIONS

A. For non-commercial sources, the Contractor shall notify the Engineer not less than 30 calendar days in advance of use of the proposed sources of materials and shall make arrangements for the Engineer to obtain samples as required for testing purposes.

1. The sources of materials to be used on a project shall not be changed during the job except with the written consent of the Engineer.

2. If permission to change sources of material is granted, a new job mix formula shall be required.

3. Samples shall not exceed 500 pounds for each separate grading.

B. When requested by the Contractor, exceptions to the above requirement may be granted in writing by the Engineer under either of the following conditions:

1. The concrete structures on the project are minor in nature, such as culvert headwalls, manholes, small boxes, sidewalks, etc., generally, when less than 100 cubic yards of concrete are called for on the project.

2. When the aggregate source has been previously tested within the past 1 year and accepted by the Contracting Agency.

C. The Contractor shall give the Engineer advance notice in writing when any changes are to be made in the batch proportions. In the case of Class EA concrete, no changes will be allowed without new laboratory trial testing and subsequent approval.

D. Batches of concrete shall not vary more than ±3 pounds per cubic foot in unit weight from design mix. The cement factor of any individual batch placed in the work shall not be more than 14 pounds per cubic yard less, nor more than 23 pounds per cubic yard greater than the designated cement factor. Batch aggregates and report by weight to the Engineer. The weights used may be varied as necessary to comply with the above tolerances in cement factor and unit weight.

E. For Class EA Concrete, Modified, perform laboratory trial tests to determine strength and compatibility of all materials (as specified in Table 2 of this subsection and in ***Subsection 501.02.03, "Admixtures"***) to be used. Contractor shall have an approved laboratory perform the tests and furnish documentation of such tests. Laboratory trial batches may be observed by the Engineer.

Table 2 - Concrete Mix Designation[4, 5]							
Class of Concrete	**Cementitious Range lb/yd³**	**Max. Nom. Coarse Aggregate Size inches**	**Min. 28-Day Compressive Strength[6] psi**	**Slump Range inches**	**Entrained Air Range %**	**Unit Weight Variation lb/ft³**	**Use**
A	564-705	1-1/2	3000	1-4	4-7	± 3	General use and reinforced structures
AA	564-705						
B	517-705	2	3000	1-5	4-7	± 3	Massive or lightly reinforced sections
BA				1-4			
C	470-611	2-1/2	2500	1-5	4-7	± 3	Massive unreinforced and backfill
CA	517-658						
D	564-705	3/4	3000	1-4	4-7	± 3	Thin reinforced sections, hand rails, etc.
DA	564-752						
PA A	564-752	3/4	Specified on Plans	1-4	Specified on Plans	± 3	Prestressed members
Modified A and AA	564-752	1-1/2	Specified on Plans	1-4	4-7 (AA only)	± 3	Where specified on plans
Modified D and DA	564-752	3/4	Specified on Plans	1-4[7]	4-7 (DA only)	± 3	Where specified on plans
Modified EA[8]	564-752	3/4	Specified on Plans	1/2 -4	4-7	± 3	High Performance Concrete
S and SA	639-925[9]	3/4[10]	Specified on Plans	N/A	4-7 (SA only)[11]	± 3	Self Consolidating Concrete

[4] Blend the coarse aggregate gradation from stockpiles conforming to the requirements of ***Subsection 706.03.01, "Coarse Aggregate,"*** and the stated nominal maximum size. Submit test reports for trial batches showing each stockpile sieve size and the proportions used for blending. Adhere to ***Subsection 706.02.01, "General,"*** for the combined gradation regardless of coarse aggregate gradation. If approved, coarse aggregate nominal maximum size of 1 inch may be used in lieu of 3/4 inch.

[5] Air entrainment on mixes placed above 6000 feet elevation

[6] Comply with ***Subsection 501.02.04, "Concrete Making Properties,"*** of the Standard Specifications for the moving average method of evaluating concrete specified under Statistical Evaluation of Concrete Strength.

[7] For extruding barrier or bridge rail, slump range is 0.5-4 inches.

[8] Aggregates shall consist of a blend of coarse, intermediate, and fine aggregates in order to produce a dense grading. Consideration of the grading, workability factor, and coarseness factor, as outlined in ACI 302 shall be utilized. The aggregate maximum nominal size shall consist of at least a nominal 3/4 inch stone size.

[9] The maximum shrinkage requirement of 0.06% in 28 days air dry after 28-day wet cure, ASTM C157, shall apply if the total cementitious material exceeds 752 pounds per cubic yard.

[10] If approved, 1/2 inch or 3/8 inch may be used in lieu of 3/4 inch.

[11] Air content shall be as follows: For 1/2 inch max. aggregate size, 4.5% - 7.5%, and for 3/8 inch max. aggregate size, 5% - 8%.

F. Concrete shall be composed of cement, admixtures (when approved), aggregates and water. These materials shall be as specified. The exact proportions in which these materials are to be used for different parts of the work shall be determined by the Contractor and submitted to the Engineer for review prior to use in the work. In general, the mix shall be so designed as to produce concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have maximum smoothness of surface. Mix designs where sand represents more than 41 percent of the total weight of fine and coarse aggregate shall not be permitted. The proportions shall be changed whenever necessary or desirable in the opinion of the Engineer. Concrete mixes shall be designed by a Registered Professional Engineer in the State of Nevada representing a qualified independent testing laboratory and approved in advance by the Engineer. Concrete mixing operations shall conform to ASTM C 94. Water shall not be added to concrete after leaving the batch plant unless specifically authorized by the Engineer.

501.03.05 PROPORTIONING METHODS

A. Except as hereinafter noted, aggregate bins shall conform to either 1 or 2 as follows:

1. Each specified size of aggregates shall be stored in a separate bin. Except as hereinafter specified, each bin shall be provided with an individual outlet gate, designed and constructed to prevent leakage when closed. The gates shall cut off quickly and completely.

2. Each size aggregate shall be weighed individually in a single bin, providing there is a satisfactory method employed to eliminate any excess material resulting from over-charging of the bin before the material reaches the surge hopper.

B. Conformance to 1 and 2 above will not be required when batching for culvert headwalls, manholes, small boxes, sidewalks, etc., and the total quantity of concrete called for on the project does not exceed 300 cubic yards.

C. All aggregates for use in Portland cement concrete shall be proportioned by weight, with the exception that aggregates for culvert headwalls, short pieces of curb and gutter, or small sections of sidewalk and related minor work may be proportioned either by weight or volume as the Contractor may elect. Measuring boxes of known capacity shall be furnished and used to measure each size of aggregate proportioned by volume.

D. Water shall be proportioned to maintain batching consistency with regard to stockpile moisture contents and varying absorption values for both coarse and fine aggregates. The Engineer may request the Contractor to submit a new mix design if either the coarse or fine aggregate absorption values vary from the approved mix design by more than 1 percent.Water shall be proportioned to maintain batching consistency with regard to stockpile moisture contents and varying absorption values for both coarse and fine aggregates. The Engineer may request the Contractor to submit a new mix design if either the coarse or fine aggregate absorption values vary from the approved mix design by more than 1 percent.

E. Bulk cement shall be weighed separately when the batch is 1 cubic yard or more.

1. The scale and weigh hopper for the cement shall be separate and cement hopper shall be interlocked against opening before the full amount of cement is in the hopper, against closing before the contents of the hopper are entirely discharged and the scales are back in balance, and against opening when the amount of cement in the hopper is underweight by more than 1 percent of the amount specified.

2. An interlock system will not be required on projects having less than 300 cubic yards in the bid schedule.

F. Scales utilized in the proportioning device may be of the springless dial type or of the multiple beam type.

G. If of the dial type, the dial shall be of such size and so arranged that it may be read easily from the operating platform.

H. If of the multiple beam type, the scales shall be provided with an indicator operated by the main beam which will give positive visible evidence of over or under weight.

1. The indicator shall be so designed that it will operate during the addition of the last 400 pounds of any weighing.

2. The over travel of the indicator hand shall be at least 1/3 of the loading travel.

3. The indicator shall be enclosed against moisture and dust.

I. Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the entire plant is running, the scale reading and cutoff shall not vary from the weight designated by more than 1 percent for cement and 1-1/2 percent for any size aggregate, nor 1-1/2 percent for the total aggregate in any batch.

J. Scales shall be approved with a certificate of inspection as required by ***Subsection 109.01, "Measurement of Quantities."***

K. When the entire plant is running, the scale reading and cutoff weights shall not vary from the mix design by more than 1 percent for cement, fly ash, and silica fume, 1.5 percent for any individual size aggregate, and 1 percent for the total combined aggregate in any batch. The total water shall not exceed the maximum water specified in the mix design.

L. Should separate supplies of aggregate and material of the same size group, but of different moisture content or specific gravity be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the material therein completely exhausted before starting upon another.

M. Stockpiled aggregates shall be in a saturated surface dry condition just prior to batching.

1. The moisture content of the aggregate shall be such that no visible separation of moisture and aggregate will take place during transportation from the proportioning plant to the point of mixing

2. Aggregate containing excess moisture shall be stockpiled prior to use until sufficiently dried to meet the above requirements.

N. Batches with cement in contact with damp aggregates shall be mixed within 30 minutes after being proportioned. Batch trucks hauling more than 1 batch of cement and aggregate shall be so constructed that materials do not flow from one compartment to another during haul or discharge.

O. Coarse and fine aggregate shall be handled and measured separately. Cement shall be emptied directly into the charging skip of the mixer. Water shall be measured either by volume or by weight.

P. The equipment for measuring and supplying the water to the mixer shall be so constructed and arranged that the amount of water added to the mixture can be measured in one operation into the mixing drum without dribbling.

1. The equipment shall be so designed that water from the source of supply cannot enter the measuring tank while the water is being discharged from the measuring tank into the mixer.

2. Tanks or other equipment for measuring and discharging water into the mixer shall be sufficiently accurate that the amount of water delivered to the mixer for any batch shall not vary more than 1 percent from the required quantity of water for any position of the mixer with respect to a level plane.

3. The tanks or other equipment shall be so arranged as to permit the checking of the amount of water delivered by discharging into measured containers.

501.03.06 MACHINE MIXING

A. Concrete manufactured by any procedure which results in any unmixed lumps of cement in the mixed product shall be rejected. The preparation of the mix shall be in accordance to ACI 318, Section 5.8, “Mixing,” and this section. The Cement and Concrete terminology is defined in ACI 116.

B. For structural concrete, the Operator shall provide a computer printed legible ticket and for non-structural concrete, at a minimum, a hand written ticket. The ticket shall be presented with each load, and shall contain the following information:

1. Name of Vendor.

2. Name of Contractor.

3. Number of Cubic Yards in the Load.

4. Amount of Cement and of each Size of Aggregate.

5. Amount of Water Added at the Plant.

6. Amount of Water in the Aggregate.

7. Brand and Type of Cement.

8. Brand and Amount of Admixture.

9. Time and Date of Batching.

10. For Mobile mixer add:

    a. Truck Number (the truck unit the mixer is mounted).
    b. The Model of the mixer with Serial Number.

C. Space shall be provided on the ticket so the amount of water added on the job may be indicated.

D. All concrete shall be mixed in mechanical mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in accordance with the provisions of ***Subsection 501.03.07, "Hand Mixing."***

1. Mixers shall have legible permanently attached plates showing manufacturer's rated capacity, mixing speeds, and serial number.

2. Mixers may be stationary mixers or truck mixers.

    a. Agitators may be truck mixers operating at agitating speed or truck agitators.
    b. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete, and the speed of rotation of the mixing drum or blades.

3. The Contractor, at no additional cost to the Contracting Agency, shall furnish samples of the fresh concrete and provide safe and satisfactory facilities for obtaining the samples.

4. Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer.

5. The temperature of materials as charged into the mixer shall be such that the temperature of the mixed concrete at the time it is placed in final position is not less than 50 degrees F nor more than 90 degrees F as specified in ***Subsection 501.03.10.B, "Cold Weather – General,"*** and

Subsection 501.03.10.C, "Low Temperature Protection." Aggregates and water used for mixing shall not exceed 150 degrees F.

6. Concrete for structures shall be mixed for a period of not less than 60 seconds nor more than 5 minutes after all materials, including water, are in the mixer.

7. Cement shall be batched and charged into the mixer by means that will not result either in loss of cement due to the effect of wind, or an accumulation of cement on surfaces of conveyors or hoppers, or in other conditions which may vary the required quantity of cement in the concrete mixture.

8. Stationary mixers having a capacity of 1 cubic yard or more and all paving mixers shall be operated with an automatic timing device that can be locked by the Engineer. The time device and discharge mechanisms shall be so interlocked that during normal operations no part of the batch will be discharged until the specified mixing time has elapsed.

9. The total elapsed time between the intermingling of damp aggregates and cement and the start of mixing shall not exceed 30 minutes.

10. Mixers and agitators which have an accumulation of hard concrete or mortar or worn blades shall not be used.

11. When central-mixed concrete is furnished and non-agitating hauling equipment is used for transporting concrete to the delivery point for Portland cement concrete pavement, discharge into the laydown machine shall be completed within 45 minutes after the addition of the cement to the aggregates.

E. **Ready-Mixed Concrete.**

1. Ready-mixed concrete shall be central-mixed, shrink-mixed, or transit-mixed concrete. Shrink-mixed concrete is that which has been mixed partially in a stationary mixer and the mixing completed in a truck mixer.

2. The size of batch in truck mixers and truck agitators shall not exceed the rated capacity as determined by the current Standard Requirements of Truck Mixer Manufacturers Bureau. The size of batch in stationary mixers shall not exceed the rated capacity of the mixer as determined by the standard requirements of the Associated General Contractors of America. No batches requiring fractional sacks of cement will be permitted unless all of the cement is weighed when added to the batch.

3. If the use of ready-mixed concrete is approved, the producers shall use only that cement approved by the Contracting Agency for use on the project. Contracting Agency approved cement shall be stored at the concrete plant in such a manner that it can be identified and kept separate from other cement.

4. Ready-mixed concrete for structures shall be transported in truck mixers or truck agitators.

5. The mixer, when loaded to capacity, shall be capable of combining the ingredients of the concrete within the specified time, into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity. The agitator, when loaded to capacity, shall be capable of maintaining the mixed concrete in a thoroughly mixed uniform mass and of discharging the concrete with a satisfactory degree of uniformity.

6. Mixers and agitators shall be examined periodically for changes in condition due to accumulation of hardened concrete or mortar or to wear of the blades.

    a. When any such change in condition is found, the concrete shall be subjected to the slump tests.
    b. If the tests indicate that the concrete is not being properly mixed, the faulty equipment shall be corrected before its further use is allowed.

7. Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may be readily verified. The counters shall be of the continuous-registering, non-resettable type, which accurately register the number of revolutions, and shall be mounted on the truck mixer so that the Engineer may safely and conveniently inspect them from alongside the truck.

8. When a truck mixer is used, each batch of concrete shall be mixed for not less than 70 and no more than 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of the equipment as mixing speed. If any additional mixing is done, it shall be at the speed designated by the manufacturer of the equipment as agitating speed.

9. When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

10. No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless permitted by the Engineer. If the Engineer permits additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.

11. The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of revolution of the drum in the discharge direction with the discharge gate fully open.

12. When truck mixer or truck agitator is used for transporting concrete that has been completely mixed in a stationary mixer, mixing during transportation shall be at the speed designated by the manufacturer of the equipment as agitating speed. Do not exceed a total of 300 revolutions from the time of initial batching to complete discharge of delivered concrete.

13. When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within 90 minutes after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. In hot weather, or under conditions contributing to quick stiffening of the concrete as determined by the Engineer, a delivery time of less than 90 minutes may be required. When a truck mixer is used for the complete mixing of the concrete, the mixing operations shall begin within 30 minutes after the cement has been intermingled with the aggregate.

14. If the mixing plant is such a distance from the site of the work that it is not practical to have the mixed concrete delivered and placed in forms within the time limit specified, cement and water shall not be added until such time as requirements can be complied with.

15. The organization supplying concrete shall have sufficient plant capacity and transporting apparatus to ensure continuous delivery at the rate required.

    a. The rate of delivery of concrete shall be used as to provide for the proper handling and placing of concrete.
    b. An interval of more than 45 minutes between any 2 consecutive batches or loads, or a delivery and placing rate of less than 8 cubic yards of concrete per hour shall constitute cause of shutting down work for the remainder of the day, and if so ordered by the Engineer, the Contractor shall make, at no additional cost to the Contracting Agency, a construction joint at the location and of the type directed by the Engineer in the concrete already mixed.

16. After mixing of ready-mixed concrete has been completed, it shall be agitated continuously at agitating speed until it has been discharged from the drum.

17. Wash water shall be completely discharged from the drum or mixing container before the succeeding batch is introduced. Cement balling (intermittent clumping) and mix foaming shall be prevented by controlling the batch sequence, mixing speed, and mixing time.

    a. When intermittent clumping exceeds 1-2 clumps per yard or 10 clumps per truck, the entire load will be rejected.
    b. The clumps shall not exceed 5 inches in diameter.

F. Mobile Mixers

1. The concrete mobile mix truck and placement of concrete shall comply to the ASTM C685 “Concrete Made by Volumetric Batching and Continuous Mixing” and Volumetric Mixer Manufacturers Bureau manual VMMB 100-01 “Volumetric Mixer Standards” with the exception as follows:

    a. ASTM C685 section 7.8 and VMMB 100-01 section 1.2.4 tolerance table shall be replaced with American Concrete Association 3046R section 6.2.2 tolerance table.

2. Material bins shall conform to Table 1 of VMMB 100-01 with the following addition:

   a. Reinforcing fibers and fly ash, if required, must be stored and dispensed from their own separate bin. Bins for cementitious materials shall be sealed to prevent damage to the cementitious materials by ambient air moisture.

3. Rating Plate

   a. The rating plate shall comply to ASTM C685 and VMMB 100-01. One size of volumetric mixer units of the same design and configuration shall have been approved by the VMMB to be eligible to carry the VMMB plate.
   b. Mixers that were certified by a VMMB member company subsequent to issue of the VMMB 100 standard in 2001 shall have a rating plate furnished by the VMMB attached to the mixer equipment. They shall be certified by completing the qualification report forms. These forms are on the VMMB website and shall be submitted to VMMB for review and approval.
   c. Separate VMMB qualification report forms are required for each individual mixer unit.

4. Prior to the use of the mobile mixer, it shall be inspected by the Contracting Agency. At the time of the inspection, the supplier must provide all of the documentation as required in ASTM C685.

   a. The frequency of the mixer inspection is six months.
   b. The maximum calibration interval of the flow meter shall be six months or 2500 cubic yards of production and a minimum of three calibration runs shall be performed as required by ACI 304.6R.
   c. Mixing uniformity evaluation must be performed on a minimum 1 cubic yard sample and reviewed and approved by the VMMB prior to delivery of a rating plate. Prior to initial submittal of an application package to Clark County, an initial mixing uniformity evaluation must be performed within the last 3 months.
   d. A mixing uniformity evaluation must then be performed at a maximum interval of 6 months as required by ASTM Standard C685. A mixing uniformity evaluation must be performed within the last 3 months, prior to submittal of an annual application for renewal as an approved concrete fabricator with Clark County.

5. Material

   a. For onsite materials, it shall be placed in stockpiles with tests of each in accordance to the table one test methods in section 706 and frequencies on the Clark County QAQC website:
      http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx
   b. For established offsite material sources, test results within 6 months of the mix design date shall be attached to the mix design based on the Table 1 requirements.
   c. The mix design shall include the source name and location. If the material source changes, the mix shall be re-designed and be resubmitted.
   d. The data shall include the material ASTM C33 information.

e. The documentation shall be delivered to the Contracting Agency.
f. The source material test data and vendor sheets shall be attached to the mix design.

501.03.07 HAND MIXING

A. Hand mixing shall not be permitted, except in case of an emergency or under written permission of the Engineer.

B. When permitted, hand mixing shall be done only on watertight platforms.

1. The sand shall be spread evenly over the platform and the cement spread upon it.

2. The sand and cement shall then be thoroughly mixed while dry by means of shovels until the mixture is of uniform color, after which it shall be formed into a "crater" and water added in the amount necessary to produce mortar of the proper consistency.

3. The material upon the outer portion of the "crater" ring shall then be shoveled to the center and the entire mass turned and sliced until a uniform consistency is produced.

4. The coarse aggregate shall then be thoroughly wetted and added to the mortar and the entire mass turned and returned at least 6 times and until all of the stone particles are thoroughly covered with mortar and the mixture is of a uniform color and appearance.

C. Hand mixing will not be permitted for concrete to be placed under water.

D. Preproportioned sack concrete may be used for grout caps or other nonstructural uses as approved by the Engineer.

501.03.08 RETEMPERING

A. Concrete shall be mixed only in such quantities as are required for immediate use and shall be placed before initial set has taken place. Any concrete in which initial set has begun shall be wasted and not used in the work.

B. No retempering of concrete shall be allowed.

501.03.09 CURING

A. Comply with ACI 308, Standard Specification for Curing Concrete, with the following exceptions or additions:

1. General. All concrete shall be cured for the length of time hereinafter specified. If Type III cement is used, the curing time may be reduced as directed by the Engineer. In the event of low temperatures, the time will be increased according to the procedures specified in ***Subsection 501.03.10.B, "Cold Weather – General."***

a. Cure all bridge decks and approach slabs according to Subsection 501.03.09.A.6, "Bridge Deck Curing."
b. Curing shall commence immediately upon completion of the finish. In the event that the application or placement of the curing medium is delayed, curing will be as described under 2 below.

2. **Water Method.** The concrete shall be kept continuously wet by the application of water for a minimum period of 7 days after the concrete has been placed.

a. Use fogging equipment capable of applying water through an atomizing nozzle in the form of a fine mist, not a spray. The equipment may use water pumped under adequate high pressure, or a combination of air and water pumped under high pressure. Use equipment sufficiently portable for use in the direction of any prevailing wind. Adapt equipment for intermittent use as directed to prevent excessive wetting of the concrete.
b. Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period. The cotton mats, rugs, or carpets shall be of such character that they will retain water.

3. **Curing Compound Method.** The entire surface of the concrete shall be sprayed uniformly with a curing compound. It shall be applied when just a light film of water is present on the surface. If the surface is dry, water shall be added as specified in 2 above before the curing compound is applied.

a. On decks or slabs cured by this method, foot traffic shall be held to a minimum and these surfaces shall not be used as a work area during the cure period. Should the film of the compound be damaged before the expiration of 7 days, the damaged portions shall be repaired immediately with additional compound.
b. Uniformly spray the entire surface of the concrete with a curing compound conforming to Subsection 702.03.01, "Curing Materials," except as hereinafter specified for concrete bridge decks that are to be the roadway surface. The curing compound shall be applied to the exposed surface at a uniform minimal rate of 1 gallon per 150 square feet of area.
c. Do not apply the curing compound until all patching and surface finishing, except grinding, have been completed. When ordered during periods of hot weather, continue fogging of the concrete with water after curing compound is applied until no longer required.
d. The curing compound shall be delivered to the work in ready-mixed form. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. The compound shall not be diluted or altered in any manner, unless dilution is recommended by the manufacturer.
e. Provide curing compounds which remain sprayable at temperatures above 40 degrees F and do not hard settle in storage.
f. Curing compound that has become chilled to such an extent that it is too viscous for satisfactory application shall be warmed to a temperature not exceeding 100 degrees F

g. Curing compound shall be packaged in clean 55-gallon steel barrels or round 5-gallon steel containers or supplied from a suitable storage tank located at the jobsite.
   1) Each 55-gallon barrel shall be equipped with a built-in agitator having 2 sets of blades, one at the bottom and one midway between top and bottom, and with removable lids and airtight band fasteners.
   2) On-site storage tanks shall be kept clean and free of all contaminants. Each tank shall be provided with a permanent system designed to completely redisperse any settled material without introducing air or any other foreign substance.
   3) Barrels shall be filled in a manner that will prevent skinning.
   4) Ring seals and lug type crimp lids shall be used to seal 5-gallon containers well.
   5) Containers shall be provided with lining that will resist the solvent of the curing compound and will not permit skins to be loosened into the body of the curing compound.
   6) Each container shall be labeled with the manufacturer's name, batch number, type of compound, number of gallons, and date of manufacture. Each container shall also be labeled with an Interstate Commerce Commission Red Label warning concerning flammability. The label shall also warn that the curing compound shall be well stirred before use.
   7) When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall be supplied with each load containing the same information as that required herein for container labels.

h. Curing compound may be sampled by the Engineer at the source of supply, at the job site, or at both locations.
i. Curing compound not used within 6 months of the date of manufacture will require certification from the manufacturer that the curing compound still conforms to ASTM C309. Curing compound more than 1 year old or without a manufacture date on the container will not be allowed for use.

4. Waterproof Membrane.

a. Keep the exposed finished surfaces of concrete damp with water using an atomizing nozzle, as specified in Subsection 501.03.09.A.2, "Water Method," until the concrete has set.
b. Place the curing membrane after the concrete has set.
   1) The membrane shall be formed into sheets of such width as to provide a complete cover of the entire concrete surface.
   2) All joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint.
   3) Overlap of sheets shall have a minimum lap of 18 inches.
   4) The sheets shall be securely weighted down by placing a bank of earth on the edges of sheets or by other means satisfactory to the Engineer.
   5) Sheeting material shall conform to Subsection 702.03.01, "Curing Materials."
c. The curing membrane shall remain in place for a period of not less than 7 days.

d. Should any portion of the sheets be broken or damaged before the expiration of the curing period, the broken or damaged portion shall be immediately repaired with new sheets properly cemented into place, or water curing as described above shall commence immediately.
e. Sections of the membrane which have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing shall not be used.

5. Form Method.

a. If forms are kept on the concrete surfaces, this will be considered adequate cure for these surfaces.
b. However, should the forms be removed within 7 days after the concrete has been placed, one of the above methods shall be used on the exposed surfaces.
c. Comply with Subsection 502.03.11, "Removal of Falsework and Forms."

6. Bridge Deck Curing.

a. Submit a quality control plan for concrete placement and curing, for review and approval, a minimum of 30 days prior to the pre-pour conference for bridge decks and approach slabs. The plan shall include, but not be limited to, information on the procedures for when and how the concrete and the curing system is to be placed, frequency for monitoring, maintaining, and re-wetting the curing system chosen, and a list of personnel responsible for performing such work. Include in the plan, equipment to be used for placement of concrete and the curing system, methods of protecting the covers from displacement from wind or weather, and methods of preventing loss of heat and moisture.
b. Describe procedures to be followed in the event of equipment breakdown or inclement weather during concrete placement. In addition, describe the method to be used to protect pedestrian and vehicular traffic under the structure.
c. Use Figure 2.1.5 from ACI 305R, Hot Weather Concreting, to determine the evaporation rate. Additional protection measures shall be provided if the rate of evaporation exceeds 0.1 pound per square foot per hour.
    1) Accurate record of placement location, air temperature, relative humidity, concrete temperature, and wind velocity shall be provided.
    2) Readings shall be taken an hour prior to the concrete placement and at 1-hour increments during concrete placement, until the final curing blanket is placed.
    3) Required data shall be submitted to the Engineer.

d. Concrete temperature shall be monitored during the entire curing period by utilizing recording thermocouples embedded at 1 inch below the concrete surface and 1 inch above the bottom concrete surface.
    1) A minimum of 2 sets of thermocouple installations will be required per each day's placement.
    2) The thermocouple shall be capable of recording the concrete temperature as a function of time.
    3) Acceptable devices include thermocouples connected to electronic data loggers.

4) The recording time intervals shall be a maximum of 30 minutes.
5) The recording devices shall be accurate to within ±1.8 degrees F. Concrete temperature between the top and bottom of the slabs and the supporting girders shall be maintained to a maximum differential temperature of 30 degrees F.
6) If differential temperatures exceed the requirements, measures shall be taken to correct the curing process.
7) Required data shall be submitted to the Engineer.

e. Immediately after the concrete is placed, the moisture content shall be maintained by humidifying the air directly above the concrete surface until the curing covers are placed. Fogging equipment described in Subsection 501.03.09.A.2, "Water Method," shall be used, mounted on a finishing bridge that is separate from the concrete placing equipment.
f. Begin placing pre-soaked burlap within 30 minutes after finishing has started. Wet curing of the surface shall be performed for 10 days, unless otherwise directed, with the following covering:
   1) Burlap and Polyethylene Covering. Burlap conforming to Subsection 702.03.01, "Curing Materials," and polyethylene (white or reflective) conforming to ASTM C171 shall be furnished. Soaker hose shall be placed or other approved method shall be used to provide continuous wetting of burlap between the burlap and polyethylene covering.
g. Pre-wetted curing coverings shall be placed with a finishing bridge. Covers shall be placed directly behind the concrete fogging operation.
h. The covering shall be maintained uniformly wet during the entire curing period. Provide 24-hour monitoring of the wet curing for the full length of the curing period. Water temperature shall not be more or less than 20 degrees F from the temperature of top of bridge deck.
i. Covers shall be lapped a minimum of 18 inches. All lapped edges shall be sealed to prevent loss of heat and moisture.
j. If the ambient temperature drops below 45 degrees F during the first 4 days of curing, additional protection shall be provided according to Subsection 501.03.10.C, "Low Temperature Protection."
k. After completion of wet curing and removal of curing covering, immediately remove excess water and apply an application of curing compound according to Subsection 501.03.09.A.3, "Curing Compound Method."
l. All cracks on new bridge decks and approach slabs shall be repaired. Requested method of repair shall be submitted for approval.

7. Maturity Meter Method:

a. This method may be used if referred to in the contract special provisions.
b. The method specified in ASTM C1074 may be used in order to reduce the cure time. This method requires training and certification of the Quality Assurance and Control personnel.
c. This method shall not be used for acceptance but for reducing the time required for form removal. The Contractor shall have a plan of action approved by the Engineer and monitored by a third party engineer for meter placement and monitoring.

501.03.10 WEATHER LIMITATIONS

A. **General.** If impending inclement weather conditions exist, the Contractor shall decide whether or not to begin the placement and the Contractor shall have sole responsibility for Contractor's decision.

1. Before any concrete is placed, the Contractor shall have adequate provisions readily available as approved by the Engineer, to protect the concrete from any impending weather conditions.

2. In case precipitation should occur after placing operations have started, the Contractor shall provide ample covering to protect the work.

3. The placing of concrete shall be stopped before the quantity of precipitation is sufficient to cause a flow or to wash the surface.

4. All exposed concrete surfaces shall be sprayed liberally with an evaporation retarder such as Confilm by Masterbuilders or approved equal, when the ambient air temperature is greater than 100 degrees F.; or when the ambient air temperature is above 90 degrees F. and the wind speed is above 20 mph; or as directed by the Engineer. Spraying shall be per manufacturer's recommendation and shall occur immediately upon completion of the finish.

B. **Cold Weather – General.** Comply with ACI 306, Cold Weather Concreting, with the following exceptions or additions:

1. All concrete shall be maintained at a temperature of not less than 50 degrees F for 3 days or not less than 40 degrees F for 7 days. The count of time shall commence immediately upon completion of final placement and vibration. The three 50-degree F days need not be consecutive.

2. One 24-hour period shall constitute 1 day.

3. The temperature of the concrete shall be determined by placement of thermometers on the concrete surfaces and properly insulating these devices to record the surface temperature of the concrete.

    a. Temperature shall be monitored continuously throughout the total protection time required by this subsection.
    b. In case the surface temperature of the concrete falls below 40 degrees F for a duration of 3 hours or more in any 24-hour period during the time of temperature protection, the time shall be increased 1 day for each day this occurs.
    c. An absolute minimum temperature of 35 degrees F shall be maintained for the total time of protection specified in this subsection.
    d. Should the temperature of the concrete fall below 35 degrees F at any time, damage may occur.
    e. The assessment of damage will be determined by a professional engineer registered in Nevada and paid for by the contractor and concrete so damaged may require repair or replacement at the option of the Engineer.

4. The concrete shall have a temperature of at least 50 degrees F and not more than 90 degrees F at the time of placing. (Also, comply with temperature constraints specified in ***Subsection 501.03.06, "Machine Mixing."***)

   a. Heating equipment or methods which alter or prevent the entrainment of the required amount of air in the concrete shall not be used.
   b. The equipment shall be capable of heating the materials uniformly.
   c. Aggregates and water used for mixing shall not be heated to a temperature exceeding 150 degrees F.
   d. Concrete containing frost or lumps at the time of placing shall not be used.

5. Stockpiled aggregates may be heated by the use of dry heat or steam. Aggregates shall not be heated directly by gas or oil flame or on sheet metal over fire.

6. Reinforcing steel shall be free of ice, snow, and frost during placement of concrete. Concrete shall not be placed on frozen ground.

7. Concrete shall not be placed on frozen ground, nor shall it be placed when atmospheric temperature is below 40 F. and within 24 hours of the time that the concrete is to be placed, except with the written permission of the Engineer and only after such precautionary measures for the protection of the concrete have been taken as the Engineer may direct.

C. **Low Temperature Protection.** Refer to guidelines in ACI 306, Cold Weather Concreting, with the following exceptions or additions:

1. **General.** After the concrete has been placed, means shall be taken to protect the concrete from any impending low temperatures.

   a. Methods and materials not hereinafter prescribed may be used if approved by the Engineer and the following requirements adhered to:
      1) Materials shall be fire resistant
      2) Materials shall be waterproof
      3) Materials shall not adhere, abrade or damage the surface of the concrete.

   b. Approval of the Engineer shall not relieve the Contractor from obtaining specification results.

2. **Insulating Blankets.**

   a. Insulating blankets used to protect concrete from low temperatures shall be fire resistant and waterproof.
   b. The blankets shall be secured and overlapped along the edges and joints to ensure that no opening will exist in the protection during high winds or other adverse conditions.
   c. Provisions shall be made to allow the reading of thermometers placed inside of the protection.

d. When depositing concrete against previously cast concrete, the blanket insulation shall extend at least 14 inches onto the existing concrete and shall be securely held in place.

3. **Low Temperatures Protection – Heating and Housing.**

a. In order to meet the provisions of ***Subsection 501.03.09, "Curing,"*** paragraphs A and B, the concrete may be protected by applying artificial heat within an enclosure.
b. The enclosure shall be constructed with fire resistant material, unless otherwise directed by the Engineer, and shall be subject to Engineer's approval.
c. The heating system shall be so arranged as to provide uniform heating, ensuring that the concrete farthest from the source of heat is receiving adequate protection without drying the concrete near the source of heat so as to cause shrinkage cracks.

4. The temperature of the concrete will be determined by placement of thermometers on the concrete surfaces and properly insulating these devices to record the surface temperature of the concrete according to NV Test Method T440.

a. Temperature will be monitored continuously throughout the total projection time required by this subsection.
b. If the surface temperature of the concrete falls below 50 degrees F during the first 3 days and 40 degrees F during the next 4 days of the temperature protection for a duration of 3 hours, the curing time will be increased 1 day for each day this occurs.
c. Should the temperature of the concrete fall below 35 degrees F at any time during the 7 days of temperature protection or if the surface temperature of the concrete falls below 40 degrees F during the first 24 hours of temperature protection period, the assessment of damage will be determined by a Nevada registered professional engineer paid for by the Contractor and damaged concrete shall be repaired or replaced at the option of the Engineer.
d. Contractor shall be responsible for all costs associated with damage assessment and repair.

D. **Hot Weather.** Comply with guidelines in ACI 305, Hot Weather Concreting, with the following exceptions or additions:

1. The maximum temperature of cast-in-place concrete shall not exceed 90 degrees F immediately before placement.

2. For continuous placement of concrete on the deck with reinforcing steel units, retard the initial set of the concrete sufficiently to ensure that concrete remains plastic for subsequent placement.

3. For both simple and continuous spans, submit a retardation schedule for approval.

4. The consistency of the concrete as placed shall allow the completion of initial finishing operations without the addition of water to the surface. When conditions are

such that additional moisture is needed for initial finishing, the required water shall be applied to the surface fog spray only, and shall be held to a minimum amount. Apply fog spray for this purpose as specified in ***Subsection 501.03.09.A.2, "Water Method."*** Fog spray for this purpose may be applied with hand-operated fog equipment, as approved by the Engineer.

5. From the time of initial strike-off until final finish is complete, the unformed surfaces of slab concrete shall be protected from rapid evaporation of mixing water from the concrete due to wind, high temperature, low humidity, or combination thereof.

6. Equipment for fogging, type of evaporation retarder, and method of application shall be approved by the Engineer. Equipment shall be portable, adapted for intermittent use, and operable in the direction of any prevailing wind.

7. Use fogging equipment capable of providing a fog mist, as necessary, to the area between the finishing machine and the tining machine. The fogging equipment shall meet the requirements of ***Subsection 501.03.09.A.2, "Water Method."*** If at any time it becomes apparent that the combination of fogging and curing application are not, or will not be effective in preventing plastic shrinkage cracking, stop the concrete placement until environmental conditions improve substantially, or until other preventative measures are approved in writing by the Engineer.

8. After all finishing operations are complete a final curing membrane shall be applied.

9. When the temperature is 90 F. or above, or is likely to rise above 90 F. within the 24-hour period after concrete placement; or when there is any combination of high air temperature, low relative humidity and wind velocity which would impair concrete strength or quality, follow the recommendations of ACI 305R and the following:

   a. Keep concrete as cool as possible during placement and curing
   b. Do not allow concrete temperature to exceed 90° F. at placement.
   c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
   d. Dampen subgrade and forms with cool water immediately prior to placement of concrete.
      Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.
   e. Take appropriate precautions per ACI 305R when the actual or anticipated evaporation rate equals or exceeds 0.2 pounds per square foot per hour as determined from ACI 305R, Figure 2.1.4.

501.03.11 TRIAL SLAB AND PROCESS CONTROL TESTING

A. If silica fume is used in bridge deck concrete, construct a trial slab at least 30 days prior to placement of concrete on a bridge deck. Submit a written plan for the casting of decks. Include in this plan, at a minimum, the location of slab, the equipment and personnel used for construction, and disposal of slab. Prior to placement of the trial slab, conduct a Pre-Activity Meeting.

B. Use approved mix designs. Place concrete at a location other than the bridge deck, but under similar conditions to those that exist during bridge deck concrete placement.

1. The trial slab shall have a minimum length and width of 50 feet and a depth of 8 inches.

2. Reinforce slab with a top and bottom mat of no. 5 bars spaced 6 inches longitudinally and transversely.

3. Place top mat at a depth of 2-1/2 inches from the top of the slab.

4. Place bottom mat at a depth 1-1/2 inches from the bottom of slab.

5. The trial slab shall be wet-cured in accordance with the specifications.

6. Use personnel such as superintendent, key operators, and finishers that are the same personnel who will be involved in the final construction of the bridge deck.

7. Demonstrate the use of equipment, proficiency of personnel, and techniques for mixing, transporting, placing, and curing of the concrete during the trial.

8. Fifteen days after the placement of the trial slabs, conduct a post construction critique of the trial slab placement in writing.

C. Do not commence placement of bridge deck concrete until after any issues from the post construction critique of trial slab construction have been resolved to satisfaction of the Engineer.

D. Upon notification, remove and dispose of trial slabs according to ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

501.03.12 MORTAR

A. Cement mortar shall consist of a mixture of Portland cement, sand, and water. Cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with the required amount of water.

1. Cement mortar shall be designated by class and proportioned by loose volume as follows:

Table 3 - Mortar Proportioning

Designation	Proportions
Class "A" Mortar	1 Part Cement to 1 Part Sand
Class "B" Mortar	1 Part Cement to 1-1/2 Parts Sand
Class "C" Mortar	1 Part Cement to 2 Parts Sand
Class "D" Mortar	1 Part Cement to 2-1/2 Parts Sand
Class "E" Mortar	1 Part Cement to 3 Parts Sand
Class "F" Mortar	1 Part Cement to 3-1/2 Parts Sand

2. The quantity of water to be used in the preparation of mortar shall be only that required to produce a mixture sufficiently workable for the purpose intended.

3. Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Re-tempering of mortar will not be permitted.

B. **Cement.** Cement shall conform to the requirements of ***Section 701, "Hydraulic Cement."***

C. **Sand.** Sand shall conform to the requirements of ***Subsection 706.03.04, "Grout and Mortar Sand."*** In proportioning the sand it shall be measured loose (without shaking or compacting) in measuring boxes or other suitable containers of known capacity.

D. **Admixtures.** No admixture shall be used in mortar unless otherwise specified or approved by the Engineer.

501.03.70 CORROSION PROTECTION REQUIREMENT

A. Pipe, conduit, dowels and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there shall be a minimum of two inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement shall not be permitted.

501.03.71 PREPARATION OF SURFACES FOR CONCRETING

A. Native material surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud and debris at the time of placing concrete.

B. Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, in the opinion of the Engineer, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be leveled with a wooded float to provide a reasonably smooth surface. A surface consisting largely of coarse aggregate shall be avoided. The joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material.

C. No concrete shall be placed until all form work, installation of parts to be embedded, and preparation of surfaces involved in the placing have been approved by the Engineer.

501.03.72 EXCLUSION OF WATER

A. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited under water without the explicit permission of the Engineer and then only in strict accordance with the Engineer's directions, nor shall the Contractor, without explicit permission from the

Engineer, allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as to injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing groundwater, if required, shall be subject to the approval of the Engineer and shall be the responsibility of the Contractor. Said items shall be considered incidental to construction and no additional compensation shall be made.

501.03.73 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogenous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement.

501.03.74 CARE AND REPAIR OF CONCRETE

B. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which for any other reason does not conform to the specifications, shall be removed and replaced at the Contractor's expense.

METHOD OF MEASUREMENT

501.04.01 MEASURMENT

A. Portland cement concrete will be measured for payment in accordance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

BASIS OF PAYMENT

501.05.01 PAYMENT

A. Portland cement concrete shall be paid for in accordance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

501.05.02 TRIAL SLAB PAYMENT

A. Full compensation for construction and removal of trial slabs and trial pours shall be considered as included in the contract unit price paid for other appropriate items and no separate payment will be made therefor.

END OF SECTION 501

SECTION 502 – CONCRETE STRUCTURES

DESCRIPTION

502.01.01 GENERAL

A. This work shall consist of furnishing and placing Portland cement concrete in bridges, culverts, headwalls, retaining walls, barrier rail, and all other types of concrete structures.

B. The concrete structures shall be constructed to the lines and grades given by the Engineer and in accordance with the design shown on the plans.

C. The concrete shall be of the class or classes of concrete specified in the contract documents and shall conform to the requirements of Section 501, "Portland Cement Concrete," unless otherwise specified.

D. This work shall also include construction of headwalls, wingwalls, u-channels, trapezoidal channels, stilling basins, outlet structures, connection and transition/splitter structures, and pre-cast concrete box culverts. This shall include the construction of temporary head walls necessary to support the travel lanes and/or work adjacent to the excavation for the reinforced concrete box culvert and roadway.

MATERIALS

502.02.01 GENERAL

A. The materials used shall be those prescribed for the several items which constitute the finished work and shall conform to the requirements for such materials in the following sections:

Materials	Section
Portland Cement Concrete	501
Concrete Curing Materials and Admixtures	702
Joint Material	707
Reinforcement	713
Miscellaneous Metal	712
Elastomeric Bearing Pads	725

CONSTRUCTION

502.03.01 DEPTH OF FOOTINGS

A. The elevation of the bottoms of footings as shown on the plans shall be considered as approximate only and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be necessary to secure a satisfactory foundation.

502.03.02 FORMS

A. All forms shall be built mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations.

1. Forms previously used shall be thoroughly cleaned of all dirt, mortar, and foreign matter before being reused.
2. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly coated with an approved coating or form oil.
3. Coating or form oil shall leave no film on the surface of the form that can be absorbed by the concrete.
4. When required by the Engineer and immediately before placing concrete, the forms shall be thoroughly wetted with water.

B. When requested by the Engineer, the Contractor shall submit detailed plans of form work for examination by the Engineer. If such plans are not satisfactory to the Engineer, the Contractor shall make such changes as may be required, but it is understood that the Engineer's concurrence in the use of the plans as submitted or corrected shall in no way relieve the Contractor of responsibility in obtaining satisfactory results.

C. The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours.

1. The design of the forms shall take into account the effect of vibration on the concrete as it is placed.
2. Forms shall be filleted at all exposed corners unless corners are rounded as hereinafter provided.
    a. Triangular molding used for fillets shall have 2 equal sides.
    b. In general, the width of the equal sides of moldings shall be 3/4 inch.
    c. For massive work, such as heavy pier copings and columns, the width shall be 1-1/2 to 2 inches.
    d. Top edges of walls may be filleted or rounded as hereinafter provided for curbs.
    e. Top edges of curbs and slabs shall be rounded with an edging tool to a radius of 1/2 inch to 3/4 inch.

D. When concrete is placed in excavation, forms shall be provided for all vertical surfaces unless otherwise permitted by the Engineer.

1. On thin walls, such as abutments, wing walls, and retaining walls, the forms on 1 face may be built up as the concrete is poured, but only to such elevation as will permit proper placing and thorough spading, and in no case greater than the height which can be placed in 1 day's run.
2. Ports shall be provided in high, thin walls to permit thorough cleaning before placing concrete.
3. If the forms develop any defects, such as bulging or sagging, after the concrete has been placed, that portion of the work shall be corrected in a manner satisfactory to the Engineer, without additional compensation to the Contractor.
4. During the erection and after the completion of the forms, the forms shall be protected in such a manner as to preclude shrinkage, warping, curling, and distortion.

5. Form lumber used a second time shall be free from bulge or warp and shall be thoroughly cleaned.

E. Forms for concrete over or in the vicinity of operating railroads shall be so constructed and placed that standard clearances demanded by the railroad company will be maintained at all times.

F. The falsework and forms supporting the bottom slab of the superstructure of box girder structures shall remain in place until the curing period of the deck of the superstructure has expired.

1. Unless otherwise permitted by the Engineer, forms for the webs of box girders shall be removed before the deck slab is poured.

2. All interior forms in box girders, except those permitted to remain in place, shall be completely removed and the inside of the box girder cleared of all loose material and swept clean.

G. Side Forms:

1. Side forms for beams, girders, columns, railing, or other members of the structure wherein the forms do not resist dead load bending may be removed as specified in ***Subsection 502.03.11, "Removal of Falsework Forms."***

2. The side forms for arch rings, columns, and piers shall be removed before the members of the structure which the forms support are poured or placed, so that the quality of the concrete may be inspected.

3. All such side forms shall be so constructed that the forms may be removed without disturbing other forms which resist direct load or bending stresses.

H. The condition of the forms will have a direct bearing upon the amount of finishing required.

I. Form Requirements and Physical Design:

1. Full pieces of forms shall be used and shall extend from the bottom to the top of the wall or post.

2. Curved surfaces shall be formed to provide a smooth surface without visible breaks.

3. The forms shall be so constructed that portions, where finishing is required, may be removed without disturbing portions of forms to remain.

4. Forms shall be of sufficient strength to carry the dead weight of the concrete as a liquid without a deflection in excess of L/270, and if such deflection occurs, the deflection shall be sufficient cause for rejection of the work.

5. Forms for girders and slabs shall be cambered in such amounts as may be required by the Engineer.

6. Approved form clamps or bolts shall be used to fasten forms. The use of ties consisting of twisted wire loops to hold forms in position during the placing of concrete will not be permitted.

7. Bolts or form clamps shall be positive in action and shall be of sufficient strength and number to prevent spreading of the forms.

a. The clamps shall be of such type that the clamps can be entirely removed or cut back sufficiently to allow finishing of the concrete.

b. All forms for the outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales.

8. Plywood for forms shall be "exterior type" of the grade Concrete-Form Exterior.

a. Plywood form panels shall be furnished and placed in 4-foot widths and in uniform lengths of not less than 8 feet, except where the dimensions of the member form are less than the specified panel dimensions.

b. Where form panels are attached directly to the studding of joints, the panel shall not be less than 5/8 inch thick.

c. Form panels less than 5/8 inch thick, otherwise conforming to the requirement herein specified, may be used with continuous backing of 1 inch nominal thickness surfaced material.

d. All form panels shall be placed in a neat symmetrical pattern subject to the approval of the Engineer.

e. The panel shall be placed with the long dimensions perpendicular to the studs.

9. Plywood for left-in-place forms in box girders may be of any grade and thickness that will satisfy the other requirements of this subsection.

10. Fabricated stay-in-place metal forms may be used for concrete floor slabs at the Contractor's option when so noted on the plans.

11. Metal forms to remain in place for concrete floor slabs shall be fabricated from steel conforming to ASTM A466 (Grades A through E) having a coating class of G165.

12. The following criteria shall govern the design of permanent stay-in-place steel bridge deck forms:

a. The steel forms shall be designed on the basis of dead load of form, reinforcement, and plastic concrete plus 50 pounds per square foot for construction loads. The unit working stress in the steel sheet shall not be more than 0.725 of the specified minimum yield strength of the material furnished, but shall not exceed 36,000 pounds per square inch.

b. Deflection under the weight of the forms, the plastic concrete and reinforcement shall not exceed L/180 of the form span or 1/2 inch, whichever is less, but in no case shall this loading be less than 120 psf total.

c. The permissible form camber shall be based on the actual dead load condition. Camber shall not be used to compensate for deflection in excess of foregoing limits.

d. The design span of the form sheets shall be the clear span of the form plus 2 inches measured parallel to the form flutes.

e. Physical design properties shall be computed in accordance with requirements of the American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members, latest published edition.

f. All reinforcement shall have minimum concrete cover of 1 inch.

g. The plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck shall be maintained.

h. Permanent steel bridge deck form shall not be considered as lateral bracing for compression flanges of supporting structural members.

i. Permanent steel bridge deck form shall not be used in panels where longitudinal deck construction joints are located between stringers.

j. Welding shall not be permitted to flanges in tension or to structural steel bridge elements fabricated from nonweldable grades of steel.

J. Fabricator's shop and erection drawings shall be submitted to the Engineer for approval. These drawings shall indicate the material properties and grade of steel, the properties of geometric sections for all permanent steel bridge deck form sheets, and all locations where the forms are in the vicinity of steel beam flanges subject to tensile stresses.

K. Form Supports:

1. Form sheets shall not be permitted to rest directly on the top of the stringer or floor beam flanges.

2. Sheets shall be securely fastened to form supports and shall have a minimum bearing length of 1 inch at each end.

3. Form supports shall be placed in direct contact with the flange of stringer or floor beam.

4. All attachments shall be made by permissible welds, bolts, clips, or other approved means.

5. Welding of form supports to flanges of steel not considered weldable and to portions of flange subject to tensile stresses shall not be permitted.

6. Welding and welds shall be in accordance with the provisions of AWS D2.0 pertaining to fillet welds except that 1/8-inch fillet welds will be permitted.

L. Any permanently exposed form metal where the galvanized coating has been damaged shall be thoroughly cleaned, wire brushed, and painted with 2 coats of zinc oxide zinc dust primer, Federal Specification TT-P-641D, Type II, no color added, to the satisfaction of the Engineer. Minor heat discoloration in areas of welds need not be touched up.

M. Transverse construction joints shall be located at the bottom of the flute and 1/4-inch weep holes shall be field drilled at not more than 12 inches on center along the line of the joint.

N. Emphasis shall be placed on proper vibration of the concrete to avoid honeycomb and voids.

1. Pouring sequences, procedures, and mixes shall be approved by the Engineer.

2. Calcium chloride or any other admixture containing chloride salts shall not be used in the concrete placed on permanent steel bridge deck forms.

O. The Contractor's method of construction shall be carefully observed during all phases of the construction of the bridge deck slab.

1. These phases include installation of the metal forms; location and fastening of the reinforcement; composition of concrete items; mixing procedures, concrete placement, and vibration; and finishing of the bridge deck.
2. Should the Engineer determine that the procedures used during the placement of the concrete warrant inspection of the underside of the deck, the Contractor shall remove at least 1 section of the forms at a location and time selected by the Engineer for each span in the contract.
3. This should be done as soon after placing the concrete as practicable in order to provide visual evidence that the concrete mix and the Contractor's procedures are obtaining the desired results.
4. An additional section shall be removed if the Engineer determines that there has been any change in the concrete mix or procedures warranting additional inspection.

P. After the deck concrete has been in place for a minimum period of 2 days, the concrete shall be tested for soundness and bonding of the forms by sounding with a hammer as directed by the Engineer.

1. If areas of doubtful soundness are disclosed by this procedure, the Contractor will be required to remove the forms from such areas for visual inspection after the pour has attained adequate strength.
2. This removal of the permanent steel bridge deck forms shall be at no additional cost to the Contracting Agency.
3. At locations where sections of the forms are removed, the Contractor will not be required to replace the forms, but the adjacent metal forms and supports shall be repaired to present a neat appearance and ensure their satisfactory retention.
4. As soon as the form is removed, the concrete surfaces will be examined for cavities, honeycombing and other defects.
5. If irregularities are found, and it is determined by the Engineer that these irregularities do not justify rejection of the work, the concrete shall be repaired as the Engineer may direct and shall be given an Ordinary Surface Finish.
6. If the concrete where the form is removed is unsatisfactory, additional forms, as necessary, shall be removed to inspect and repair the slab, and the Contractor's methods of construction shall be modified as required to obtain satisfactory concrete in the slab.
7. All unsatisfactory concrete shall be removed or repaired as directed by the Engineer.

Q. The amount of sounding and form removal may be moderated, at the Engineer's discretion, after a substantial amount of slab has been constructed and inspected, if the Contractor's methods of construction and the results of the inspections as outlined above indicate that sound concrete is being obtained throughout the slabs.

502.03.03 FALSEWORK

A. Detailed plans of the falsework or centering shall be furnished by the Contractor to the Engineer in accordance with ***Subsection 105.02, "Plans and Working Drawings,"*** for

any structures having a clear cast-in-place span of 20 feet or over or any cast-in-place structure over traffic. If such plans are not satisfactory to the Engineer, the Contractor shall make such changes in the plans as may be required.

B. In addition to the detailed drawings of the falsework or centering which are to be furnished to the Engineer as specified herein, the Contractor shall also furnish the Engineer with a copy of falsework or centering design calculations.

C. All falsework or centering shall be designed and constructed to provide the necessary rigidity and to support the loads.

1. Falsework for the support of superstructures for box girder spans shall be designed to support the loads that would be superimposed were the entire superstructure poured at 1 time.

2. For designing falsework and centering, a weight of 150 pounds per cubic foot shall be assumed for green concrete (120 pounds for lightweight concrete) and an allowance of not less than 25 pounds per cubic foot for forms, live load, and impact.

3. Falsework or forms shall be constructed to produce in the finished structure the lines and grades indicated on the plans.

4. Suitable screw jacks or wedges in pairs shall be used in connection with falsework or centering to set the forms to grade or cambered as shown on the plans, or to take up any settlement in the form work either before or during the placing of concrete.

5. Excessive use of blocking and shims shall be cause for rejection of the falsework.

6. Falsework failures shall become the sole responsibility of the Contractor.

D. Immediately prior to placing bridge or slab concrete, the Contractor shall check all falsework and wedges or jacks and shall make all necessary adjustments.

1. Care shall be exercised to ensure that settlement and deflection due to the added weight of the deck or slab concrete will be minimal.

2. Suitable means such as telltales shall be provided by the Contractor to permit ready measurement of settlement and deflection as it occurs.

E. Falsework or centering shall be founded on a solid footing safe from undermining and protected from softening. Falsework which cannot be founded on a satisfactory footing shall be supported on piling which will be spaced, driven, and removed in a manner approved by the Engineer.

F. Arch span shall be removed uniformly and gradually beginning at the crown and working toward the spring, to permit the arch to take its load slowly and evenly. Centering for bridges having 2 or more adjacent arch spans will be struck simultaneously.

G. Falsework supporting the main carrying members of all continuous structures shall not be removed from any span until all spans between expansion joints are cured.

H. Falsework and forms left in place in the cells of box girders shall not exceed 12 pounds per square foot of deck. All supports between the top and bottom slabs in the cells of box girders shall be water soaked for a period of not less than 48 hours.

502.03.04 REINFORCEMENT

A. Reinforcing shall be furnished and placed as shown on the plans and in accordance with the applicable provisions of ***Section 505, "Reinforcing Steel,"*** of these specifications.

502.03.05 COFFERDAMS AND CRIBS

A. Cofferdams for foundation construction shall be carried well below the bottom of the footings and shall be well braced and as watertight as practical. The interior dimensions of cofferdams shall be such as to provide sufficient clearance for constructing forms and, when no seal is placed, to permit pumping outside the forms.

B. The Contractor shall submit for approval, drawings showing proposed method of construction of cofferdams or cribs in accordance with ***Subsection 105.02, "Plans and Working Drawings."***

1. Approval of such drawings shall in no way relieve the Contractor of Contractor's responsibility under the contract for the successful completion of the improvement.

2. Cofferdam construction shall not start before the submitted drawings are approved and returned.

C. After the completion of the substructure, the cofferdams with all sheeting and bracing shall be removed to 1 foot below the stream bed, by the Contractor, and such removal shall be performed in such a manner as not to disturb or mar the finished concrete foundation. Removal of cofferdams, sheeting, and bracing shall be considered subsidiary to other pay items of work and no further payment will be made therefor.

502.03.06 PUMPING WATER

A. Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete.

B. No pumping will be permitted during the placing of concrete or for a period of at least 24 hours thereafter, unless it be done from a suitable pump separated from the concrete work by a watertight wall or other effective means.

C. Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure.

502.03.07 MIXING CONCRETE

A. All concrete shall be mixed and proportioned as specified in ***Section 501, "Portland Cement Concrete."***

502.03.08 HANDLING AND PLACING CONCRETE

A. **General.** In preparation for the placing of concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from the interior of forms.

1. Struts, stays, and braces serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary.

2. These temporary members shall be entirely removed from the forms and not buried in the concrete.

B. No concrete shall be used which does not reach its final position in the forms within the time and temperature stipulated under ***Section 501, "Portland Cement Concrete."***

C. Surfaces on which concrete is to be placed shall be thoroughly moistened with water immediately before placing concrete.

D. Concrete shall be placed so as to avoid segregation of the material and the displacement of the reinforcement.

1. The use of long troughs, chutes, and pipes for conveying concrete from the mixer to the forms shall be permitted only on written authorization of the Engineer.

2. In case an inferior quality of concrete is produced by the use of such conveyors, the Engineer may order discontinuance of their use and the substitution of a satisfactory method of placing.

3. Open troughs and chutes shall be of metal or metal lined; where steep slopes are required, the chutes shall be equipped with baffles or be in short lengths that reverse the direction of movement.

4. All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run; water used for flushing shall be discharged clear of the structure.

E. When placing operations would involve dropping the concrete more than 5 feet, concrete shall be deposited through sheet metal or other approved pipes, except when placing concrete for thin vertical walls less than 15 inches thick, double belting may be used in lieu of adjustable pipes or elephant trunks.

1. As far as practicable, the pipes shall be kept full of concrete during placing and the lower ends of pipe shall be kept buried in the newly placed concrete.

2. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the projecting ends of reinforcement bars.

F. All concrete placed in concrete structures, except tremie seal concrete, shall be compacted by means of mechanical vibration subject to the following provisions:

1. The number of vibrators employed shall be ample to consolidate incoming concrete to a proper degree within 15 minutes after concrete is deposited in the forms. In all cases, at least 2 vibrators shall be available at the site of the structures in which more than 25 cubic yards is being placed.

2. The vibration shall be internal unless special authorization of other methods is given by the Engineer or as provided herein.

3. Vibrators shall be capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.

4. The intensity of vibration shall be such as to visibly affect a mass of concrete of 1-inch slump over a radius of at least 18 inches.

5. Vibrators shall be manipulated to thoroughly work the concrete around the reinforcement and imbedded fixtures and into the corners and angles of the forms.

6. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators shall be inserted and withdrawn out of the concrete slowly.

7. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued at any 1 point to the extent that localized areas of grout are formed.

8. Application of vibrators shall be at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibly effective.

9. Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration.

10. Vibration shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

11. Vibration shall be supplemented by such spading as is necessary to ensure smooth surfaces and dense concrete, along form surfaces and in corners and locations impossible to reach with the vibrators.

12. The provisions of this article shall apply to the filler concrete for steel grid floor except that the vibrator shall be applied to the steel.

G. Immediately following the discontinuance of placing concrete, all accumulations of mortar splashed upon the reinforcement steel and the surface of forms shall be removed.

1. Dried mortar chips and dust shall not be puddled into the unset concrete.

2. If the accumulations are not removed prior to the concrete becoming set, care shall be exercised not to injure or break the concrete-steel bond at and near the surface of the concrete while cleaning the reinforcement steel.

H. **Culverts.**

1. The base slab or footings of box culverts shall be placed and allowed to set before the remainder of the culvert is constructed. Suitable provisions shall be made for bonding the sidewalls to the culvert base.

2. Walls and top slab shall not be constructed as a monolith on box culverts where the depth of pour below the bottom of the top slab exceeds 4 feet unless approved in writing by the Engineer. When this method of construction is used, any necessary construction joints shall be vertical and at right angles to the axis of the culvert.

3. When walls are poured separately, in non-rigid frame box culverts, the concrete in the walls shall be placed and allowed to set a minimum of 2 hours before the top slab is placed.

4. When walls are poured separately, in rigid frame box culverts, the concrete in the walls shall be placed and allowed to set a minimum of 12 hours before the top slab is placed.

5. Each wing wall shall be constructed, if possible, as a monolith. Construction joints, where unavoidable, shall be horizontal and so located that no joint will be visible in the exposed face of the wing wall above the ground line.

I. **Girders, Slabs, and Columns.**

1. When the height of a web in a "T" beam is more than 3 feet, the top slab shall be poured independently.
2. When the distance from a construction joint to the top of the web in a box girder exceeds 3 feet, the top slab shall be poured independently.
3. Concrete in slab spans shall be placed in 1 continuous operation for each span unless otherwise specified.
4. Concrete in columns shall be placed in 1 continuous operation, unless otherwise specified. The concrete shall be allowed to set at least 12 hours before the succeeding pour is started.
5. Before pouring concrete for superstructure, the forms on base of columns shall be exposed sufficiently to determine the character of the concrete in the columns.

502.03.09 CONCRETE DEPOSITED UNDER WATER

A. If conditions render it impossible or inadvisable, in the opinion of the Engineer, to dewater excavation before placing concrete, the Contractor shall deposit under water, by means of a tremie or underwater bottom dump bucket, a seal course of concrete of sufficient thickness to thoroughly seal the cofferdam.

1. The concrete shall be carefully placed in a compact mass and shall not be disturbed after being deposited.
2. Still water shall be maintained at the point of deposit.

B. The use of an aluminum tremie for placing concrete is prohibited.

C. A tremie shall consist of a watertight tube having a diameter of not less than 10 inches with a hopper at the top.

1. The tube shall be equipped with a device that will prevent water from entering the tube while charging the tube with concrete.
2. The tremie shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering when necessary to retard or stop the flow of concrete.
3. The tremie shall be filled by a method that will prevent washing of the concrete.
4. The discharge end shall be completely submerged in concrete at all times and the tremie tube shall contain sufficient concrete to prevent any water entry.
5. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete.
6. The flow shall be continuous until the work is completed and the resulting concrete seal shall be monolithic and homogeneous.

D. The underwater bucket shall have an open top and the bottom doors shall open freely and outward when tripped.

1. The bucket shall be completely filled and slowly lowered to avoid backwash and shall not be dumped until it rests on the surface upon which the concrete is to be deposited.

2. After discharge, the bucket shall be raised slowly until well above the concrete.

E. Concrete deposited in water shall be in accordance with ***Section 501, "Portland Cement Concrete,"*** with 10 percent extra cement added.

1. The exact thickness of the seal will depend upon the hydrostatic head, bond, and spacing of piles, size of cofferdam, and other related factors, but in no case shall the seal be less than 2 feet in thickness, unless otherwise shown on the plans.

2. Before dewatering, the concrete in the seal shall be allowed to cure for not less than 5 days after placing.

F. If a seal which is to withstand hydrostatic pressure is placed in water having a temperature below 45 degrees F, the curing time before dewatering shall be increased.

1. Periods of time during which the temperature of the water has been continuously below 38 degrees F shall not be considered as curing time.

2. After sufficient time has elapsed to ensure adequate strength in the concrete seal, the cofferdam shall be dewatered and the top of the concrete cleaned of all scum, laitance, and sediment.

3. Before fresh concrete is deposited, local high spots shall be removed as necessary to provide proper clearance for reinforcing steel.

G. Groundwater may be encountered on this project. In such case, the Contractor will dewater the excavated area and subbase for the concrete structures improvements in such a manner that the concrete will not be placed in any standing water.

502.03.10 CONSTRUCTION JOINTS

A. Construction joints shall be made only where located on the plans or shown in the pouring schedule, unless otherwise approved by the Engineer.

B. Construction joints where the placing of concrete is delayed until the concrete has taken its initial set and for which no expansion is provided, shall be planned in advance and shall be subject to approval by the Engineer.

1. The placing of concrete shall be continuous from joint to joint.

2. These joints shall be perpendicular to the principal lines of stress and, in general, located at points of minimum shear.

3. Only joints shown on the plans will be permitted in a cantilevered member.

4. Horizontal joints at piers and abutments, except where specified, shall be avoided, and when used shall not be located within 2 feet of the normal water level.

C. Unless otherwise specified, construction joints shall be struck off but not troweled.

D. When making a horizontal construction joint, care shall be taken to have the concrete as dry as possible, and any excess water or creamy material shall be drawn off before the concrete sets. On all exposed surfaces, the line of the proposed joint shall be made

straight by placing a temporary straightedge on the inside of the form and pouring the concrete so that it will set flush with the edge as provided.

E. To avoid visible joints as far as possible upon exposed faces, the top surfaces of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather edge" might be produced at a construction joint, as in the slope top surface of a wing wall, an insert form block shall be used to produce a blocked out portion in the proceeding layer which shall produce an edge thickness of not less than 6 inches in the succeeding layer.

F. When the work is unexpectedly interrupted by breakdowns, storm, or other causes, and the concrete as placed would produce an improper construction joint, the Contractor shall either rearrange the freshly deposited concrete or continue by hand mixing, if necessary, until a suitable arrangement is made for a construction joint. When such a joint occurs at a section on which there is shearing stress, the Contractor shall provide adequate mechanical bond across the joint by inserting reinforcing steel or by some other means satisfactory to the Engineer, which will prevent a plane of weakness.

G. In resuming work, the surface of the concrete previously placed shall be thoroughly cleaned of dirt, scum, laitance, or other soft or porous materials by 1 of the following methods:

1. Concrete surface of fresh concrete (not more than 8 hours after placement) shall be cleaned with air and water jets in such a manner that the surface is thoroughly cleaned and the aggregate is not loosened.

2. Hardened concrete surface (more than 8 hours after placement) shall be cleaned by abrasive blast methods in such a manner that the aggregate is not loosened or the edges of the concrete shattered.

H. The surface of the joint shall be thoroughly washed with clean water and the forms tightened to close contact with the previously placed work, after which the concreting may proceed. The surface of the joint shall be wet just prior to placing new concrete.

502.03.11 REMOVAL OF FALSEWORK AND FORMS

A. **General.**

1. Methods of form removal likely to cause overstressing of the concrete shall not be used.

   a. Forms and their supports shall not be removed without the approval of the Engineer.

   b. Supports shall be removed in such a manner as to permit the concrete to uniformly and gradually take the stresses due to its own weight.

2. Compressive strengths will be determined by ASTM C39 and ASTM C31 and will be considered information tests only and not acceptance tests as described in ***Subsection 501.02.04, "Concrete Making Properties."***

3. Comply with ***Subsection 501.03.09, "Curing."***

B. **Falsework.**

1. Where stresses will be placed on the concrete, in arch centers, centering under beams and girders, and in floor slabs, falsework shall not be removed until the

concrete has reached an age of 10 days and it has reached 75 percent of the required 28-day compressive strength.

2. In the event of cold weather, the 10-day time requirements shall be increased 1 day for every day the curing time is increased as prescribed in ***Subsection 501.03.10.B, "Cold Weather — General."***

3. In case the concrete does not reach the desired strength within the time specified, the Engineer shall determine when the strength is adequate to allow removal of falsework.

4. Form removal and replacement with shoring will not be permitted.

C. **Forms.**

1. Forms on parapets and curbs shall not be removed until concrete has set sufficiently to prevent distorting or cracking.

2. Forms for columns, walls, side of beams, girders and all other parts that are not subjected to stress shall not be removed until the concrete has reached a minimum age of 40 hours unless authorized by the Engineer.

3. Forms that are subjected to stresses shall not be removed until the requirements of Subsection 502.03.11.B have been satisfied, unless otherwise approved by the Engineer.

502.03.12 EXPANSION AND FIXED JOINTS AND BEARINGS

A. All joints shall be constructed according to details shown on the plans and as specified in this subsection.

B. **Open Joints.**

1. Open joints shall be placed in the locations shown on the plans and shall be constructed by the insertion and subsequent removal of a wood strip, metal plate, or other approved material.

2. The insertion and removal of the template shall be accomplished without chipping or breaking the corners of the concrete.

3. Reinforcement shall not extend across an open joint unless so specified on the plans.

C. **Filled Joints.**

1. Poured expansion joints shall be constructed similar to open joints.

2. When premolded types are specified, the filler shall be placed in correct position before concrete is placed against the filler.

3. Holes and joints in the filler shall be filled with mastic to prevent the passage of mortar or concrete from 1 side of the joint to the other.

4. The edges of the concrete at the joint shall be edger finished.

D. **Steel Joints.**

1. The plates, angles, or other structural shapes shall be accurately shaped, at the shop, to conform to the section of the concrete floor.

2. The fabrication and painting shall conform to the requirements of these specifications covering those items.
3. When called for on the plans or in the Special Provisions, the materials shall be galvanized in lieu of painting.
4. Care shall be taken to ensure that the surface in the finished plane is true and free of warping.
5. Positive methods shall be employed in placing the joints to keep the joints in correct position during the placing of the concrete.
6. The opening at expansion joints shall be that designated on the plans at normal temperature, and care shall be taken to avoid impairment of the clearance in any manner.

E. **Waterstops.**

1. Waterstops shall be furnished and installed in accordance with the details shown on the plans.
2. The edge of the waterstop shall be supported in a manner satisfactory to the Engineer.
3. Waterstops shall be manufactured from either natural rubber, synthetic rubber, or polyvinyl chloride (PVC) at the option of the Contractor.
4. Waterstops shall be manufactured with an integral cross section which shall be uniform within ±1/8 inch in width, and the web thickness or bulb diameter, within +1/16 inch and -1/32 inch .
    a. No splices will be permitted in straight strips.
    b. Strips and special connection pieces shall be well cured in a manner such that any cross section shall be dense, homogeneous, and free from porosity.
    c. Junctions in the special connection pieces shall be fully molded.
    d. During the vulcanizing period, the joint shall be securely held by suitable clamps.
    e. The material at the splices shall be dense and homogeneous throughout the cross section.
5. Field splices for either natural or synthetic rubber waterstops shall be either vulcanized, mechanical, using stainless steel parts, or made with a rubber splicing union of the same stock as the waterstop, at the option of the Contractor. All finished splices shall have a full size tensile strength of 600x (width in inches) pounds.
6. Field splices for polyvinyl chloride waterstops shall be formed by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations.
    a. A thermostatically controlled electric source of heat shall be used to make all splices.
    b. The heat shall be sufficient to melt but not char the plastic.

7. Waterstops, when being installed, shall be cut and spliced at changes in direction as may be necessary to avoid buckling or distortion of the web or flange.

F. **Bearing Devices.**

1. Bearing plates, bars, rockers, assemblies, and other expansion or fixed devices shall be constructed in accordance with the details shown on the plans and shall be hot-dip galvanized after fabrication in accordance with ***Section 715, "Galvanizing."***

2. Structural steel and cast steel shall conform to the provisions in ***Section 506, "Steel Structures,"*** for those items.

3. The bearing plates shall be set level and the rockers or other expansion devices shall be set to conform to the temperature at the time of erection or to the setting specified.

4. When bearing assemblies or masonry plates are shown on the plans to be placed (not embedded) directly on concrete, the concreted bearing area shall be constructed slightly above grade and shall be finished by grinding or other approved means to a true level plane which shall not vary perceptibly from a straightedge placed in any direction across the area. The finished plane shall not vary more than 1/8 inch from the elevation shown on the plans.

5. When elastomeric bearing pads, elastic bearing pads, preformed fabric pads, or asbestos sheet packing are shown on the plans, the concrete surfaces on which pads or packing are to be placed shall be wood float finished to a level plane which shall not vary more than 1/16 inch from a straightedge placed in any direction across the area. The finished plane shall not vary more than 1/8 inch from the elevation shown on the plans.

6. Where bearing assemblies or masonry plates are shown on the plans to be placed on grout pads, they shall be placed in accordance with the provisions in ***Subsection 506.03.25, "Bearing and Anchorage."***

G. **Elastomeric Bearing Pads.**

1. Pads over 1 inch in thickness shall be laminated.

2. Laminated pads shall consist of alternate laminations of elastomer and metal or elastomer and fabric bonded together.

3. All elastomeric bearing pads shall be 50 durometer.

4. Pads shall be installed where designated on the plans.

502.03.13 CURING

A. Curing of formed concrete shall conform to the requirements of ***Subsection 501.03.09, "Curing."***

502.03.14 PATCHING

A. After removal of forms, all metal ties except those to be used to aid future forming shall be cut back and patched.

1. Honeycomb shall be removed and patched.

2. When honeycomb is determined by the Engineer to be excessive, the excessive honeycombing shall be sufficient cause for rejection of all or a part of the structure.

B. Loose or broken material shall be chipped away until a dense, uniform surface exposing solid coarse aggregate is obtained.

1. Feather edges shall be cut away to form a face perpendicular to the surface being patched.

2. All surfaces of the cavity shall be thoroughly saturated with water.

3. Contact surfaces shall be coated with an approved bonding agent.

4. Bonding agent may be mixed with mortar in lieu of coating the contact surfaces.

C. Patching mortar shall consist of 1 part cement and 3 parts sand.

1. White cement or other approved tinting materials shall be used on all surfaces where an "ordinary finish" is final.

2. For patching large or deep areas, coarse aggregate shall be added to the patching mortar.

D. The patching mortar shall be thoroughly tamped into place.

1. Mortar may be placed pneumatically when approved by the Engineer.

2. The surface of the mortar shall be floated with a wooden float before initial set takes place.

3. The patch shall present a neat and workmanlike appearance.

E. The patched surface shall be cured by 1 of the methods described in ***Subsection 501.03.09, "Curing."***

F. Patching is the only treatment required for those portions of the structure below ground.

502.03.15 FINISH OF HORIZONTAL SURFACES

A. Concrete bridge decks shall be struck off with a template immediately after pouring to provide the proper crown and shall be finished to a smooth even surface by means of both longitudinal and transverse wooden floats, or other suitable means.

1. When a transversely broomed finish is used, the allowable variations noted herein shall be independent of the depth of the broom marks.

2. No variations will be permitted that will tend to prevent complete drainage on all parts of the deck.

3. The surface shall be corrected by grinding off the high spots, or other approved method, as may be required to conform to these limits.

4. An edging tool shall be used at expansion joints and deck edges not armored.

B. Approach slabs to concrete bridges shall be finished to the tolerances specified for bridge decks.

C. Finishing Bridge Decks.

1. A smooth riding surface of uniform texture, true to the required grade and cross section, shall be obtained on all bridge roadway decks.

2. The Contractor may use hand tools, or finishing machines, or a combination of both, conforming to the requirements specified herein for finishing bridge roadway deck concrete.

3. Finishing of concrete placed in bridge decks shall consist of striking off the surface of the concrete as placed and floating with longitudinal floats the surface so struck off.

4. The placing of concrete in bridge roadway decks will not be permitted until the Engineer is satisfied that:

    a. The rate of producing and placing concrete will be sufficient to complete the proposed placing and finishing operations within the scheduled time.

    b. Experienced finishing machine operators and concrete finishers are employed to finish the deck.

    c. Fogging equipment and all necessary finishing tools and equipment are on hand at the site of the work and in satisfactory condition for use.

5. Finishing machines shall be set up sufficiently in advance of use to permit inspection by the Engineer during the daylight hours before each pour.

6. The adjustment and operation of deck finishing machines shall be verified by moving the machine over the full length of the deck section to be placed and traversing the float completely across all end bulkheads before placement of concrete is begun.

7. Unless adequate lighting facilities are provided by the Contractor, the placing of concrete in bridge decks shall cease at such time that finishing operations can be completed during daylight hours.

8. Rails for the support and operation of finishing machines and headers for hand-operated strike off devices shall be completely in place and firmly secured for the scheduled length for concrete placement before placing of concrete will be permitted.

    a. Rails for finishing machines shall extend beyond both ends of the scheduled length for concrete placement a sufficient distance that will permit the float of the finishing machine to fully clear the concrete to be placed.

    b. Rails or headers shall be adjustable for elevation and shall be set to elevations, with allowance for anticipated settlement, camber, and deflection of falsework, as required to obtain a bridge roadway deck true to the required grade and cross section.

    c. Rails or headers shall be of a type and shall be so installed that no springing or deflection will occur under the weight of the finishing equipment, and shall be so located that finishing equipment may operate without interruption over the entire bridge roadway deck being finished.

    d. Rails or headers shall be adjusted as necessary to correct for unanticipated settlement or deflection which may occur during finishing operations.

9. Should settlement or other unanticipated events occur, which in the opinion of the Engineer would prevent obtaining a bridge deck conforming to the requirements of

these specifications, placing of deck concrete shall be discontinued until corrective measures satisfactory to the Engineer are provided.

a. In the event satisfactory measures are not provided prior to initial set of the concrete in the affected area, the placing of concrete shall be discontinued and a bulkhead installed at the location determined by the Engineer.

b. All concrete in place ahead of the bulkhead shall be removed.

10. Unless otherwise permitted by the Engineer, bridge deck concrete shall be placed in a uniform heading approximately parallel to the bridge pier or bent caps. The rate of placing concrete shall be limited to that which can be finished before the beginning of initial set, except that concrete for the deck surface shall not be placed more than 10 feet ahead of strike-off.

11. After the concrete has been placed and consolidated, the surface of the concrete shall be carefully struck off by means of a hand-operated strike board operating on headers, or by a finishing machine operating on rails. A uniform deck surface true to the required grade and cross section shall be obtained.

12. Following strike off, the surface of the concrete shall be floated longitudinally.

a. In the event strike off is performed by means of a hand-operated strike board, 2 separate hand-operated float boards for longitudinal floating shall be provided.

b. The first float shall be placed in operation as soon as the condition of the concrete will permit and the second float shall be operated as far back of the first float as the workability of the concrete will permit.

13. In the event the strike off is performed with a finishing machine, longitudinal floating of the concrete shall be performed by means of a hand-operated float board or a finishing machine equipped with a longitudinal wooden float.

a. The longitudinal wooden float on the finishing machine shall have a length of not less than 8 feet nor more than 12 feet.

b. When both strike off and longitudinal floating are to be performed by finishing machines, 1 machine, with operator, shall be used for strike off and a second machine, with second operator, shall be used for longitudinal floating.

c. Longitudinal floating may be performed with the same finishing machine that is used for strike off provided that the length of deck unit being placed is not more than 30 feet and the strike off operation is completed for the deck unit before the condition of the concrete requires that longitudinal floating be started.

14. Finishing machines used for strike off having a wheel base 6 feet or less shall be followed by 2 separate hand-operated float boards for longitudinal floating. All the provisions in this section pertaining to hand-operated float boards shall apply to the 2 separate float boards for longitudinal floating.

15. Longitudinal floats, either hand-operated or machine-operated, shall be used with the long axis of the float parallel to the centerline of the bridge roadway.

a. The float shall be operated with a combined longitudinal and transverse motion planing off the high areas and floating the material removed into the low areas.

b. Each pass of the float shall lap the previous pass by 1/2 the length of the float.

c. Floating shall be continued until a smooth riding surface is obtained.

D. In advance of curing operations, the surface of the concrete shall be textured by brooming with a stiff bristled broom or by other suitable devices which will result in uniform scoring. Brooming shall be performed transversely from finishing bridges.

E. Hand-operated float boards shall be from 12 feet to 16 feet long, ribbed and trussed as necessary to provide a rigid float and shall be equipped with adjustable handles at each end.

1. The float shall be wood, not less than 1 inch thick and from 4 inches to 8 inches wide.

2. Adjusting screws spaced at not to exceed 24 inches on centers shall be provided between the float and the rib.

3. The float board shall be maintained true and free of twist.

F. Hand-operated float boards shall be operated from transverse finishing bridges.

1. The finishing bridges shall span completely the roadway area being floated and a sufficient number of finishing bridges shall be provided to permit operation of the floats without undue delay.

2. Not less than 2 transverse finishing bridges shall be provided when hand-operated float boards are used.

3. When a finishing machine is used for longitudinal floating, 1 finishing bridge equivalent to the transverse finishing bridge specified herein shall be furnished for use by the Engineer.

G. Finishing bridges shall be of rigid construction and shall be free of wobble and springing when used by the operators of longitudinal floats and shall be easily moved.

H. Fogging equipment furnished shall be capable of applying water to the concrete in the form of a fine fog mist in sufficient quantity to curb the effects of rapid evaporation of mixing water from the concrete on the deck. The fog mist shall be applied at the time and in the manner approved by the Engineer.

I. Immediately following completion of the deck finishing operations, the concrete in the deck shall be cured as specified in ***Subsection 501.03.09, "Curing."***

J. The finished surface of the concrete shall be tested by means of a straightedge 12 feet long.

1. The surface shall not vary more than 0.01 foot from the lower edge of the straightedge.

2. All high areas in the hardened surface in excess of 0.01 foot as indicated by testing shall be removed by abrasive means.

3. After grinding by abrasive means has been performed, the surface of the concrete shall not be smooth or polished, but shall have a surface texture satisfactory to the Engineer.

4. Ground areas shall be of uniform texture and shall present neat and approximately rectangular patterns.

K. Where the concrete of the bridge deck is to be covered by bituminous surfacing, earth, or other cover, 1 inch or more in thickness, the surface of the concrete shall not vary more than 0.03 feet from the lower edge of the 12-foot straightedge.

L. Bridge deck surfaces under the curbs, railings, and sidewalks shall be struck off to the same plane as the roadway and left undisturbed when future widening is shown on the plans.

M. The top and face of the finished parapet and curb shall be true and straight, and the top surface shall be of uniform width, free from humps, sags, or other irregularities. When a straightedge 12 feet long is laid on top of the face of the curb or on the face of the parapet, the surface shall not vary more than 1/8 inch from the theoretical grade or alignment in 12 feet, except that proper allowance shall be made for curves and camber.

N. Manual methods, other than specified in this subsection, or other machine methods for finishing bridge deck concrete may not be permitted, unless directed by Engineer.

502.03.16 FORMED SURFACES REQUIRING FINISHING

A. Structures requiring a "fine surface finish (F.S.F.)" will be noted on the plans.

B. All structures not requiring a fine surface finish shall be given an ordinary surface finish.

C. Only exposed surfaces of structures will require finishing (ordinary or fine).

D. Exposed surfaces are defined as follows:

1. Exterior vertical faces of slab spans, rigid frames, arches, and box girders.

2. The underside of overhanging slabs to point of junction of the supporting beams.

3. Vertical surfaces of piers, columns, bent caps, abutments, wing walls, and retaining walls which are exposed to view after all backfill and embankment is placed. Exposed surfaces in this case are considered to extend to 1 foot below finished grade.

4. The inside of culvert barrels over 4 feet in height for the same distance as the height of the opening when seen from a traveled way.

5. The underside of superstructures in urban areas.

502.03.17 ORDINARY SURFACE FINISH

A. The surface shall have all holes left by form ties and all other holes 1/4 inch or more in largest diameter repaired in accordance with ***Subsection 502.03.14, "Patching."*** The surface shall be true and even, free from stone pockets, depressions, or projections beyond the surface.

B. All fins and projections shall be knocked off or ground flush. Offsets greater than 1/8 inch shall be filled or tapered back to present a smooth appearance. A uniform color and appearance shall be obtained on all patched surfaces.

502.03.18 FINE SURFACE FINISH

A. Where it is indicated on the plans that a fine surface finish is required, the finish shall conform to the requirements for "Bonded Grout Finish" as specified below.

1. Before the finish is applied, the surface shall be true and even and free from stone pockets, depressions, or projections beyond the surface.
2. All fins and projections shall be knocked off or ground flush.
3. Offsets greater than 1/8 inch shall be filled or tapered back to present a smooth appearance.
4. All holes 1/4 inch or more in largest diameter shall be patched in accordance with ***Subsection 502.03.14, "Patching."***

B. **Bonded Grout Finish.**

1. This finish shall be an application of grout consisting of sand and other pigments and mineral fillers combined with a suitable binder.
   a. The sand shall pass a No. 30 sieve.
   b. The binder shall be either an epoxy, acrylic, vinyl, or phenolic resin.
   c. This mixture may be thinned by not more than 25 percent water by volume.
2. The finish shall be of such consistency and composition that it will provide a uniform appearance in color and texture when applied as specified below, and shall meet the requirements set forth in ***Section 727, "Concrete Surface Finishing Material."***
3. At least 30 days in advance of placing bonded grout finish, the Contractor shall furnish the Engineer a quart sample or larger, of the complete mixture for testing.
   a. The Contractor shall also furnish 2 certificates, issued by the manufacturer, certifying that the product complies with the specifications.
   b. The certificates shall be delivered to the Engineer at least 30 days in advance of placing the material.
4. The grout shall be applied by spray, using conventional spray equipment with a 1/4-inch round spray head.
   a. Material shall be supplied by either a surge pump with a 12-to-1 ratio or an auger type pump, with air pressure sufficient to achieve uniform texture.
   b. Worn spray heads shall be replaced as required to achieve a uniform finish.
5. Application shall be at the rate of 25-40 square feet per gallon.
6. The finish surface shall present a uniform appearance.
7. Color of fine surface finish to be applied will be shown on the plans. Where the color of the fine surface finish that is to be applied is not indicated on the plans, it

shall conform to Federal Color No. 37875 as shown in Table I of Federal Standard No. 595.

8. Surfaces of concrete shall be thoroughly cleaned just before applying fine surface finish. This may be accomplished by:

   a. Application of a 10 percent solution of muriatic acid or a 25 percent zinc sulfate solution, which shall be applied to completely remove oily film and to lightly etch the surface, or

   b. Thorough cleaning by an approved abrasive as required to remove all oily film.

9. Following cleaning, the surface shall be thoroughly rinsed with clean water. Surface to be finished need not be completely dry, but may be damp, prior to application of finish.

10. **CAUTION:** Do not apply finish unless temperature is at least 40 degrees F and is rising. Application shall be stopped if temperature is 40 degrees F and is dropping.

502.03.19 LIVE LOADS

A. Live loads such as traffic or superimposed earth loads shall not be allowed on the structure until concrete has reached an age of 14 days and has reached the 28-day compressive strength required.

B. Live loads may be allowed on the structure, with the approval of the Engineer, when the concrete has reached an age of 8 days and/or the 28-day compressive strength required in cases where the use of a special high-early strength concrete mix design has been approved.

C. Approach slabs shall be treated as concrete paving under ***Section 409, "Portland Cement Concrete Pavement."***

D. In the event of cold weather, the above specified time requirement shall be increased 1 day for every day the curing time is increased as prescribed in the ***Subsection 501.03.10.B, "Cold Weather — General."***

E. In case the concrete does not reach the desired strength within the time specified, the Engineer shall determine when the strength is adequate to carry live loads.

502.03.70 TEMPORARY HEAD WALL

A. The Contractor may utilize the temporary head walls for support of the required travel lane(s) and/or work areas adjacent to open excavation. If the Contractor chooses to utilize temporary head walls, the Contractor shall provide the Engineer with design plans and calculations for such head walls and/or supports. The design plans shall be in detail, showing all information as required by the Engineer, and shall bear the seal of a Nevada Registered Engineer.

END OF SECTION 502

SECTION 505 – REINFORCING STEEL

DESCRIPTION

505.01.01 GENERAL

A. This work shall consist of furnishing and placing reinforcing steel and mesh reinforcing in accordance with ACI 318 Chapter 7 and ACI 315 with the additions or exceptions listed below.

MATERIALS

505.02.01 GENERAL

A. Materials shall conform to the requirements specified in the following subsections:

Materials	Subsection
Fabricated Steel Bar or Rod Mats Reinforcement	***713.03.02***
Bar Steel Reinforcement	***713.03.01***
Welded Steel Wire Fabric Reinforcement	***713.03.03***

B. Bar steel reinforcement shall be Grade 60 bar steel reinforcement unless otherwise specified on the plans.

C. Spiral Reinforcement may be either Bar Steel Reinforcement or Steel Wire, of the equivalent size of the bar steel.

D. Epoxy coatings for steel reinforcing bars shall conform to ASTM D3963. Epoxy coatings listed in the NDOT QPL, found on the web at http://www.nevadadot.com, shall be used.

E. Tie wire shall be commercial quality 16 gage minimum, black annealed soft iron wire, unless otherwise approved. Tie wires used on epoxy coated reinforcing steel shall be coated with plastic or an equal type coating as approved.

F. At selected locations as indicated on the Contract Drawings, reinforcing steel shall be galvanized (zinc coated), in accordance with ASTM A767 or epoxy-coated.

G. At the expansion joint locations shown on the Contract Drawings or as directed by the Engineer, reinforcing steel shall be sprayed, coating the entire circumference of the bar, with a zinc-rich formulation conforming to ASTM A767.

505.02.02 SAMPLES

A. One extra bar of each diameter shall be furnished for each 100 tons or fraction thereof.

1. This bar shall be selected from the longest bar of each size so that the bar, or a portion of it, can be used to replace any bar of that diameter that is selected to be used as a field sample.

2. Supplied field sample shall be of sufficient length to provide two 30-inch samples of each diameter.

3. The extra bars shall be indicated on the fabricator's details.

505.02.03 SPECIFICATIONS FOR COATING REINFORCING STEEL

A. Coating of reinforcing steel shall conform to AASHTO M284.

4. The coating fabricator for epoxy coated reinforcing steel shall be certified by the Concrete Reinforcing Steel Institute's Certification Program for Fusion Bonded Epoxy Coating Applicator Plants.

5. A copy of the Epoxy Coating Certification along with notification starting date of coating application shall be submitted.

H. Notification shall be given of the date and location of the coating operation, in writing, at least 10 days before the planned date for beginning the coating operation.

1. The Engineer shall be allowed free access to plant of the coating applicator for inspection.

2. If the representative so elects, preparation, coating, and curing of the bars shall be performed in the representative's presence.

I. Patching or repair material that is in compliance with AASHTO M284 shall be made available from the coating manufacturer.

CONSTRUCTION

505.03.01 REINFORCING STEEL LIST

A. In accordance with ACI 315, before placing reinforcing steel, the Contractor shall submit shop drawing details and furnish 2 copies of a list of all reinforcing steel showing sizes, lengths, and numbers of pieces and bends required to the Engineer at the site for Engineer's use in administering the contract.

1. Furnishing such lists to the Engineer shall not be construed to mean that the lists will be reviewed for accuracy.

2. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing all bar reinforcing steel in accordance with the details shown on the plans and as specified.

505.03.02 PROTECTION OF MATERIALS

A. Reinforcing steel shall be protected at all times from damage.

J. When placed in the work, the reinforcing steel shall be free from dirt, detrimental scale, paint, oil, or other foreign substance.

K. However, when steel has on its surface loose mill scale or dust that is easily removable, it may be cleaned by a satisfactory method, if approved by the Engineer.

505.03.03 BENDING

A. Bent bar reinforcement shall be cold bent to the shape shown on the plans.

L. Unless otherwise provided on the plans or by authorization, bends shall be made in accordance with the ACI Manual of Standard Practice for Detailing Reinforced Concrete Structures.

505.03.04 PLACING AND FASTENING

A. In accordance with ACI 315, all bar reinforcement shall be accurately placed in the positions shown on the plans and firmly held during the placing and setting of concrete.

M. When the spacing of bars exceeds 1 foot in either direction, all intersections shall be tied.

N. Distances from the vertical and horizontal forms shall be maintained by means of stays, blocks, ties, hangers, or other approved supports.

1. Blocks used for holding reinforcing bars from contact with the forms or between layers of bars shall be precast mortar blocks of approved shape and dimensions and shall have a compressive strength of not less than 3,000 psi.

2. Metal chairs that are in contact with the exterior surface of the concrete shall be fabricated of galvanized steel, or have the steel tips plastic coated to at least 3/4 inch into the concrete, or be of stainless steel conforming to the requirements of ASTM A493, Type 430.

3. The use of pebbles, pieces of broken stone or brick, metal pipe, and wooden blocks will not be permitted.

O. Reinforcement in any member shall be placed, and then inspected and approved by the Engineer, before the placing of concrete begins. Concrete placed in violation of this provision may be rejected and its removal required.

P. If mesh reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.

505.03.05 SPLICING

A. In accordance with ACI 315, all reinforcement bars shall be furnished in the full lengths indicated on the plans.

Q. Splicing of bars, except where shown on the plans, will not be permitted without the written approval of the Engineer.

1. Splices shall be staggered as far as possible.

2. Unless otherwise shown on the plans, bars near the top of beams and girders having more than 12 inches of concrete under the bar shall be lapped 35 diameters and all other bars shall be lapped 20 diameters to make the splice.

3. In lapped splices, the bars shall be placed in contact and wired together.

R. Welding of reinforcing steel shall be done only if detailed on the plans or authorized by the Engineer in writing. Welding shall conform to the specifications for Welded Highway and Railway Bridges of the American Welding Society.

S. Lapped splices in reinforcement shall not be used for sizes larger than No. 11.

T. Tensile reinforcement shall preferably not be spliced at points of maximum stress. The length of lap for deformed bars shall not be less than 24 and 36 bar diameters for Grade 40 and Grade 60, respectively, nor less than 12 inches.

U. Where lapped splices are used in reinforcement in which the critical design stress is compressive and with concrete having a strength of 3,000 psi or more, the length of lap for deformed bars shall be 20 bar and 24 bar diameters for Grade 40 and Grade 60,

respectively, but not less than 12 inches. When the specified concrete strengths are less than 3,000 psi, the amount of lap shall be 1/3 greater than the values given above.

V. Splices in spiral steel shall be made by welding or a lap of 1-1/2 turns.

W. Sheets of mesh reinforcement shall overlap each other sufficiently to maintain a uniform strength and shall be securely fastened at the ends and edges. The edge lap shall not be less than 1 mesh in width.

505.03.06 SUBSTITUTIONS

A. Substitution of different size bars will be permitted only with specific authorization by the Engineer.

X. The bars substituted shall have an area equivalent to the design area or larger.

END OF SECTION 505

SECTION 506 – STEEL STRUCTURES

DESCRIPTION

506.01.01 GENERAL

A. This work shall consist of furnishing, fabricating, casting, machining, or otherwise preparing, transporting, erecting, and painting structural steel, rivet and eye bar steel, steel forgings, casting, and any other metal of the type, shape, dimensions, and quality, required by these specifications or as shown on the plans.

MATERIALS

506.02.01 GENERAL

A. Materials shall meet the pertinent requirements of the following sections:

Materials	Section
Structural and Eyebar Steel	***710***
Aluminum for Bridge Rail	***711***
Miscellaneous Metal	***712***
Paint and Pavement Markings	***714***
Galvanizing	***715***
Elastomeric Bearing Pads	***725***

B. Turned bolts shall meet the material specifications set forth for Structural Rivet Steel. Anchor bolts, nuts, and washers shall be of structural steel, galvanized in accordance with ASTM A153. Bolts for fastening tubes to the rail posts sockets shall be stainless steel.

C. Steel bridge and pedestrian railing shall be primed and painted in accordance with ***Subsection 714.03.01, "Iron and Steel Use Items Classifications."***

D. Bridge or pedestrian rail and posts made of aluminum shall not be painted.

E. Shims shall be either aluminum alloy or asbestos sheet packing, at the Contractor's option.

1. Aluminum Alloy Shims shall conform to ASTM B209, Alloy 1100-0.
2. Asbestos sheet packing shall be composed essentially of asbestos fibers bonded together with a cementing medium rendering it tough and pliable.
3. The deformation of the packing under a load of 10,000 pounds per square inch shall be less than 16 percent of the thickness and the loss on ignition shall not be more than 25 percent.

F. Insulating material for insulating the base of aluminum rail posts from concrete and from steel anchor bolts shall be an aluminum impregnated light colored caulking compound of the consistency of putty.

G. Shims for steel railing shall be galvanized steel plates.

H. All bolts, nuts, and washers shall be either steel galvanized in accordance with ASTM A153; stainless steel conforming to ASTM A276; or steel cadmium plated in accordance with ASTM B766, Type TS.

CONSTRUCTION

506.03.01 SHOP DRAWINGS

A. Shop drawings shall consist of shop detail, erection, and other working drawings showing dimensions, size of material, details, and other information necessary for the complete fabrication and erection of the metal work.

1. The drawings shall be prepared on sheets 24 inches by 36 inches.
2. Eetails shall be drawn so that the prints will be clear and legible.

B. Unless otherwise requested, the Contractor shall submit to the Engineer, for approval, 3 sets of drawings.

1. The Engineer reserves the right to refuse prints of shop drawings which are not clear and legible.
2. Upon approval, the Contractor shall furnish the Engineer with the number of sets of shop drawings requested.
3. All shop plans shall be submitted for approval at least 15 days before fabrication is started and no material shall be fabricated until the plans have been finally approved by the Engineer.

C. After approval, there shall be no deviation from the shop drawings or changes made thereon without the prior approval of the Engineer.

D. Approval of shop drawings shall be understood to be an acceptance of the character and sufficiency of the details and not a check of any dimensions. Checking shop drawings is intended as a means of facilitating the work and avoiding errors, but it is expressly understood that it will not relieve the Contractor from the responsibility for errors or omissions on the shop drawings.

E. The contract price shall include the cost of furnishing all shop drawings and the Contractor will be allowed no extra compensation for shop drawings.

506.03.02 NOTICE OF BEGINNING WORK

A. The Contractor shall give the Engineer ample notice of manufacturing of material at the mill so that inspection may be provided. "Mill" means any rolling mill or foundry where material for the work is to be manufactured.

B. No material shall be manufactured or fabrication begun without authorization by the Engineer.

C. The Engineer may inspect the material, as provided for in ASTM A6, at Engineer's option.

D. Material not inspected at the place of manufacture shall be subject to inspection as provided for in ***Subsection 506.03.03, "Inspection and Testing."***

E. Prior to the beginning of fabrication, a 15-day written notice shall be provided by the Contractor to the Engineer.

F. Any purchase of material prior to inspection at the mill or fabrication of any work without authorization from the Engineer shall be at the Contractor's risk.

506.03.03 INSPECTION AND TESTING

A. The Engineer will examine and test as necessary all material before fabrication.

1. Adequate facilities and free access to the necessary work areas will be provided to the Engineer by the manufacturer and fabricator.
2. Required test samples will be furnished free of charge.
3. Material not inspected at the place of manufacture shall be subject to all chemical, physical, and workmanship requirements established for the material supplied.
4. Materials or workmanship not in conformity with the specified product may be rejected.

B. The Engineer may inspect and test all material by any visual, destructive, or non-destructive method to evaluate the material for its specified properties.

1. Mill orders and certificates, showing test values obtained, shall be furnished in triplicate to the Engineer.
2. All certified test values shall include physical and chemical results and steel making process used.
3. Test samples will be obtained from all steel not identified by mill heat numbers.
4. Acceptance of any material at the mill or fabrication shop prior to incorporation shall not prevent the rejection of the material or finished member if defects are discovered during the fabrication process.

C. Inspection in the fabrication shop is intended as a means of facilitating the work and avoiding errors as far as possible.

1. It is expressly understood that shop inspection does not relieve the Contractor from responsibility for material or fabrication defects or errors and the necessity for replacement or correction of rejected materials and workmanship.

D. Shop inspection of rail pipe and tubes will, in most cases, be waived and the Contractor permitted to ship subject to inspection at the project site.

1. The field inspection will cover the general appearance, size, thickness, etc., of the pipe and tubing.
2. Conformance of chemical and mechanical properties to requirements of the specifications will also be considered before the material is approved.
3. Shop inspection of rail posts will be made on the first few rail post castings furnished for each project in order to establish a satisfactory class of finish and workmanship.
4. When shop inspection is waived on a portion of the handrail posts for a project, a careful inspection will be made in the field to determine the acceptability of these posts on the basis of the finish and workmanship as compared to that of the other posts previously inspected and approved.

E. Fabrication of aluminum alloy material shall, in general, conform to or be equivalent to fabrication methods and practices recommended in the handbook of the major producers of aluminum materials and specifically the following requirements:

1. Material shall be sawed, routed, or milled.

2. Flame cutting is not permissible.

3. Tubing may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 15 minutes to facilitate bending.

4. Holes in pipe tubing shall be drilled. Holes in castings shall be cored and reamed, or drilled from the solid. Seats for pipe shall be finished smooth.

F. The fabrication and handling of aluminum materials in the shop and field shall be performed in a manner to prevent scoring or marring of the surfaces.

1. An objectionable appearance resulting from such scoring or marring shall be cause for rejection of the material.

2. Sleeves and rails shall be fabricated in lengths indicated on the plans.

G. The finishing of rail posts shall be performed after fabrication is completed. All fins, pipes, and other casting irregularities and all drilling, reaming, and other fabrication marks shall be removed.

506.03.04 STORAGE

A. The loading, transporting, unloading, storing, and handling of structural steel shall be conducted so that the metal will be kept clean and free from injury.

1. When unloaded, the material shall be placed on skids above the ground.

2. All material for the project shall be stored separate from "in stock" materials.

3. Girders and beams shall be placed upright and shored.

4. Long members, such as columns and chords, shall be supported on skids placed near enough together to prevent injury from deflections.

B. Different grades and classifications of material shall be color coded, as provided for in ASTM A6. This color code shall be transferred throughout fabrication.

C. If the contract covering the erection of the steel does not include the fabrication, the Contractor shall check the material received by Contractor and report promptly, in writing to the Engineer, any shortage or injury discovered.

506.03.05 STRAIGHTENING

A. Rolled material before being laid out or worked shall be straight. Subassemblies and completed members shall be straight before being incorporated into the work.

B. If straightening is necessary, it shall be done by methods acceptable to the Engineer. Details of methods proposed for straightening shall be submitted in writing to the Engineer prior to their use.

C. After straightening, evidence of fracture or other damage will be cause for rejection of the material.

D. Dimensional tolerances and repairs of surface irregularities described in ASTM A6 shall govern for the acceptance of repaired material.

506.03.06 SUBPUNCHING, DRILLING, AND REAMING

A. Unless otherwise specified, rivet holes and connections and splices (shop and field) of main truss or arch members, continuous beams, plate girders and rigid frames and rivet holes in plate girder flanges, and stiffeners, intermediate stiffeners intended as supports for concentrated loads, and web splices shall either be subpunched (or subdrilled) and reamed while shop assembled or drilled to full size from the solid while assembled at the shop.

B. The assembly, including camber, alignment, accuracy of holes and mill joints, shall be approved by the Engineer before reaming is commenced.

C. Unless otherwise specified, each individual (full length) truss, arch, continuous beam, or girder shall be assembled at the shop before reaming or drilling is commenced. During shop assembly, all members shall be supported at such intervals and in such manner as is necessary to avoid undesirable deflections.

D. All holes for floor beams and stringer field end connections shall be subpunched and reamed to a steel template.

506.03.07 BOLTS AND BOLTED CONNECTIONS

A. **Bolted Connections:**

1. Bolted connections shall not be used unless called for in the contract documents.
2. Where bolted connections are permitted, the bolts furnished shall be as hereinafter specified.
    a. Ribbed high-tensile strength bolts or high-tensile strength bolts may be substituted for field rivets in locations where, in the opinion of the Engineer, it is impractical to drive rivets.
    b. Bolts shall be of such length that they will extend entirely through the nut, but not more than 3/8 inch beyond.
    c. The Contractor shall furnish sufficient bolts of each type for each size and length to bolt such connections as called for with an ample surplus to replace bolts lost or rejected.
3. The holes, except holes in end diaphragms, shall be truly cylindrical.
    a. Holes shall be at right angles to the surface of the metal so that both head and nut will bear squarely against the metal.
    b. Bolts shall be driven accurately into the holes without damaging the thread.
    c. A snap shall be used to prevent damaging the heads.
4. Bolt holes in end diaphragms shall be slotted 1/2 inch in addition to the dimensions shown on the plans, in the direction to facilitate erection. At all locations where such slotted bolt holes are required, circular washers shall be placed on each side of the bolted connection, and the necessary bolt length adjusted accordingly.
5. Bolts in end diaphragms to girder connections shall not be tightened until the deck pour has been completed.

6. All bolted connections shall be fastened with high-tensile strength bolts or ribbed high-tensile strength bolts. The use of unfinished bolts or plain ribbed bolts will not be permitted.

B. **High-Tensile Strength Bolts.** The use of high strength bolts in structural connections shall comply with Article 2.10.20, "Construction Using High Strength Bolts," of the current AASHTO Standard Specifications for Highway Bridges.

506.03.08 SHOP ASSEMBLY

A. Shop assembly of trusses, arches, continuous beams, continuous plate girders, plate girders, and rigid frames shall be according to ***Subsection 506.03.06, "Subpunching, Drilling, and Reaming."*** All members shall be match marked before being disassembled.

B. Complete shop assembly of an entire structure, including floor system, which may be necessary in the case of complicated design or of skewed or super-elevated structure shall be done only if required by the Special Provisions.

1. The several component parts of a built-up member shall be straight and close fitting.
2. Surfaces of metal in contact shall be cleaned before assembling.
3. The parts of a member shall be assembled, well pinned, and firmly drawn together with bolts before drilling, reaming, or riveting is commenced.
4. Assembled pieces shall be taken apart, if necessary, for the removal of burrs and shavings produced by the operations.
5. The member shall be free from twists, bends, and other deformations.
6. End connections, angles, stiffener angles, and similar parts shall be carefully adjusted to correct positions and bolted, clamped, or otherwise firmly held in place until riveted.

C. The drifting done during assembling shall be such as to bring the parts into position, and not sufficient to enlarge the holes or distort the metal. If any holes must be enlarged to admit the rivets, they shall be reamed.

D. Parts not completely riveted in the shop shall be secured by bolts insofar as practicable to prevent damage in shipment and handling.

E. Connecting parts assembled in the shop for the purpose of reaming holes in field connections shall be match marked, and a diagram showing such marks shall be furnished to the Engineer.

506.03.09 EDGE PLANING

A. Sheared edges of plates more than 5/8 inch in thickness and carrying calculated stress shall be planed to a depth of 1/4 inch.

B. Re-entrant cuts shall be filleted to a radius of 3/4 inch.

506.03.10 FACING OF BEARING SURFACES

A. The surface finish of bearing and base plates and other bearing surfaces that are to come in contact with each other or with concrete shall meet the American Standards Association

surface roughness requirements as defined in ASA B46.1-55, Surface Roughness, Waviness and Lay, Part 1:

Steel Slabs	ASA 2,000
Heavy Plates in Contact in Shoes to be Welded	ASA 1,000
Milled Ends of Compression Members, Stiffeners, and Fillers	ASA 500
Bridge Rollers and Rockers	ASA 250
Pins and Pin Holes	ASA 125
Sliding Bearings	ASA 125

B. Surfaces of bronze bearing plates intended for sliding contact shall be planed parallel to the movement of the spans and polished.

506.03.11 ABUTTING JOINTS

A. Abutting joints in compression members of trusses and in columns shall be milled.

B. Opening and abutting joints in tension members shall not exceed 1/4 inch.

C. Abutting joints of continuous I-beam spans shall be square and tight-fitting.

D. Abutting joints in top and bottom flanges of plate girders shall be square and tight-fitting.

506.03.12 FLAME CUTTING

A. Preparation of material for flame cutting shall be in accordance with the provisions of AWS D2.0, Paragraph 302.

506.03.13 END CONNECTION ANGLES

A. Floor beams, stringers, and girders having end connection angles shall be built to exact length shown on the plans measured between the heels of the connection angles, with a permissible tolerance of minus 1/16 inch.

B. Where continuity is required, end connections shall be faced.

C. The thickness of the connection angles shall not be less than 3/8 inch, nor less than that shown on the detail drawings.

506.03.14 LACING BARS

A. The ends of lacing bars shall be neatly rounded unless another form is required.

506.03.15 WEB PLATES

A. In girders having no cover plates and not to be encased in concrete, the top edge of the web plate shall not extend above the backs of the flange angles and shall not be more than 1/8 inch below at any point.

1. Any portion of the plate projecting beyond the angles shall be chipped flush with the backs of the angles.

2. Web plates or girders having cover plates may be 1/2 inch less in width than the distance back to back of flange angles.

B. Splices in webs of girders without cover plates shall be sealed on top by welding.

C. At web splices, the clearance between the ends of the web plates shall not exceed 3/8 inch. The clearance at the top and bottom ends of web splice plates shall not exceed 1/4 inch.

506.03.16 STUD SHEAR CONNECTORS

A. Stud shear connectors shall be of a design suitable for end welding and shall be end welded to steel beams, girders, or plates with automatically timed stud welding equipment.

1. The type, size or diameter, placement pattern, and length of stud shall be as specified in the contract documents. (See Figure No. 1, below, for allowable tolerances or dimensions).
2. A maximum variation of 1 inch from the location shown will be accepted provided the adjacent studs are not closer than 2-1/2 inches center to center.
3. The clear distance between the edge of a girder flange and the edge of the shear connectors shall be not less than 1 inch.
4. Fillet welds varying in size from 3/16 inch to 5/16 inch are satisfactory provided the studs pass all other tests required.
5. Adequate provision shall be made in fabrication of structural members to compensate for loss of camber due to welding of the shear connectors.

B. Studs shall not be painted or galvanized.

1. The studs shall be free from rust, scale, rust pits, and oil at the time of welding and immediately before the concrete is placed.
2. The beam surface to which the studs are welded shall be free from excessive mill scale, rust, dirt, paint, grease, or any other material which might impair the quality of the weld.
3. When necessary to obtain satisfactory welds, the areas on the beam, girder, or plate to which the studs are to be welded shall be wire-brushed, peened, prick-punched, or ground free of scale or rust.

C. The Contractor shall submit to the Engineer for approval before installation, information on the studs to be furnished as follows:

1. The name of the manufacturer.
2. A detailed description of the stud and arc shield.
3. A certification from the manufacturer that the stud is qualified as specified in AWS D2.0. The certification must also indicate the heat from which the studs were manufactured.

D. Welding specifications and procedure requirements shall conform to AWS D2.0.

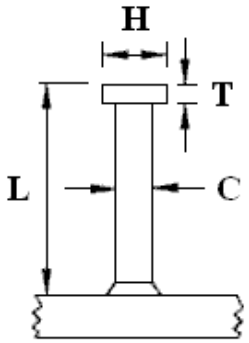
STEEL STRUCTURES	STANDARD DIMENSIONS			
	C	L*	H	T
	3/4" +0.000" –0.010"	4" +0.062" –0.125"	1-1/4" ±1/64"	3/8" minimum
	7/8" +0.000" –0.010"	4" +0.062" –0.125"	1-3/8" ±1/64"	3/8" minimum
	*NOTE: 4" length is standard. Other lengths may be obtained by special order.			

Figure 1. DIMENSIONS AND TOLERANCES

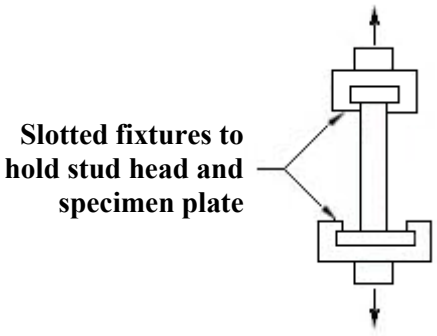


Figure 2. TYPICAL TENSILE TEST FIXTURE

506.03.17 WELDING

A. Welding of steel structures when authorized in accordance with the provisions contained herein, called for in the contract documents, or upon written permission from the Engineer shall conform to the most recent edition of the American Welding Society's *Bridge Welding Code*, except as modified in this subsection.

B. All welding shall be performed in the fabrication shop, except as otherwise noted on the plans or permitted by the Engineer.

C. **Inspection and Testing of Shop Welds:**

1. **Radiographic Inspection:**

   a. The procedure, techniques, and standards of acceptance shall be in conformance with the current AWS D2.0 Specifications.

   b. The Engineer will make all final interpretations of weld defects and film quality.

   c. All radiographs will be the property of the Contracting Agency during and after completion of the project.

2. **Ultrasonic Inspection.** The procedure, techniques, and standards of acceptance shall be in conformance with the current AWS D2.0 Specifications except as modified in this subsection.

3. **Magnetic Particle Inspection.** This procedure and technique shall be in conformance with ASTM E709, "Standard Guide for Magnetic Particle Testing."

D. **Inspection and Testing of Field Welds:**

1. The Contracting Agency will make magnetic particle inspections, ultrasonic inspections, or radiographic inspections of field welds when so required by the plans or the Special Provisions.

2. The acceptability of welds will be judged in accordance with the Inspection and Testing of Shop Welds for the type of inspection employed.

E. Welds shall be painted according to the applicable provisions of ***Section 614, "Painting."***

F. All groove welds on primary members shall be finished smooth and flush with the base metal on all surfaces by grinding in the direction of applied stress, leaving surfaces free from depressions. Chipping may be used provided it is followed by such grinding.

506.03.18 FIT OF STIFFENERS

A. End stiffeners of girders and stiffeners intended as supports for concentrated loads shall be milled or ground to secure an even bearing against the flange.

1. Intermediate stiffeners shall fit sufficiently tight to exclude water after being painted.

2. Fillers under stiffeners shall fit within 1/4 inch at each end.

B. Welding will be permitted in lieu of milling or grinding if noted in the contract documents. Where stiffeners are required on 1 side of the web only, they shall be welded to the compression flange.

506.03.19 ANNEALING AND STRESS RELIEVING

A. Members such as bridges shoes, pedestals, or other parts which are built up by welding sections of plate together, and stress relieving is called for in the contract documents, stress relieving shall be in accordance with the provisions of the American Welding Society.

506.03.20 PINS AND PIN HOLES

A. Rollers shall be of structural carbon steel, and pins shall be carbon steel forgings meeting the requirements of ***Subsection 710.03.08, "Pins and Rollers."***

1. Pins and rollers shall be accurately turned to the dimensions shown on the drawings and shall be straight, smooth, and free from flaws.

2. Final surface shall be produced by a finishing cut.

B. In pins larger than 9 inches in diameter, a hole not less than 2 inches in diameter shall be bored full length along the axis after the forging has been cooled to a temperature below the critical range under suitable conditions to prevent injury by too rapid cooling, and before being annealed.

C. Pin holes shall be bored true to the specified diameter, smooth and straight, at right angles with the axis of the member, and parallel with each other unless otherwise specified.

D. The distance outside to outside of holes in tension members and inside to inside of holes in compression members shall not vary from that specified more than 1/32 inch. Boring of holes in built-up members shall be done after the assembly is completed.

E. The diameter of the pin hole shall not exceed that of the pin by more than 1/50 inch for pins 5 inches or less in diameter, or more than 1/32 inch for larger pins.

F. Screw threads for all bolts and pins for structural steel construction shall conform to the American National Coarse Thread Series, Class 2, free fit, except that pin ends having a diameter of 1-3/8 inches or more shall be threaded 6 threads to the inch.

G. Pilot and driving nuts shall be used in driving pins.

1. They shall be furnished by the Contractor without charge.
2. Two pilot nuts and 2 driving nuts for each size of pin shall be furnished, unless otherwise specified.
3. Pins shall be so driven that the members will take full bearing.
4. Pin nuts shall be screwed up tight and the threads burred at the face of the nut with a pointed tool.

506.03.21 SHOP PAINTING

A. Unless otherwise provided, the application of shop paints shall conform to the requirements of ***Section 614 "Painting."***

B. Surfaces to be in contact after shop riveting is completed shall be cleaned but shall not be painted.

506.03.22 MARKING AND SHIPPING

A. Each member shall be painted or marked with an erection mark for identification and an erection diagram shall be furnished with erection marks shown thereon.

B. Members weighing more than 3 tons shall have the weight marked thereon.

C. Structural members shall be loaded on trucks or cars in such a manner that they may be transported and unloaded at their destination without being excessively stressed, deformed, or otherwise damaged.

D. All girders shall be shipped with the web vertical, which position shall be maintained in subsequent operations.

506.03.23 ERECTION METHODS AND EQUIPMENT

A. Before starting work, the Contractor shall inform the Engineer fully as to the method of erection the Contractor proposes to follow and as to the amount and character of the equipment the Contractor proposes to use, the adequacy of which shall be subject to the approval of the Engineer.

1. The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety and adequacy of Contractor's methods or equipment or from carrying out the work in full accordance with the plans and specifications.
2. No work shall be done without the sanction of the Engineer.

B. Spot welding for the purpose of eliminating field erection bolts or for holding steel parts together while fastening will not be permitted.

C. All work of erection shall be subject to inspection.

1. The Contractor shall furnish facilities for inspection of material and workmanship.

2. Material and workmanship not previously inspected shall be inspected after delivery to the site of the work.

D. The Contractor shall provide the falsework and all tools, machinery, and appliances, including drift pins and fitting-up bolts necessary for the expeditious handling of the work.

E. Anchor bolts for rail posts shall be galvanized high-strength bolts set with suitable templates in exact position and securely fixed to prevent displacement during the concreting operations.

1. The areas of concrete upon which posts are to be set shall be dressed by grinding or rubbing to a true plane for the proper seating of the posts.

2. All surfaces of aluminum alloy posts and adjustment shims to be in contact with concrete or with the steel anchor bolts nuts and washers shall be coated with aluminum insulating compound.

F. Rail posts shall be erected in sections.

1. Erection of sections of rails and posts shall continue successively until all or an approved portion of the required rail is erected.

2. The rail shall then be aligned and the nuts on the anchor bolts tightened.

3. In final adjustment, no posts shall deviate more than 1/8 inch from true alignment and there shall be no abrupt break in alignment of any location.

4. Aluminum shims may be slotted for ease in placing if approved by the Engineer.

506.03.24 FALSEWORK

A. The falsework shall be designed and substantially constructed and maintained for the vertical and lateral loads that will be applied to the structure.

1. The Contractor shall prepare and submit to the Engineer for approval plans for falsework or for changes in an existing structure necessary for maintaining traffic.

2. Approval of the Contractor's plans shall not be considered as relieving the Contractor of any responsibility.

B. Upon completion of the erection and before final acceptance, the Contractor shall remove all falsework, excavated or useless materials, rubbish and temporary buildings, replace or renew any fences damaged, restore in an acceptable manner all property, both public and private, which may have been damaged during the prosecution of the work, and leave the structure site and adjacent highway in a neat and presentable condition satisfactory to the Engineer.

C. All excavated material or falsework placed in the stream channel before construction shall be removed by the Contractor before final acceptance.

506.03.25 BEARING AND ANCHORAGE

A. Masonry bearing plates shall not be placed upon bridge seat bearing areas which are improperly finished, deformed, or irregular.

1. Bearing plates shall be set level in exact position and shall have a full and even bearing upon the masonry.

2. Unless otherwise directed by the Engineer, the bearing plates shall be placed on a layer of canvas and red lead applied as follows:

a. Thoroughly swab the bridge seat bearing area with red lead paint and place upon it 3 layers of 12-ounce to 14-ounce duck, each layer being thoroughly swabbed on its top surface with red lead paint.

b. Place the superstructure shoes or pedestals in position while the paint is plastic.

c. As an alternate to canvas and red lead, sheet lead may be used if called for on the plans.

B. The milled and finished surfaces of castings or bearing plates shall have the shop coat of tallow, white lead, or oil removed immediately prior to placing in the structure. Surfaces designed for sliding movement, one upon the other, shall be given a field coat of graphite grease when placed in the structure.

C. The Contractor shall drill the holes and set the anchor bolts, except where the holes are formed or the bolts are built into the masonry.

1. The bolts shall be set accurately and fixed with Portland cement grout, completely filling the holes.

2. The location of the anchor bolts in relation to the slotted holes in the expansion shoes shall correspond with the temperature at the time of erection.

3. The nuts on anchor bolts at the expansion ends of spans shall be adjusted to permit free movement of the span.

D. Elastomeric bearing pads shall conform to ***Subsection 502.03.12, "Expansion, Fixed Joints and Bearings."***

506.03.26 FIELD ASSEMBLING

A. The parts shall be accurately assembled as shown on the plans and match-marks shall be followed.

1. The material shall be carefully handled so that no part will be bent, broken, or otherwise damaged.

2. Hammering which will injure or distort the members shall not be done.

3. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.

4. Unless erected by the cantilever method, truss spans shall be erected on blocking so placed as to give the trusses proper camber.

5. The blocking shall be left in place until the tension chord splices are fully fastened and all other truss connections pinned and bolted.

6. Splices of butt joints of compression members, in railings, and in other field splice connections shall have 1/2 of the connection holes filled with bolts and cylindrical erection pins (half bolts and half pins) before fastening.

7. Splices and connections carrying traffic during erection shall have 3/4 of the holes so filled.

B. Cylindrical erection pins shall be 1/32 inch larger than the fitting up bolts.

506.03.27 MISFITS

A. The correction of minor misfits involving nonharmful amounts of reaming, cutting, and chipping shall be considered a legitimate part of the erection.

B. However, any error in the shop fabrication, or deformation resulting from handling and transportation, which prevents the proper assembling and fitting up of the parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be reported immediately to the Engineer and Engineer's approval of the method of correction obtained.

C. The correction shall be made in the Engineer's presence.

D. The Contractor shall be responsible for all misfits, errors, and injuries and shall make the necessary corrections and replacements.

506.03.28 FIELD PAINTING

A. Structural steel, unless otherwise specified, shall be painted as specified in ***Section 614, "Painting."***

END OF SECTION 506

SECTION 601 – PIPE CULVERTS-GENERAL

DESCRIPTION

601.01.01 GENERAL

A. This section includes general requirements that are applicable to all types of culvert pipes regardless of the material or culvert use with the following exceptions:

1. Structural plate pipe,
2. Water distribution systems and sanitary sewer system specifications will specify the pipe to be used in their respective installations.

B. This work shall consist of furnishing and installing pipe culverts, siphons, end sections, end walls, and so forth, as may be required to complete the work shown on the plans or established by the Engineer.

C. The pipe shall comply with AASHTO Design and Construction LRFD Specifications most current edition and these specifications. The more stringent requirements shall apply.

D. This work shall also consist of preparing utility final location information as described on the project drawings and in Section 622 of these Special Provisions.

MATERIALS

601.02.01 GENERAL

A. The materials used shall conform to the requirements in the following subsections:

Materials	Section/Subsection
Bituminous Coated Corrugated Metal Pipe and Pipe Arches	***709.03.02***
Clay Pipe	***708.03.04***
Corrugated Aluminum Pipe	***709.03.04***
Corrugated Metal Pipe and Pipe Arches	***709.03.01***
Grout and Mortar Sand	***706.03.04***
Nonreinforced Concrete Pipe	***708.03.02***
Hydraulic Cement	***701***
Reinforced Concrete Pipe	***708.03.01***
Rubber Gaskets	***707.03.06***
Thermoplastic Pipe	***709.03.10***

B. When the location of manufacturing plants allows, the plants will be inspected periodically for compliance with specified manufacturing methods.

1. Material samples will be obtained for laboratory testing for compliance with materials quality requirements as specified in the referenced specifications.
2. This can be the basis for acceptance of manufacturing lots.

C. All materials will be subject to inspection for acceptance as to condition at the latest practicable time the Engineer has the opportunity to check for compliance prior to or during incorporation of materials in the work.

D. The lengths shown on the plans are approximate.

E. BLANK

CONSTRUCTION

601.03.01 EARTHWORK

A. Excavation and backfill shall conform to the requirements of ***Section 206, "Structure Excavation,"*** and ***Section 207, "Structure Backfill,"*** or ***Section 208, "Trench Excavation and Backfill,"*** when the culvert is placed in a trench.

1. The pipe shall be bedded as shown in the plans and/or drawings appended to the plans or as specified in the Special Provisions.

2. When no bedding class is specified, the requirements for normal bedding as shown in the Uniform Standard Drawings shall apply.

3. The lines and grades will be established by the Engineer or as designated in the contract documents.

B. Where pipes are to be installed in new embankments on a steep slope or in a difficult location, the height of new embankments may be varied as directed by the Engineer before installing pipes.

C. When headwalls are not required and granular materials are used for backfilling, the fill at the ends of the structure shall be sealed against the infiltration of water by bedding the ends of the structure using Class II CLSM or concrete.

601.03.02 HEADWALLS

A. Where shown on the plans, inlet and outlet headwalls shall be constructed or installed in connection with culvert pipes.

B. Where headwalls are constructed or installed, the ends of pipes shall be placed flush or cut off flush with the headwall face, unless otherwise permitted by the Engineer.

C. Headwalls shall be constructed to conform ***to Section 501, "Portland Cement Concrete"*** and ***Section 502, "Concrete Structures."***

601.03.03 END SECTIONS

A. The bed for the end section shall be excavated to the required width and grade.

B. For metal end sections with toe plates, a trench shall be excavated for the toe plate in a manner to permit the toe plate from being against the inner face of the trench when the end section is in its final position. After end sections have been properly secured to the pipe, this trench shall be backfilled and firmly compacted.

C. Precast concrete end section shall be placed with its tongue (or groove) fully entered in the groove (or tongue) of the pipe.

D. Thermoplastic pipe greater than 30 inches shall not be used at the open-end sections.

601.03.04 JACKED PIPES

A. Culvert pipe to be jacked in place between the limits shown on the plans shall conform to the requirements of the respective section of pipe culverts.

B. The strength of pipe or gauge of pipe will be determined for vertical load only in embankment conditions. Any additional reinforcement or strength required to withstand jacking pressure shall be determined and furnished by the Contractor at no additional cost to the Contracting Agency.

C. Variation from theoretical alignment and grade at the time of completion of placing shall not exceed 0.2 foot for each 20 feet of pipe placed.

D. The diameter of the excavated hole shall not be more than 0.1 foot greater than the outside diameter of the pipe.

1. Sluicing and jetting with water will not be permitted.

2. When the material tends to cave in from outside these limits, a shield shall be used ahead of the first section of pipe or the face of excavation shall not extend beyond the end of the pipe greater than 1-1/2 feet unless permitted by the Engineer.

E. Areas resulting from caving or excavating outside the above limits shall be backfilled with sand or grout by a method that will fill the voids.

601.03.05 LAYING CULVERT PIPE

A. Laying of culvert pipe shall conform to the requirements of the respective sections of culvert pipe.

601.03.06 EXTENDING EXISTING CULVERTS

A. Where shown on the plans or directed by the Engineer, existing culverts shall be extended in accordance with the provisions for installing new culverts and the following additional provisions.

B. Existing headwalls shall be demolished and removed and disposed of or moved to the extended location as indicated on the plans or ordered by the Engineer. Comply with ***Section 202, "Removal of Structures and Obstructions."***

C. A headwall that is not to be reset shall be demolished without injury to the existing culvert and removed and disposed of in accordance with the provisions of ***Section 202, "Removal of Structures and Obstructions."*** If shown on the plans or ordered by the Engineer, a new concrete headwall shall be constructed in accordance with the provisions of ***Section 501, "Portland Cement Concrete,"*** of these specifications or a flared end section shall be attached thereto.

601.03.07 VIDEO INSPECTION

A. Unless otherwise approved by the Contracting Agency, all video inspection shall be completed by a National Association of Sewer Service Companies (NASSCO) certified operator, certified at the user level minimum.

1. The user shall have completed the Pipeline Assessment and Certificate Program (PACP).

2. Video inspection reports must follow the NASSCO format and use standard sewer defect codes.

B. The following paragraphs define the requirements for internal video inspection of storm drain facilities after installation.

1. The Contractor shall inspect the storm drain facility interior using a color closed circuit television (CCTV) camera and document the inspection on image with audio location and date information, image title information, and hard copy inspection logs. The CCTV inspection shall be performed after the installation has been completed.

2. Field operator(s) of inspection equipment must have current National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) Certification.

3. Television Inspection Camera. Equipment shall be operative in 100 percent humidity conditions. Lighting intensity shall be remote controlled and shall be adjusted to minimize reflective glare. Lighting and camera quality shall provide a clear, in-focus picture of the entire inside periphery of the storm drain facility.

4. Digital Storage Medium. The inspection shall be recorded, stored and submitted on CD's (or DVD's) in high quality MPG format on CD -R/+R disks formatted for use with PC systems. The audio portion of the composite CD shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report.

5. Footage Counter. A footage counter device, which measures the distance traveled by the camera in the storm drain facility, shall be accurate to plus or minus 2 feet in 1,000 feet.

6. Video Tilting. Pan and tilt unit, with adjustable supports specifically designed and constructed for operation in connection with storm drain facility inspection.

7. Flow in Storm Drain Facility. During internal video inspections the Contractor shall provide temporary dry conditions in the storm drain facility unless otherwise agreed upon by the Engineer.

C. Inspection Methods for Internal Video:

1. Verbal Commentary. None required except to note operational problems such as camera failure, or restart of inspection.

2. Access. The Engineer shall have access to observe the monitor and all other operations at all times. The system of cabling employed to transport the camera and transmit its signal shall not obstruct the camera's view.

3. Inspection Rate. The camera shall be pulled through the storm drain facility in either direction, but all inspections at each location shall be in the same direction. Rate of travel shall be such that a comprehensive inspection/analysis may be performed but at no time shall exceed 30 feet per minute when recording.

4. Image Perspective. The camera image shall be down the center axis of the storm drain facility when the camera is in motion. The Contractor is required to provide a

360-degree view of the interior. Points of interest shall also be shown on the video and shall include, but not be limited to, all joints, defects, encrustations, mineral deposits, debris, sediment, any location determined not to be clean or part of a proper installation or defects in the materials.

5. Storm Drain Facility Identification. All inspection documentation shall include the location referenced to the project survey control specifically the pipe stationing.

6. Defect Coding. National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) coding system, latest version, shall be used to document all defects visible on the image recordings.

7. Quality Control. The Engineer will review CD's or DVD's and logs to ensure compliance with the requirements listed in this specification and contract documents.

8. The Contractor shall be responsible for modifications to his equipment and/or inspection procedures to achieve report material of acceptable quality. No work shall commence prior to approval of the material by the Engineer. Once accepted, the report material shall serve as a standard for the remaining work.

9. Contractor shall maintain a copy of all inspection documentation (CDs, databases, and logs) for the duration of the work and warranty period.

601.03.70 MARKER BALLS

A. Marker balls shall be installed per local entity requirements.

END OF SECTION 601

SECTION 603 – REINFORCED CONCRETE PIPE

DESCRIPTION

603.01.01 GENERAL

A. This work shall consist of furnishing circular or elliptical, reinforced concrete pipe, siphons, and conduits of the size, classes, and dimensions and at locations shown on the plans or established by the Engineer and in accordance with ASTM C76, ASTM C655, or ASTM C507, with design basis in accordance with ***Section 708, "Concrete and Clay Pipe and Drains,"*** and where indicated in these specifications.

B. The installation shall conform to the AASHTO LRFD Bridge Construction Specifications and these specifications.

C. This work shall also consist of providing storm drain connections for the storm drain and laterals as directed by the Engineer.

MATERIAL

603.02.01 GENERAL

A. Materials and their use shall conform to ***Subsection 601.02.01, "General,"*** and the requirements below.

B. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and ***Section 708, "Concrete and Clay Pipe and Drains,"*** from an authorized source approved by the Interagency Quality Assurance Committee (IQAC).

C. Flared end sections (precast) shall conform to the details and dimensions shown on the plans and, except for shape, shall conform to the material requirements of this section for reinforced concrete pipe.

D. Rubber gaskets are required for all circular pipes and elliptical pipes. Rubber gaskets shall conform to ***Subsection 707.03.06, "Rubber Gaskets."***

E. If joint mortar is required, it shall be as specified in ***Subsection 501.03.12, "Mortar," Class "C."***

1. Sand shall conform to ***Subsection 706.03.04, "Grout and Mortar Sand."***
2. The materials shall be mixed to a consistency suitable for the purpose intended.
3. All mortar shall be used within 30 minutes after the mixing water has been added.
4. Admixtures of hydrated lime, fire clay, diatomaceous earth, or other approved inert material may be used in the mortar to facilitate workability if the Contractor elects.
5. The amount of admixture to be added shall be the quantity determined by the Engineer.

CONSTRUCTION

603.03.01 GENERAL

A. Construction methods shall conform to ***Subsection 601.03.01, "Earthwork,"*** through ***Subsection 601.03.06, "Extending Existing Culverts,"*** and shall meet the requirements below. All pipe installations shall conform to the workmanship and inspection requirements of the AASHTO LRFD Bridge Construction Specifications and this specification as applicable.

B. No pipe shall be laid that is excessively cracked (in accordance with ***Subsection 603.03.07, "Inspection"***), checked, spalled, or damaged, and all such sections of pipe shall be permanently removed from the work. Pipes that show defects due to handling shall be rejected at the site of the installation regardless of prior acceptance.

603.03.02 EARTHWORK

A. Where pipes are to be installed in new embankment (projection), the embankment shall first be constructed to the required elevation as set forth below. The height of embankment to be constructed in advance of installing the pipe may be varied when permitted by the Engineer.

B. In the case of pipes 24 inches or less in diameter, the roadway embankment shall be constructed to an elevation of 6 inches above the grade proposed for the top of the pipe, after which the trench shall be excavated and the pipe installed.

C. In the case of pipes more than 24 inches in diameter, the roadway embankment shall be constructed to an elevation of 30 inches above the grade proposed for the bottom of the pipe, after which the trench shall be excavated and the pipe installed.

D. When pipe having bells or hubs is used, cross trenches shall be excavated for them to prevent non-uniform loading of the joints.

603.03.03 LAYING CULVERT PIPE

A. Construction installation shall comply with the AASHTO LRFD Bridge Construction Specifications; ***Section 208, "Trench Excavation and Backfill"***; and this subsection.

1. The installation shall be conducted by a certified supervisor/foreman at the crew level who is responsible for the work.
2. The certified person is the designated installation inspector for the Contractor and shall generate a daily report attesting to the workmanship for each of the installation components described below.
3. This does not relieve the Contractor of responsibility for other Quality Control aspects of this and other specifications.

B. Installation Components:

1. Bedding.
2. Pipe Condition.
3. Pipe Installation.
4. Haunch Compaction.
5. Complete Pipe Zone Compaction.

C. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe. Blocking shall not be used to bring the pipe to grade.

D. Pipe sections shall be checked for alignment and grade at the time of joining the sections.

1. Pipe laying shall begin at the downstream end of the pipeline except for extensions of existing pipes.

2. Place the bottom of the pipe in contact with the shaped bedding throughout its full length.

3. The first section of pipe to be laid shall be firmly placed to the designated line and grade at the outlet end with the groove end or bell end pointing in the direction to be followed by the pipe laying.

4. Maintain the manufacturer's recommended minimum and maximum cover at all times unless otherwise shown in the contract.

5. Pipe will be inspected before any backfill is placed.

6. Ensure that no rocks greater than 3 inches or other rigid or jagged material is present in the bedding material where pipe may be laid directly on the material.

7. Take up and relay or replace pipe that is out of alignment, unduly settled, or damaged.

E. The interior of the pipe shall be kept free of dirt, and other foreign material as the pipe laying progresses, and left clean at the completion of the work. Any pipe, which is not in true alignment or which shows any undue settlement after laying, or is damaged, shall be taken up and re-laid at the Contractor's expenses.

F. **Backfill:** Prior to placing backfill material, all lifting holes in concrete culverts shall be completely filled with grout.

603.03.04 RUBBER GASKETED JOINTS

A. Circular reinforced concrete culvert pipe shall use rubber or neoprene gasketed joints.

B. Rubber gaskets shall not be exposed to the direct rays of the sun for more than 72 hours.

C. The Contractor shall make every effort to provide a concrete-to-concrete connection and pull the pipe completely home.

1. Should gapping occur due to changes or corrections in horizontal or vertical alignment or radius turns, the gaps shall not exceed the gap tolerance indicated in Table 1.

2. If pipes are laid that exceed these tolerances, the inner annular space between the pipe sections shall be completely filled with cement mortar (where pipe diameters allow for entry).

3. If pipes are laid that exceed the tolerances in Column 2, the pipe will need to be removed and re-laid or an acceptable concrete collar will need to be installed.

Table 1 - Maximum Joint Gap Tolerances[1]

	Column 1	Column 2
Inner Diameter of Pipe	**Maximum Joint Gap Tolerance**	**Maximum Joint Gap Tolerance (with Grouting)**
12-inch to 36-inch	5/8 inch	3/4 inch
42-inch to 48-inch	7/8 inch	1-1/8 inch
54-inch to 90-inch	1 inch	1-1/4 inch
96-inch	1- 5/8 inch	1-3/4 inch
Above 96-inch up to 144-inch	As recommended by Manufacturer	As recommended by Manufacturer

D. Where reinforced concrete collars or bells with rubber gaskets are used at the pipe joints, mortar will not be required in the outer annular space.

E. Where pipes are used with exposed metal surfaces at the joint, both the inner and outer annular joint spaces between pipe sections must be completely filled with cement mortar, except that pipes less than 24 inches in diameter may be pointed inside by brushing smooth and removing all surplus mortar.

F. The rubber gasket shall be the sole element depended upon to make the joint watertight for the purposes intended.

603.03.05 SIPHONS AND PRESSURE PIPE

A. Reinforced concrete pipe used for siphons or pressure pipe shall be laid in accordance with the above provisions, be connected by flexible, watertight rubber gasket joint and, prior to backfilling, be subject to the following hydrostatic test:

1. The pipeline shall be filled with water at a hydrostatic head of that required to maintain the design pressure.
2. The pressure head shall be maintained for a period of not less than 24 hours and any visible leak or other defects that develop under test shall be corrected by the Contractor at no additional cost to the Contracting Agency.
3. Sweating that does not develop into a flow or drip will not be considered as leakage.
4. The test shall be repeated until all leaks or other defects are eliminated

603.03.06 JUNCTIONS

A. All junctions of laterals with a main line or junctions of 2 or more main lines, which are not made in a manhole or concrete junction structure, shall be in a manufactured wye or tee.

B. The wye or tee shall be of the same material as the conduits to which they are joined, and shall have the same or greater stiffness as the pipe.

603.03.07 INSPECTION

A. All pipe joints and lengths shall be 100 percent inspected.

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[1] In no case shall maximum joint gap tolerance exceed ½ of the length where the gasket seats within the pipe

1. Inspection and testing shall be performed by the Contractor during and after installation to ensure proper performance.
2. Installation, placement, and compaction of bedding and backfill materials shall comply with this section.
3. During the initial phases of the installation process, inspection shall concentrate on detecting improper practice and poor workmanship.
4. Errors in line and grade, improper assembly, and improper backfill techniques shall be corrected prior to placing significant backfill or trench fill.
5. Bell/spigot joints shall be properly assembled to prevent the infiltration of soil fines.
6. Gaskets shall be properly seated to prevent groundwater infiltration and shall appear uniformly oriented around the pipe.
7. Shallow cover installations shall be checked to ensure the minimum cover level is provided.

B. After the pipe has been bedded and backfilled to subgrade level, internal quality inspection shall be paid for and performed by the Contractor a minimum of 30 days after final backfill has been placed and prior to final acceptance by the Contracting Agency.

1. The line shall be cleaned and inspected for cracks and joint gaps using visual physical measurement or other devices, including but not limited to calibrated television or video cameras, subject to approval by the Engineer.
2. Cracks in pipes (both longitudinal and circumferential) that are less than 0.10 inch in width are generally considered non-structural flaws and need not be repaired.
3. Cracks that are equal to or exceed 0.10 inch in width shall require an evaluation by a Nevada licensed professional engineer.
4. The Contractor's engineer shall provide a recommendation regarding removal or repair subject to approval by the Contracting Agency.
5. Pipe joints and lengths that do not meet the specification shall be repaired or pipe replaced at no additional cost to the Contracting Agency.

C. All inspection results shall be submitted and approved by the Engineer before final payment.

1. Any replacement pipe shall also be subject to the same testing.
2. All inspection and testing results shall be submitted to the Engineer for approval.

D. The Engineer shall be allowed access to randomly inspect at least 10 percent of the total number of pipe runs.

E. Internal Video Inspection. Internal video inspection shall be performed by the Contractor a minimum of 30 days after final backfill has been placed and prior to final acceptance by the Contracting Agency. This inspection includes 360 degree taping of all storm drain lateral joints. The line shall be cleaned and inspected per ***Subsection 601.03.07 "Video Inspection."***

END OF SECTION 603

SECTION 609 – CATCH BASINS, MANHOLES AND INLETS

DESCRIPTION

609.01.01 GENERAL

A. This work shall consist of constructing or reconstructing catch basins, manholes, inlets, and similar structures, consisting of Portland cement concrete with necessary reinforcement, metal frames, grates, and lids, including required excavation and backfilling.

B. This work shall also consist of preparing utility final location information as described on the project drawings and in Section 622 of these Special Provisions.

MATERIALS

609.02.01 GENERAL

A. Materials shall conform to the following sections and subsections:

Materials	Section/Subsection
Portland Cement Concrete	***501***
Reinforcing Steel	***505***
Miscellaneous Metal	***712***
Gray Iron Castings	***712.03.02***

B. Casting shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting strength and value for the service intended.

1. Casting shall be boldly filleted at angles and the arises shall be sharp and perfect.
2. Casting shall be sand blasted or otherwise effectively cleaned of scale and sand so as to present a smooth, clean, and uniform surface.

C. The Contractor shall obtain from the fabricator of the structural steel grates, frames, and gray iron castings a Certificate of Compliance stating that the fabrications meet these specifications, and giving certified shop weights for the fabrications.

D. Mortar for setting grates shall be mixed in the proportions of 1 part cement to 3 parts of fine aggregate.

E. Pipe crossbars for drop inlets shall be unpainted standard weight black pipe conforming to ASTM A53. Straps shall be unpainted ASTM A36 steel.

F. Grout shall conform to ASTM C476 and shall have a minimum strength of 2000 psi. Fine grout shall be proportioned by volume of one part Portland cement and 2-1/4 to 3 parts sand. Coarse grout shall consist of one part Portland cement, 2-1/2 to 3 parts sand, and 1 to 2 parts course aggregate.

G. Laboratory design mixes for grout, approved by a Licensed Professional Engineer in the State of Nevada, are acceptable in lieu of the above proportions and are required if the maximum strength is more than 2000 psi. Grout shall be of a fluid consistency with proper proportions of sand to gravel for pouring and pumping.

H. All exposed steel shall be hot-dipped galvanized per section 715.

CONSTRUCTION

609.03.01 GENERAL

A. Catch basins, inlets, and manholes shall be constructed in accordance with ***Section 501, "Portland Cement Concrete."***

B. Inlet and outlet pipes shall be placed prior to pouring concrete.

C. Grates shall be set in full mortar beds or otherwise secured as shown on the plans. Grates shall be set accurately to the final elevations so that no subsequent adjustments will be necessary.

D. Concrete covers, when indicated on the plans, shall be constructed to fit snugly and be readily removable.

E. Structural steel grates shall be painted as specified in ***Section 614, "Painting."***

F. Pipe or tile placed in masonry for inlet or outlet connections shall extend through the walls and beyond the outside surfaces of the walls a sufficient distance to allow for connections with conduit, and the masonry shall be carefully constructed around the pipe or tile to prevent leakage around their outer surfaces.

G. Commercially prefabricated frames and grates of equal or greater capacity and strength may be substituted for the design shown on the plans for drop inlets provided prior approval is obtained in writing from the Engineer.

H. Frames and grates shall be matchmarked in pairs before delivery to the work and grates shall fit into the frames without rocking.

609.03.02 ADJUSTING CATCH BASIN, MANHOLE, AND INLET COVERS

A. Unless otherwise provided on the plans or by the contract, existing covers including frames, grates, lining, and lids shall be adjusted to the required elevation.

B. Remove the existing covers and adjust the top of the existing structures by removing or adding concrete, brick masonry, concrete block masonry, high density polyethylene adaptor rings, or steel or cast iron adaptor rings, as applicable.

C. Reinstall the fixtures by supporting them on a satisfactory collar of concrete constructed to hold the fixtures firmly in place.

D. Concrete collars for manholes shall be constructed in accordance with Uniform Standard Drawing No. 408.1 “Concrete Collar Around Manholes, 30 Inch Ring and Cover.”

609.03.03 CLEAN OUT

A. All catch basins, manholes, inlets, and similar structures shall be thoroughly cleaned of any accumulations of silt, debris, or foreign matter of any kind, and shall be clean of accumulations at the time of final inspection.

609.03.04 EARTHWORK

A. Structure excavation and structure backfill shall conform to ***Section 206, "Structure Excavation"*** and ***Section 207, "Structure Backfill."***

END OF SECTION 609

SECTION 610 – SLOPE AND CHANNEL PROTECTION

DESCRIPTION

610.01.01 GENERAL

A. This work shall consist of constructing slope and channel protection structures to the lines and grades established by the Engineer using riprap or wire mesh gabions in accordance with the design shown on the plans and these specifications.

B. Riprap construction shall consist of furnishing and placing riprap (with or without grout) or sacked Portland cement concrete riprap.

C. Wire mesh gabion construction shall consist of furnishing, assembling, tying, and filling open mesh wire baskets with stone.

MATERIALS

610.02.01 GENERAL

A. All materials shall conform to the following sections and subsections:

Materials	Section/Subsection
Water	***722***
Hydraulic Cement	***701***
Grout and Mortar Sand	***706.03.04***
Riprap Grout	***706.03.05***

B. When so provided and with prior approval of the Engineer, crushed concrete may be substituted for the above designated stone. In such a case, the concrete shall be sound and meet all requirements as specified for stone.

610.02.02 GROUT

A. Grout shall be composed of 1 part by volume of Portland cement and 3 parts by volume of sand and shall be of such consistency that it will fill all voids in the riprap.

B. Comply with ***Subsection 706.03.05, "Riprap Grout."***

610.02.03 SACKED CONCRETE

A. Sacked concrete shall be composed of sacks filled with Portland cement concrete.

1. The mixed concrete shall contain a minimum of 376 pounds (4 sacks) of Portland cement per cubic yard.

2. The amount of water added at the time of mixing shall be such as will produce a mixture with a slump of from 3 inches to 5 inches.

B. Unless otherwise provided in the Special Provisions, aggregate for use in sacked concrete riprap shall consist of river run material of a sandy, gravelly nature, clean and free from roots, vegetable matter, and other deleterious substances. When tested on laboratory sieves, river run material shall conform to the following gradation requirements.

1. Passing a 2-inch sieve: 80 to 100 percent.
2. Passing a No. 200 sieve: 0 to 4 percent

C. Sacks for concrete riprap shall be made of at least 10 ounce burlap, and shall be approximately 19-1/2 inches by 36 inches measured inside the seams when the sack is laid flat.

1. The capacity of each sack shall be approximately 1.25 cubic feet.
2. Sound reclaimed sacks may be used.

610.02.04 STONES FOR RIPRAP

A. Stones used for riprap shall be hard, durable, angular in shape, resistant to weathering and erosion, and free from spoils, cracks, and organic matter.

1. The stone for non-grouted riprap shall have a minimum of 2 fractured faces with neither width nor thickness of a single stone less than 1/3 its length.
2. The specific gravity of the riprap shall not be less than 2.45.
3. The nominal stone size shall be as follows:

RIPRAP GRADATIONS

Percent Passing By Mass	Riprap D50=12" (Inches)	Heavy Riprap D50=18" (Inches)
100	20	30
70-85	18	27
35-50	12	18
5-15	5	7
0	2	3

B. This stone shall conform to the following requirements:

Source Requirements Test	Test Method	Requirements
Percent of Wear (500 Rev.)	ASTM C131	45% Maximum
Bulk Specific Gravity	ASTM C127	2.5 Minimum

C. Control of gradation will be by visual inspection.

1. Upon request by the Engineer, the Contractor shall provide a sample of stone of at least 5 tons meeting the gradation for each location riprap is indicated.
2. Each sample shall be located at the construction site near the location where the riprap is to be placed.
3. The sample shall be used as a frequent reference for judging the gradation of the riprap supplied.
4. The sample riprap shall be in place and acceptable to the Engineer before riprap

placing work begins.

5. The Contractor shall maintain the placed riprap until the project is completed and any material displaced by any cause shall be repaired to the lines and grades indicated on the plans.

D. Caliche stone or cementitious materials meeting the requirements of this section may be used as riprap with prior approval of the Engineer.

1. The riprap shall be fully cemented material. Only materials designated as hard (scratches leave only dust, requires many hammer blows to break) or very hard (difficult to scratch or break) shall be utilized.

2. Moderately hard (crumbles with several hammer blows) or partially cemented materials are not acceptable.

E. The Contractor may be required to provide riprap test results from an approved testing laboratory and a Certificate of Compliance in accordance with ***Subsection 106.05, "Certificate of Compliance."***

610.02.05 STONES FOR GABIONS

A. Stones for filling the gabions shall be well graded, hard stones, conforming to the testing requirements specified in ***Subsection 610.02.04, "Stones for Riprap."***

B. Size and gradation shall be such that the predominant size is between 4 inches and 8 inches, 85 percent by weight.

1. Minimum stone dimensions shall be 3 inches and maximum stone dimension shall be 8 inches.

2. For gabion baskets less than 1 foot in height, the maximum stone dimension shall be 6 inches.

610.02.06 FILTER MATERIAL

A. When filter material is specified or shown on the plans, the material shall consist of mineral aggregate that is clean, hard, durable, and free of any deleterious matter or harmful adherent coatings.

B. Gradation of the filter material shall conform to the requirements specified by the Engineer or as shown in the Special Provisions.

610.02.07 FILTER FABRIC

A. When filter fabric is specified or shown on the plans, the fabric shall consist of a geotextile that is made from synthetic fibers.

B. The filter fabric shall be in accordance with AASHTO M288, Section A4, and shall conform to the requirements specified by the Engineer.

610.02.08 WIRE MESH GABIONS AND GABION MATTRESSES

A. Wire mesh gabions and gabion mattresses shall be fabricated from either twisted wire mesh or welded wire mesh.

1. All wires shall be galvanized prior to fabricating the mesh and in compliance with

ASTM A90.

2. Only 1 type of wire mesh may be used in any 1 structure.

B. Gabion and gabion mattress dimensions of width, height, and length shall be as shown on the plans.

1. Each gabion unit shall not vary more than 5 percent from the dimensions shown on the plans.

2. Gabions come 1 foot or greater in height, 3 feet in width, and are compartmentalized into cells not larger than 3 feet by 3 feet by attaching to the base single diaphragm panels made of the same type and size mesh as the gabion panels.

3. Gabion mattresses come 9 inches or less in height, 6 feet in width, and are compartmentalized into cells not larger than 6 feet by 3 feet by attaching to the base single diaphragm panels made of the same type and size mesh as the gabion mattress panels.

C. The baskets shall be assembled with the necessary panels and diaphragms secured to the base in accordance with ASTM A975-97, Table 2 requirements. Pleating the base panel to obtain the diaphragms is prohibited.

D. Fabrication of the wire mesh gabions and gabion mattresses shall be as follows:

1. Twisted Wire Mesh Gabions and Gabion Mattresses:

a. Gabion panels for the twisted mesh style shall be manufactured from galvanized steel wire, Class 3, soft temper, conforming to ASTM A641, or from aluminized steel wire, soft temper, conforming to ASTM A809.

1) The wire shall have a minimum tensile strength of 60,000 psi when tested in accordance with ASTM A370.

2) Twisted wire mesh gabions and gabion mattresses shall comply with ASTM A975-97 standards.

b. The mesh shall be formed with non-raveling double twists by twisting each pair of wires through two 360-degree turns. The mesh openings shall be hexagonal in shape and uniform in size and shall comply with the mesh dimensions and requirements shown on Table 1 and Table 2 below.

c. All perimeter edges of the mesh panels forming the gabion basket shall be securely tied to a selvedge wire so that the selvedge-to-mesh connection has at least the same strength as the body of the mesh. Selvedge wire shall be the same kind and type of material used for the mesh, except that wire diameters shall be as shown on the tables below.

d. When specified by the Engineer, the galvanized or aluminized wire shall be coated with a polyvinyl chloride (PVC) material. The coating shall be accomplished by using either extruded or extruded and bonded PVC material, and shall be applied before twisting the wire into mesh panels.

e. All wire used for twisted mesh gabions and gabion mattresses shall meet the following nominal requirements:

Table 1 - Nominal Requirements for Twisted Wire Mesh Gabions			
Type of Basket	**Mesh Size**	**Mesh Wire**	**Selvedge Wire**
Baskets 1 foot or greater in height	3.25-inch by 4.5-inch	0.120 inch	0.148 inch
Baskets 1 foot or greater in height with PVC coating	3.25-inch by 4.5 inch	0.106 inch, plus the PVC coating	0.134 inch, plus the PVC coating

Table 2 - Nominal Requirements for Twisted Wire Mesh Gabion Mattresses			
Type of Basket	**Mesh Size**	**Mesh Wire**	**Selvedge Wire**
Baskets 9 inches or less in height	2.5-inch by 3.25 inch	0.087 inch	0.106 inch
Baskets 9 inches or less in height with PVC coating	2.5-inch by 3.25 inch	0.087 inch, plus the PVC coating	0.106 inch, plus the PVC coating

2. Welded Wire Mesh Gabions and Gabion Mattresses:

   a. Gabion panels for the welded mesh style shall be manufactured from welded wire fabric conforming to ASTM A185 and ASTM A974-97, Type 1.

   b. Galvanized wire shall have a Class 3 coating as indicated in ASTM A641.

   c. Aluminized wire shall have a minimum coating as indicated in ASTM A809.

   d. The wire shall be soft tempered with a minimum tensile strength of 60,000 psi when tested in accordance with ASTM A370.

   e. Welded wire mesh gabions and gabion mattresses shall comply with ASTM A974-97 standards.

   f. The mesh shall form a square or rectangular grid pattern with the maximum diagonal dimension of any grid opening not to exceed 4.5 inches.

   g. The welded wire mesh shall be galvanized or aluminized prior to welding into mesh and shall comply with the dimensions and requirements shown on Table 3 and Table 4 below.

   h. When specified by the Engineer, the welded wire mesh shall be coated with a polyvinyl chloride material. The PVC coating shall be fusion bonded to the galvanized or aluminized wire after fabrication of the gabion mesh panels.

   i. All wire used for welded mesh gabions and gabion mattresses shall meet the following nominal requirements:

Table 3 - Nominal Requirements for Welded Wire Mesh Gabions		
Type of Basket	**Mesh Size**	**Mesh Wire**
Baskets 1 foot or greater in height	3-inch by 3-inch	0.120 inch
Baskets 1 foot or greater in height with PVC coating	3-inch by 3 inch, plus the PVC coating	0.106 inch, plus the PVC coating

Table 4 - Nominal Requirements for Welded Wire Mesh Gabion Mattresses		
Type of Basket	**Mesh Size**	**Mesh Wire**
Baskets 9 inches or less in height	1.5-inch by 3-inch	0.087 inch (2.21 mm)
Baskets 9 inches or less in height with PVC coating	1.5-inch by 3-inch, plus the PVC coating	0.087 inch, plus the PVC coating

j. For polyvinyl chloride coated either twisted or welded mesh gabions and gabion mattresses, the PVC coating shall have a nominal thickness of 0.020 inch and a minimum thickness of 0.015 inch. The coating shall be grey, silver, green, or black and conform to the following:

1) Specific Gravity: In the range of 1.20 to 1.40, ASTM D792.

2) Abrasion Resistance: The percentage of weight loss shall be less than 12 percent, when tested according to ASTM D1242, Method B at 200 cycles, CSI-A Abrader Tape, 80 Grit.

3) Brittleness Temperature: Not higher than 15 degrees F, ASTM D746.

4) Tensile Strength: Extruded Coating - Not less than 2,980 psi, ASTM D412. Fusion Bonded Coating - Not less than 2,275 psi, ASTM D638.

5) Modulus of Elasticity: Extruded Coating - Not less than 2,700 psi, at 100 percent strain, ASTM D412. Fusion Bonded Coating - Not less than 1,980 psi. at 100 percent strain, ASTM D638.

6) Ultraviolet Light Exposure: A test period of not less than 3,000 hours, using apparatus Type E at 145.4 degrees F, ASTM G23.

7) Salt Spray Test: A test period of not less than 3,000 hours, ASTM B117.

610.02.09 INTERNAL CONNECTING WIRES

A. Internal connecting wires to reinforce the side panels of individual gabion baskets shall meet the same specifications as the wire used in the gabion body, except wire nominal diameter shall be 0.087 inches or larger. Alternate preformed stiffeners acceptable to the gabion manufacturer and the Engineer may also be used.

610.02.10 LACING WIRE

A. Lacing wire to assemble, interconnect, and close the gabion baskets shall meet the same specifications, as the wire used in the gabion body except its nominal diameter shall be 0.087 inches.

610.02.11 WIRE FASTENERS

A. Machine formed spiral wire binders with a 3-inch pitch and 2.5-inch inside diameter maximum are the standard fastener for welded wire mesh gabions and gabion mattresses, and shall be formed from wire meeting the same quality and coating thickness requirements as specified above for the gabions and gabion mattresses.

B. As an alternative to lacing wire and spiral binders, wire fasteners including interim fasteners, interlocking ring fasteners, overlapping (hog) ring fasteners, and twist ties may be used, subject to the approval of the Engineer.

C. The Contractor shall demonstrate that:

1. The proposed fastener can consistently resist an opposed tension force of at least 600 pounds without pulling apart.

2. The proposed fastener system can consistently produce a joint with strength of at least 1,400 pounds per linear foot while encompassing the number of wires as intended for its use. When PVC coated wire is used, the joint strength shall be at least 1,200 pounds per linear foot.

3. The proposed fastener system does not cause damage to the protective coating on the wire.

4. The Contractor has the proper equipment and trained employees to correctly install the fasteners.

5. Proper installation can be readily verified by visual inspection.

D. The Contractor shall provide a complete description of the fastener system, including the number of fasteners required, the number and size of wires that the fastener is capable of properly joining, and a description of a properly installed fastener, including drawings or photographs, if necessary.

E. Properly formed fasteners shall meet the following requirements:

1. Each interlocking fastener shall be locked and closed.

2. Each overlapping ring fastener shall be closed and the free ends shall overlap a minimum of 1 inch.

3. Spiral binders shall be crimped to secure the spiral in place.

4. Twist ties shall have a minimum of 2 complete revolutions.

F. If gauges or other aids are needed to verify the proper installation of the fasteners, the Contractor shall furnish the Engineer the gauges or aids in numbers as may reasonably be required.

1. If more than 1 wire fastener is proposed, e.g. different gauge or length of wire, for different joints, the fasteners shall be readily distinguishable.

2. Wire fasteners shall not be used to join more wires, or larger wires, than for which they were tested and approved.

3. As a minimum, a fastener shall be installed at intervals of 4 inches to 6 inches at the location where mesh wire meets selvedge or edge wire.

G. Fastener Materials:

1. Galvanized wire fasteners shall be used with galvanized gabions.

2. Aluminized wire fasteners shall be used with aluminized gabions.

3. Stainless steel overlapping rings or interlocking rings shall be used for stainless steel gabions.

4. PVC coated wire spiral binders shall be used for PVC coated gabions.

H. Fastener Properties:

1. Galvanized wire fasteners shall conform to ASTM A764 with Type III coating.
2. Aluminized wire fasteners shall conform to ASTM A809 for wire diameter and coating, with tensile strength equal to ASTM A764, Table 2.
3. Stainless steel wire fasteners shall conform to ASTM A313, Grade 302.
4. Spiral binder fasteners shall be formed with wire having at least the same thickness and coating as the basket mesh wire.
5. Twist tie fasteners shall meet the requirements of lacing wire, as specified in Subsection 610.02.10, "Lacing Wire."

CONSTRUCTION

610.03.01 EARTHWORK

A. The areas where riprap or wire mesh gabions are to be placed shall be graded to the required lines and grades as shown on the plans or as directed by the Engineer.

B. Any excavations or backfill required to achieve such grade shall conform to the provisions of ***Section 206, "Structure Excavation,"*** and ***Section 207, "Structure Backfill."***

610.03.02 FILTER PLACEMENT

A. Filter material shall be spread uniformly on the prepared foundation surface in a manner satisfactory to the Engineer, and to the slopes, lines, and grades as shown on the plans or as specified by the Engineer.

1. Placing of a filter material by methods that will segregate particle sizes will not be permitted.
2. Any damage to the foundation surface during filter placement shall be repaired before proceeding with the work.
3. The filter materials shall be placed and placement shall be approved and accepted before proceeding with the work.
4. The filter materials shall be placed and finished to present a reasonably even surface free from mounds or windrows.
5. Compaction of the filter materials shall conform to the requirements shown on the plans or as outlined in the Special Provisions.

B. Filter fabric shall be installed in accordance with the manufacturer's recommendations and in manner that will not tear, puncture, or shift the fabric.

C. Joining edges of the filter fabric shall be overlapped a minimum of 18 inches.

D. Filter fabric placed behind and/or beneath gabion or gabion mattress structures shall have a minimum permeability of 0.15 inch/second and shall be designed to retain the fine particles of the subsoil while releasing any hydrostatic pressure buildup.

610.03.03 RIPRAP

A. Stone for riprap shall be placed in a manner that will produce a well-graded mass of stone with a minimum percentage of voids.

1. The entire mass of stone shall be placed in conformance with the lines, grades, and thicknesses shown on the plans.
2. Riprap shall be placed to its course thickness in 1 operation and in such a manner as to avoid displacing underlying material.
3. When filter fabric is used under the riprap, the height from which the stone is dropped shall be minimized to avoid fabric damage.
4. Placement of stones shall begin at the bottom of the slope and proceed upward to the top.

B. The large stones shall be well distributed and the entire mass of stone shall conform to the gradation specified.

1. All material placed as riprap protection shall be so placed and distributed that there is no large accumulation of either the larger or smaller sizes of stone.
2. Placing of riprap in layers, or by dumping into chutes, or by similar methods likely to cause segregation will not be permitted.

610.03.04 GROUTED RIPRAP

A. When grouted riprap is specified, the stone shall be laid as set forth above for riprap.

B. The spaces between the stones shall then be filled with grout as directed, and in accordance with ***Subsection 706.03.05, "Riprap Grout."***

C. Sufficient grout shall be used to completely fill all voids, except that the face surface of the stone shall be left exposed.

D. After grouting is completed, the surface shall be cured as specified in ***Section 502, "Concrete Structures"*** for a period of at least 3 days.

610.03.05 SACKED CONCRETE RIPRAP

A. The sacks shall be filled with concrete, loosely placed, with enough room left at the top to fold to retain the concrete at the time of placing.

1. Not more than 1 cubic foot of concrete shall be placed in each sack.
2. Immediately after being filled with concrete, the sacks shall be placed and lightly trampled to cause them to conform with the earth face and to adjacent sacks in place.

B. The slopes on which the sacked concrete riprap is to be placed shall be finished true to line and grade.

1. The first course shall consist of a double row of stretchers laid in a neatly trimmed trench.
2. The second course shall consist of a single row of headers.
3. The third and remaining courses shall consist of stretchers.

4. Courses shall be placed in such a manner that joints in succeeding courses are staggered.
5. All dirt and debris shall be removed from the top of the sacks before the next course is laid thereon.
6. Stretchers shall be placed so that the folded ends will not be adjacent.
7. Headers shall be placed with the folds toward the earth face.
8. Not more than 4 vertical courses of sacks shall be placed in any tier until initial set has taken place in the first course of any such tier.

C. When, in the opinion of the Engineer, there will not be proper bearing or bond for the concrete due to delays for any cause, a small trench shall be excavated back of the row of sacks already in place. The trench shall be filled with fresh concrete before the next layer of sacks is laid.

D. Sacked concrete riprap shall be cured in accordance with **Section 702, "Concrete Curing Materials and Admixtures."**

610.03.06 WIRE MESH GABIONS AND GABION MATTRESSES

A. Prior to the assembly and placement of the wire mesh gabions, a representative of the gabion manufacturer shall be present at the construction site for 1 day of placement or construction to demonstrate the method of assembling, interconnecting, stone filling, and closing the gabion, unless otherwise specified in the Special Provisions.

B. Construction of the gabion structure shall not proceed until the Engineer approves the Contractor's assembly and placement methods.

C. Gabion baskets shall first be assembled as empty units.

1. The panels and diaphragms shall be connected to the base panel, rotated into position, and joined along the edges with lacing wire, spiral binders, or approved wire fasteners.
2. When joined with lacing wire, the lacing wire shall be tightly looped at intervals of not more than 6 inches along the seams so that single and double loops are alternated.
3. When joined with preformed spiral binders, thread the spirals along the panels' edges through every mesh and crimp the spirals ends to secure them in place.
4. When joined with alternate fasteners, the fasteners shall be properly installed as specified in ***Subsection 610.02.11, "Wire Fasteners."***
5. For either method, there shall not be any opening greater than 2 inches (maximum line dimension) along the joined edges or at the corner of the gabion basket.

D. Empty gabion baskets shall be placed into position, over the filter fabric when required, on the prepared foundation.

1. Empty gabion baskets shall be joined successively to the next empty gabion basket before filling with stone.
2. Each row, tier, and layer of baskets shall be reasonably straight and shall conform to the line and grade shown on the plans or established by the Engineer.

3. The empty gabion baskets shall be fastened to the adjacent baskets along the top and vertical edges.

4. Each layer shall be fastened to the underlying layer along the front, back, and ends.

5. Unless otherwise shown on the plans, the vertical joints between basket units of adjacent tiers or layers shall be staggered by at least one cell along the length of the structure.

E. All fastening of adjacent baskets shall be done with lacing wire, spiral binders, or approved wire fasteners in order to obtain a monolithic structure. The method of fastening shall meet the same requirements as that specified for assembling individual gabion baskets.

F. Fastening shall be made through selvedge-to-selvedge or selvedge-to-edge wire connection. Mesh-to-mesh or selvedge-to-mesh wire connection is allowed along vertical edges or in the case where baskets are offset or stacked, and selvedge-to-mesh or mesh-to-mesh wire connection would be necessary.

G. Before filling each gabion basket with stone, tension may be applied to the empty baskets to achieve a uniform alignment and shall be accomplished to prevent any possible unraveling.

1. Welded wire mesh gabions do not require stretching.

2. The finished gabion structure shall have no gaps along the perimeter of the contact surfaces between adjoining gabion basket units.

H. The gabion cells shall be carefully filled with stone placed by hand and/or machine so that the alignment of the structure will be maintained to avoid bulges and minimize voids.

1. All exposed stone surfaces shall have a reasonable smooth and neat appearance.

2. No sharp stone edges shall project through the wire mesh.

I. The gabion baskets stone-fill may be either cobbles or crushed stone.

1. The stone shall be clean, hard, durable, and of suitable quality to ensure suitable performance in the gabions or gabion mattresses.

2. The stone shall be free from cracks, seams, and other defects that would tend to increase its deterioration in the gabion baskets.

3. The inclusion of dirt, sand, clay, debris, and rock fines will not be permitted.

4. Stone-fill used in the gabions and gabion mattresses shall be a well-graded mixture with sizes ranging between 4 inches and 8 inches in diameter for gabions 1 foot or greater in height, and between 3 inches and 6 inches in diameter for gabion mattresses 9 inches or less in height.

J. The gabion cells in any row or layer shall be filled in stages so that local deformations may be avoided.

1. At no time shall any cell be filled to a depth exceeding 12 inches more than any adjacent cell.

2. The maximum height from which the stone may be dropped into the basket units shall be 3 feet.

K. During filling operations, internal connecting wires shall be placed in all exposed front and side gabion units in the following manner:

1. For gabion cells with a 36-inch height:

a. Stone shall be placed to a depth of 1/3, 12 inches, after which a minimum of 2 equally spaced internal connecting wires shall be placed in each cell, connecting the front and back faces of the compartment.

b. For corner units, internal connecting wires shall be placed in both directions.

c. The connecting wires shall be looped around 2 twisted wire mesh openings, or a welded wire joint, at each basket face, and the wire terminals shall be securely wrapped to prevent their loosening.

1) This operation shall be repeated when the cell is 2/3 full.

2) In welded mesh gabions, these cross-ties or stiffeners are made from lacing wire and placed across the comers of the gabion cells at 12 inches from the comers, thus providing a diagonal bracing. Lacing wire or preformed hooked wire stiffeners may be used.

2. For thinner gabion cells:

a. Internal connecting wires are not required except when 18 inch baskets are used to build exposed vertical surfaces.

b. In this case, the procedures under Subparagraph 1. above shall be followed, except that the internal connecting wires shall be placed at 9 inches from the base.

610.03.07 PARTIALLY GROUTED RIPRAP

A. When grouted riprap is specified, the stone shall be laid as set forth above for riprap.

B. The spaces between the stones shall then be filled with grout as directed, and in accordance with ***Subsection 706.03.05, "Riprap Grout."***

C. Sufficient grout shall be used to fill 1/3 to 1/2 of the void spaces, and in accordance with Subsection 706.03.05, "Riprap Grout". The target distribution of grout within the riprap matrix is such that about two-thirds of the grout should reside in the upper half of the riprap layer, with one-third of the grout penetrating into the lower half.

D. No grout should penetrate deep enough to come in contact with any underlying filter.

E. The grout shall "glue" individual stones to neighboring stones at their contact points, but leaves relatively large voids between the stones.

F. Conglomerate-like elements should be present in the riprap after partial grouting.

G. After grouting is completed, the surface shall be cured as specified in Section 502, "Concrete Structures" for a period of at least 3 days.

END OF SECTION 610

SECTION 611 – CONCRETE SLOPE PAVING

DESCRIPTION

611.01.01 GENERAL

A. This work shall consist of constructing concrete slope paving and concrete mortar slope paving including aprons and cutoff walls in connection therewith, to the lines and grades established by the Engineer and in accordance with the design shown on the plans.

MATERIALS

611.02.01 GENERAL

A. Materials shall conform to the following sections:

Materials	Section
Portland Cement Concrete	***501***
Reinforcing Steel	***505***

B. Concrete mortar slope paving shall consist of a mixture of 1 part Portland cement to 4 parts sand, thoroughly mixed in a dry state prior to mixing with water.

1. Measurement may be either by volume or weight.
2. Before placing, all lumps 3/8 inch and over shall be removed by screening.
3. Sand shall conform to ***Subsection 706.03.03, "Fine Aggregate."***
4. An air-entraining admixture shall be added to the concrete mortar at a rate of 4 percent to 7 percent.

C. Reinforcing for the slope paving and cutoff walls shall be reinforcing steel in accordance with the Contract Drawings and ***Section 505, "Reinforcing Steel."***

D. Header boards consisting of 2-inch by 4-inch redwood lumber furnished and placed in the concrete or mortar slope paving shall be as shown on the plans. Lumber used in the construction of header boards shall be commercial grade heart redwood, S4S.

E. Nails used in construction of header boards shall be commercial quality galvanized nails.

F. Concrete for the concrete slope paving and cutoff walls shall be modified Class A or AA using Type V cement (6.0 sack minimum, 0.53 water/cement ratio), having a minimum twenty-eight (28) day compressive strength of 3000 psi having a slump not to exceed 4-inches.

CONSTRUCTION

611.03.01 EARTHWORK

A. The subgrade for paved ditches and slope paving shall be formed by excavating to the required depth below the prepared finish surface grade in accordance with dimensions and design indicated on the plans or as directed by the Engineer.

B. The subgrade shall be thoroughly compacted.

1. Any soft, spongy, or other unsuitable material shall be removed to the depth directed by the Engineer, backfilled with suitable material, and thoroughly compacted.

2. Water shall be sprinkled on the subgrade during compaction.

3. The subgrade shall be sufficiently moist prior to placing concrete or mortar to prevent absorption.

C. Excavations for trenches, footings, cutoff walls, and so forth shall conform to ***Section 206, "Structure Excavation."*** Gradation and compaction requirements on structure backfill will not apply.

611.03.02 GENERAL

A. Concrete, after placing, shall be tamped until it is thoroughly consolidated and mortar flushes to the surface.

1. If the slope is too steep to permit the use of concrete sufficiently wet to flush with tamping, the concrete may be tamped until consolidated and a mortar surface 1/4-inch thick troweled on immediately.

2. The mortar shall consist of 1 part Portland cement and 3 parts clean, sharp sand.

3. The mortar surface shall be considered as a part of the concrete and no additional allowance will be made therefor.

B. After striking off to grade, the concrete shall be hand floated with wooden floats not less than 4 inches in width and not less than 30 inches in length.

1. Care shall be taken to prevent rotary marks of the hand floats.

2. The entire surface shall be broomed with a fine texture hair push broom to produce a uniform surface and eliminate float marks.

3. Brooming shall be done when the surface is sufficiently set to prevent deep scarring and shall be accomplished by drawing the broom down the slope leaving the marks parallel to the edges of the panel.

4. Joints shall be edged with a 1/4 inch radius edger prior to the brooming.

C. Materials for mortar that have been mixed for more than 45 minutes and have not been incorporated in the work shall not be used unless otherwise permitted by the Engineer.

D. Concrete or mortar shall not be placed against frosted or frozen surface. If concrete or mortar is placed during cold weather, it shall be heated and protected during placing and curing as set forth in ***Section 501, "Portland Cement Concrete,"*** except concrete or mortar shall be maintained at a temperature of not less than 50 degrees F for 72 hours after placing and at not less than 40 degrees F for an additional 4 days.

E. The slope paving shall be constructed without expansion joints.

F. The mesh reinforcing shall be placed in the approximate center of the concrete mortar.

G. All joints shall be lapped 6 inches and run continuously throughout paving or between headers.

H. Concrete slope paving, aprons, and cutoff walls shall be cured as specified in **Section 502, "Concrete Structures."**

END OF SECTION 611

SECTION 614 – PAINTING

DESCRIPTION

614.01.01 GENERAL

A. This work shall consist of the preparation of surfaces to be painted and the application, protection, and drying of the required number of coats of paint of the kinds and at the points specified or ordered by the Engineer.

MATERIALS

614.02.01 GENERAL

A. Materials shall meet or exceed the minimum standards hereinafter set forth.

B. **Materials:**

1. The raw materials for use in the various paint formulas shall conform to the specifications designated by Federal or Military serial number or paint material code number under the various paint classifications hereinafter specified.
2. Subsequent amendments to the specifications quoted shall apply to all raw materials and finished products.
3. No "or equal" substitutions for any specified material shall be made without written consent of the Engineer.

C. **Manufacturing and Packaging:**

1. All manufactured paint shall be prepared at the factory ready for application.
2. The addition of thinner or other material to the paint after the paint has been shipped will not be permitted, unless so specified.
3. The finished paint shall be furnished in new, round steel containers of not more than 6-gallon capacity and of metal not thinner than 0.024-inch nominal thickness.
    a. The containers shall have lug type crimp lids with ring seals and be equipped with ears and bails.
    b. The containers shall meet U.S. Department of Transportation Hazardous Material Shipping Regulations.
    c. The containers shall be lined if necessary to prevent attack by the paint.
    d. The lining shall not come off the can as skins.
4. No finished paint shall be used until at least 7 days have elapsed from the date of its manufacture.
5. All containers of paint shall be labeled showing the exact title of the paint specification, California State specifications number, manufacturer's name, date of manufacture, and manufacturer's batch number.
6. Precautions concerning the handling and the application of paint shall be shown on the label of paint and solvent containers.

614.02.02 NUMBER OF COATS

A. Unless otherwise required in the contract documents, the number and kinds of coats of paint shall be as set forth in ***Section 714, "Paint and Pavement Markings."***

CONSTRUCTION

614.03.01 WEATHER CONDITIONS

A. Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather.

1. Except as provided below, painting will not be permitted when weather conditions during applications are such that the atmospheric temperature is at or below 40 degrees F or when freshly painted surfaces may become damaged by rain, wind, dust, or condensation, or when it can be anticipated that the atmospheric temperature will drop below 40 degrees F during the drying period.

2. If fresh paint is damaged by the elements, the paint shall be replaced by the Contractor at no additional cost to the Contracting Agency.

B. Subject to the approval of the Engineer in writing, the Contractor may provide suitable enclosures to permit painting during inclement weather.

1. Provisions shall be made to control atmospheric conditions artificially inside the enclosures within the limits suitable for painting throughout the painting operation.

2. The cost of providing and maintaining such enclosures shall be considered as included in the prices paid for the various contract items of work and no additional payment will be made therefore.

614.03.02 APPLICATION – GENERAL

A. Painting shall be done in a neat and workmanlike manner.

B. Unless otherwise specified, paint shall be applied by brush, roller, or spray methods.

1. Brushes shall have sufficient body and length of bristle to spread the paint in a uniform coat.

2. In general, the primary movement of the brush shall be such as to fill thoroughly all irregularities in the surface, after which the coating shall be smoothed by a series of parallel strokes.

3. Paint shall be evenly spread and thoroughly brushed out.

4. If a considerable amount of brush marks appear, it will be considered that the paint has been improperly applied.

5. Rollers shall be of a type that do not leave a stippled texture in the paint film.

C. Work that is defective shall be refinished or repainted as directed at no additional cost to the Contracting Agency.

D. On surfaces that are inaccessible for brushing, the paint shall be applied by sheepskin daubers or by other means approved by the Engineer.

E. If spray methods are used, the operator shall be experienced. Runs, sags, thin areas in the paint coat, or skips and holidays shall be considered as evidence that the work is unsatisfactory and the Contractor may be required to apply the remainder of the paint by brush.

F. Mechanical mixers shall be used to mix the paint.

1. The paint shall be mixed to thoroughly blend the pigment and vehicle together.

2. Paint shall be kept mixed while being applied.

G. Paint specified or formulated shall be ready for application and thinning will be allowed only on direction of the Engineer.

H. The Contractor shall protect all parts of the structure being painted against disfigurement by spots of paint or paint materials.

1. When paint is being applied on structures carrying public traffic, the Contractor shall be responsible for damage caused by Contractor's operations to passing vehicles or persons.

2. The Contractor shall use shields or other protective means to guard against such damage.

I. Paint stains that result in unsightly appearance shall immediately be removed by the Contractor at no additional cost to the Contracting Agency.

614.03.03 SURFACE PREPARATION OF STEEL

A. The following methods of surface preparation apply to steel surfaces. Unless otherwise specified, the sand blasting method shall be used.

B. **Sand Blasting:**

1. Dirt, mill scale, rust, stain, old paint, and other foreign material shall be removed from steel surfaces by an approved blast cleaning apparatus.

2. Blast cleaning shall be sufficient to give the surface the appearance of unpolished cast aluminum.

3. Abrasives used for blast cleaning shall be clean dry sand, mineral grit, steel shot, or steel grit, at the option of the Contractor, and shall be of a grading suitable to produce satisfactory results.

4. The use of abrasives other than those specified herein will not be permitted unless approved in writing by the Engineer.

5. When sand blasting is being performed on structures open to traffic, the Contractor shall provide suitable protective devices to prevent damage to traffic.

6. When sand blasting is being performed near machinery, all journals, bearings, motors, and moving parts shall be sealed against entry of sand dust before sand blasting begins.

7. Unless otherwise authorized by the Engineer, sand blasted surfaces shall be primed or treated the same day sand blasting is done.

8. If cleaned surfaces rust before painting is accomplished, the surfaces shall be recleaned by the Contractor.

C. **Washes:**

1. Rust-inhibitor chemical washes shall be applied to freshly sand blasted steel surfaces prior to the application of the first undercoat of paint, except when the first undercoat of paint is applied to the cleaned surfaces within a 4-hour period after cleaning, washes will not be required.
2. Washes shall be applied in not more than 4-hour intervals.
3. If, in the opinion of the Engineer, atmospheric conditions are such that corrosion forms on freshly sand blasted surfaces in less than 4 hours, treatment may be required at more frequent intervals.
4. Rust-inhibitor chemical washes may be applied by brush or spray, and the washes shall be applied in a careful manner to ensure that all surfaces are covered.
5. During the application of the rust-inhibitor chemical wash, no sand blasting will be permitted in the areas being treated.
6. No paint shall be applied until the treated surfaces have dried.
7. The first undercoat of paint shall be applied to the treated surfaces the same day that cleaning and washing have been done.

D. **Steam Cleaning:**

1. Dirt, grease, loose chalky paint, and other foreign material that has accumulated on the previously painted surfaces shall be removed with an approved steam cleaning apparatus which shall precede all other phases of cleaning.
2. It is not intended that sound paint be removed by this process.
3. Subsequent painting shall not be performed until the cleaned surfaces are thoroughly dry and in no case in less than 24 hours after cleaning.
4. A detergent soap consisting of 45 percent sodium metasilicate, 43 percent sodium sesquisilicate, 10 percent sodium tetraphosphate, and 2 percent Naccanol shall be added to the feed water of the steam generator at the approximate rate of 1 pound of detergent per 200 pounds of water.
5. Any residue that may accumulate on cleaned surfaces shall be removed by flushing with fresh water, but washing down the cleaned surfaces will not otherwise be required.

E. **Hand Cleaning:**

1. Dirt, loose rusts, mill scale, dead paint, or paint that is not firmly bonded to the metal surfaces shall be removed by hand or powered wire brushes, hand scraping tools, or sandpaper.
2. Pneumatic chipping hammers will not be allowed unless authorized in writing by the Engineer.
3. Hand cleaning shall be sufficient to remove all loose material that would prevent the bond of succeeding coats of paint.

F. If the amount of steel to be painted exceeds 100 tons, the surface shall be prepared by method B, "Sand Blasting"; however, if the amount to be painted is 100 tons or less, the surface may be prepared by method E, "Hand Cleaning."

614.03.04 PAINTING STRUCTURAL STEEL

A. **Paint:**

1. Unless otherwise required in the contract documents, the paints to be applied to steel surfaces shall conform to ***Section 714, "Paint and Pavement Markings."***
2. The undercoats shall consist of a minimum dry film thickness of 1 mil per coat.
3. The finish coat shall consist of a minimum dry film thickness of 1 mil.
4. The total thickness of all coats shall be not less than 3 mils.
5. Excessively thick coats of paint will not be permitted.
6. The thickness of each coat shall be limited to that which will result in uniform drying throughout the paint film.

B. **Field Cleaning:**

1. Unless otherwise specified in the contract documents, after erection and riveting or welding, all surfaces of unpainted structural steel that will be exposed to air shall be sand blasted in accordance with ***Subsection 614.03.03, "Surface Preparation of Steel."***
2. Any damage to sound paint, on areas not designated for treatment, resulting from the Contractor's operations shall be repaired to the satisfaction of the Engineer.

C. **Painting:**

1. Painting of structural steel prior to erection will be limited to surface preparation and one undercoat of paint.
2. Any deficiencies in the first coat of paint shall be corrected to the satisfaction of the Engineer, prior to the application of succeeding coats of paint.
3. Surfaces exposed to the atmosphere that would be inaccessible for painting after erection shall be painted the full number of coats prior to erection.
4. The surface of the paint coat being covered shall be free from moisture, dust, grease, or any other deleterious material that would prevent the bond of the succeeding paint coats.
5. In spot painting, any old paint that lifts after application of the first spot coat shall be removed by scraping and the area repainted before application of the next coat.
6. The application of the finish coat will be permitted until the required total film thickness of the undercoats of paint, as described in A, above, is obtained.
7. Open seams at contact surfaces of built-up members that would retain moisture shall be caulked with red lead paste before applying the second undercoat of paint.
8. Metal surfaces embedded in concrete need not be painted.

D. **Machine Finished Surfaces:**

1. With the exception of abutting chord and column splices and column and truss shoe bases, machine finished surfaces shall be coated with a rust inhibitor that can be easily removed.

2. Surfaces of iron and steel castings that have been machine finished shall be painted with a coat of shop paint.

E. **Frames and Grates:**

1. Prior to installation, all surfaces of frames and grates exposed to the atmosphere shall be painted with 2 coats of paint.

2. Unless otherwise specified in the contract documents, the exposed surfaces shall be painted after installation with 1 finish coat as specified for structural steel.

614.03.05 PAINTING TIMBER

A. **Paint:**

1. New timber requiring painting shall be painted with 3 coats of paint.

2. The paint used for various coats will be as specified in these specifications or in the contract documents.

B. **Preparation of Surfaces:**

1. Cracked or peeled paint, loose chalky paint, dirt, and other foreign matter shall be removed by wire brushing, scraping, or other approved means immediately prior to painting.

2. Unpainted timber shall be thoroughly dry before paint is applied.

C. **Painting:**

1. When permitted in writing by the Engineer, the first coat of paint may be applied prior to erection.

2. After the first coat has dried and the timber is in place, cracks, checks, nail holes, and so forth shall be puttied flush with the surface and allowed to dry before the second coat is applied.

3. Skips, holidays, thin areas, or other deficiencies in any coat of paint shall be corrected to the satisfaction of the Engineer before the succeeding coat is applied.

4. The surface of the paint coat being covered shall be free of any deleterious material before any additional paint is applied.

END OF SECTION 614

SECTION 619 – OBJECT MARKERS AND GUIDE POSTS

DESCRIPTION

619.01.01 GENERAL

A. This work shall consist of furnishing and installing object markers and guide posts of the design and at locations shown on the plans or established by the Engineer.

MATERIALS

619.02.01 GENERAL

A. Materials shall conform to ***Section 721, "Object Markers and Guide Posts."***

CONSTRUCTION

619.03.01 GENERAL

A. Target members, object markers, and reflectors appropriate to the color involved shall be assembled, fastened, set, and aligned in accordance with the details and dimensions shown on the plans.

B. All fastenings shall be tight.

619.03.02 RESET

A. Reset object markers and guide posts shall be erected, using salvaged materials, and shall be similar in type to the original construction.

B. Any new materials necessary to rebuild the markers shall be furnished by the Contractor, shall be the same as those in the original, if available, and the cost thereof shall be included in the contract price for the work.

C. The Contracting Agency reserves the right to furnish the Contractor with such new materials as the Contracting Agency deems advisable, and these materials shall be used in the resetting of the markers in lieu of salvage materials which the materials replaced.

END OF SECTION 619

SECTION 621 – MONUMENTS

DESCRIPTION

621.01.01 GENERAL

A. This work shall consist of furnishing and installing permanent survey monuments, constructed in accordance with the design and drawings shown on the plans or ordered by the Engineer.

B. All monuments destroyed and/or damaged shall be installed by the Contractor in accordance with the Uniform Standard Drawings, and under the direct supervision of the Engineer. The Contractor shall coordinate his work with the Engineer.

C. The Contractor shall coordinate Contractor's work with the Registered Land Surveyor.

MATERIALS

621.02.01 GENERAL

A. Monuments shall be constructed of Portland cement concrete, and shall be of Type I, Type II, Type III, or Type IV as shown in the Standard Drawings.

CONSTRUCTION

621.03.01 INSTALLATION

A. The monuments shall be set to assist in reestablishment of the center line for future use and shall be set at the beginning and end of each project, at the beginning and end of each curve, at any angle point, at street intersections, and to replace or reference Section Corners or other Government Land Corners.

B. The monuments may perpetuate a point or reference a point.

C. An as-built set of plans for the project, showing the exact location of all monuments set, shall be prepared by a Registered Land Surveyor and filed with the County Surveyor prior to acceptance of the project.

END OF SECTION 621

SECTION 622 – CONSTRUCTION SURVEYING BY THE CONTRACTOR

DESCRIPTION

622.01.01 GENERAL

A. The Contractor shall, under supervision of a Professional Land Surveyor, registered in the state of Nevada, furnish and set construction stakes establishing locations, lines, and slope stakes for roadway, storm drain, drainage structures, sewer, laterals, and for all other improvements for project necessary to ensure conformance of work to lines, elevations, locations, and grades as shown on the Plans and in these Special Provisions. Any horizontal or vertical discrepancies shall be reported to Engineer prior to commencement of construction. Any revisions or changes approved by Engineer that affect lines, grades, elevations or locations of any improvement shall be indicated on As-Built (Record) Drawings.

B. If necessary, the Contractor shall also perform and provide to the Engineer those items described in subsection 203.04.01 of the USS. Any revisions or changes approved by the Engineer that affect the lines, grades, elevations or locations of any improvement shall be indicated on the As-Built (Record) Drawings.

C. Contractor shall preserve property line and corner survey points. If their destruction is determined by Engineer to be unavoidable, and their replacement is not called for on the plans, Owner shall replace or pay for their replacement under this contract as determined by Engineer. Markers that are disturbed or destroyed by Contractor's operations without prior approval by the Engineer shall be replaced by Contractor at no additional cost to the Owner. Replacement shall be done only by a Nevada Professional Land Surveyor and in accordance with the USS. A monument tie sheet for replacement of permanent survey monuments shall be submitted to Engineer for approval.

D. When a permanent survey marker and/or monument is located within the construction area of any roadway, storm drain, drainage structures, sewer line or channel improvement, the Contractor shall adjust the cover or replace the monument as noted on the plans. The cost of replacement or adjustment of said monuments shall be included in the lump sum bid for Construction Survey. If monuments are to be installed as part of the work, they shall be placed in accordance with the USD numbers 239 through 243 and Section 621 of the USS.

E. The Contractor shall, under the supervision of a Professional Land Surveyor, prepare and provide GPS location and mapping of as-built conditions for all proposed sanitary sewer and storm drainage facilities as described on the Project Drawings and in this Section.

MATERIALS

622.02.01 BLANK

CONSTRUCTION

622.03.01 GENERAL

A. Prior to all work in this section, the Contractor shall carefully inspect all installed work and verify that all such work is complete to a point where this installation may properly commence.

B. The Contractor shall verify that all work can be installed in accordance with all pertinent codes and regulations, Contract Drawings and referenced standards.

C. The Contractor shall verify that there are no conflicts with existing utilities prior to the start of work.

D. In event of a discrepancy, the Contractor shall immediately notify the Engineer in writing.

E. Installation of work in areas of discrepancy shall not proceed until all such discrepancies have been fully resolved.

F. After stakes and marks have been set, it shall be the responsibility of the Contractor to protect the stakes and marks. Should any of the stakes or marks be destroyed or disturbed by the Contractor's operations or otherwise, the costs of replacing said stakes or marks shall be paid by the Contractor.

G. The Engineer, at his discretion, may periodically have survey work performed to verify conformance to the construction plans. Any nonconformity found to be the fault of the Contractor, or the Professional Land Surveyor, shall be corrected at no additional cost to the Owner.

H. Upon completion of the project and as a condition for final payment authorization, the Contractor shall furnish to the Engineer a Record of Survey/monument tie map and a certification attested to by the Professional Land Surveyor that the work performed for this contract has been constructed to the lines and grades as described in the As-built (Record) Drawings. When requested, the Contractor shall also provide the Engineer with copies of all field notes, computations, and other related work performed by the Professional Land Surveyor.

622.03.02 FINAL ACCURACY

A. Surface Drainage Structures (including all concrete or asphalt gutters and drains) shall be installed within 0.05 feet horizontally and 0.05 feet vertically from the location taken from the project plans, and shall not vary more than 10 percent of the gradient shown on the plans.

B. Monument Cases and Brass Caps shall be centered to within 0.01 feet horizontally of the position as called for on the plans, and the ties to that monument.

C. Sanitary and Storm Drainage Sewer Systems shall be installed within 0.05 feet horizontally and 0.05 feet vertically of the exact location taken from the project plans. In

addition, the gradient of any 10-foot section of pipe shall not vary by more than 10 percent of the gradient shown the project plans

622.03.03 INSTALLED/EXPOSED UTILITY SURVEYING

A. All measurements are to be made by the Surveyor who will be certifying the project as constructed.

B. The contractor is responsible for coordinating with the Surveyor during construction and shall provide access to all utilities prior to being buried; allowing accurate horizontal and vertical measurements to be acquired by the Surveyor. In the event of any discrepancies identified by CLV and at no cost to CLV, the Contractor shall verify the location and measurements of any buried utilities.

C. After construction of the approved plans and before backfilling, survey shall be conducted indicating the size, horizontal and vertical location, and configuration of any utility constructed with this project or utility exposed during construction, and utility encasement if applicable. Utility final location information shall be described by coordinates which shall be based on the official horizontal and vertical control networks of the City of Las Vegas and be certified by a Nevada professional land surveyor to have positional certainties within +/- 0.3-ft.

D. Survey measurements for utilities constructed or exposed during the course of construction including but not limited to pipes, manholes, drop inlets, conduits, cables, encasements, boxes, vaults and appurtenances shall be located to the extent possible within the excavation area. Measurements shall be taken at a minimum of 100-ft intervals, at all exposed angle points, deflections of the utility exceeding +/- 0.5-ft, at all exposed points that enter/exit the excavation or the public right-of-way, and sufficient measurements to accurately define curving layout.

E. Potholes performed by the contractor prior to or during construction shall be surveyed indicating the size, location, burial depth, and configuration of the utility. Pothole location information shall be tied to the official horizontal and vertical control networks of the City of Las Vegas and be certified by a Nevada professional land surveyor.

F. Utility final location information shall be submitted on paper and in electronic form, on a form specified by the City Surveyor. Submittal requirements and examples are included in Appendix E.

G. Interim and final survey progress reports shall be submitted to the Engineer certifying sufficient survey measurements have been performed prior to backfilling as required by this section on a weekly basis or as directed.

END OF SECTION 622

SECTION 624 - ACCOMMODATIONS FOR PUBLIC TRAFFIC

DESCRIPTION

624.01.01 GENERAL

A. The work shall consist of providing safe and effective work areas and to warn, control, protect and expedite vehicular and pedestrian traffic through the construction zone. It shall be the sole responsibility of the Contractor to provide for the safety of the traveling public within the limits of the project.

B. The work shall be performed in accordance with the MUTCD Latest Edition and as specified in these Special Provisions.

624.01.70 SPECIAL TRAFFIC CONTROL, LANE RESTRICTIONS OR ACCESS ISSUES:

A. Refer to ***Section 107.07, "Traffic and Access"*** for traffic and access requirements.

MATERIALS

624.02.01 GENERAL

A. The materials used for the construction and maintenance of facilities required for the free flow of public traffic and for protection of the work shall be those prescribed for the several items which constitute the finished work and shall conform to all the requirements for such materials as set forth herein.

CONSTRUCTION

624.03.01 SPECIAL DETOURS

A. Special detours shall be constructed as shown on the Traffic Control Plan prepared by the Contractor. Detour locations indicated on the Traffic Control Plan may be approximate only; the exact location shall be staked by the Contractor's surveyor.

B. Grading for special detours shall consist of motor grader work, supplemented where necessary by other mechanical equipment, to provide the specified roadbed width and a grade line free from breaks or rolls of sufficient magnitude to be hazardous to traffic. This work shall conform to ***Subsection 107.21, "Dust Control."***

C. When grading of special detours has been completed and approved by the Engineer and, if required on the plans or in the Special Provisions, the special detours shall receive surfacing materials of the kind and type specified, and the detours shall be placed and constructed in accordance with the requirements for the particular materials used.

D. Water shall be applied to detours in amounts necessary to attain the compaction of graded sections and of surfacing materials.

E. Maintenance on special detours shall consist of performing any work necessary to maintain the detour satisfactorily, as ordered by the Engineer.

F. Eradication of special detours shall consist of blade grader and scraper work supplemented by other equipment if needed. Eradication shall be performed to the extent

that the ground will be restored as nearly as feasible to the original, and material disposed of, all as directed by the Engineer.

G. It is the City of Las Vegas's policy that under no circumstances will travel on a temporary gravel surface be permitted for longer than fifteen (15) calendar days. Temporary gravel surfaces shall be graded, watered and maintained at all times to provide a smooth dust free traveled surface.

H. All temporary detours and/or bypasses that are expected to be in service for more than fifteen (15) calendar days shall be hard surfaced with a minimum of 1-1/2 inches of AC pavement and maintained in a smooth and usable condition at all times for the duration of the detour and/or bypass.

624.03.02 FLAGGERS

A. If, in the opinion of the Engineer, controlled traffic is necessary for protection of the work or for safety of public traffic, flaggers shall be employed by the Contractor.

B. Flaggers shall have completed an approved instructional course in flagging procedures.

C. A prospective flagger shall possess a valid flagger card attesting satisfactory completion of said instructional course conducted by the Nevada Department of Transportation or some other approved course given by another governmental agency.

D. Proper advance warning signs shall be in place when flaggers are working and removed when work requiring flaggers is completed.

E. Flaggers shall be used to assist trucks for safe ingress and egress whenever truck movements may interfere with safe passage through the work zone. The flaggers' first priority shall be to maintain the safe and efficient movement of the public traffic. In the event that a flagger is to flag at an intersection controlled by a stop sign they must bag the sign(s) prior to taking control of traffic. If a flagger is to flag at an intersection controlled by a traffic signal the traffic signal must be turned off prior to taking control of traffic. Any changes to regulatory signs or changes to a traffic signal shall be reversed at the end of every workday, unless approved by the traffic engineer. Failure to do so could result in an order to stop work.

F. The "Flagger Method" as outlined in Part VI of the MUTCD shall be used for all one lane, two-way traffic control.

624.03.03 PILOT CARS

A. If, in the opinion of the Engineer, it is necessary to afford additional protection to the work, workers, or public traffic, a pilot car and driver shall be used as the Engineer directs. This provision shall be in effect even though the pilot car and driver are not indicated on the plans or provided for in these specifications.

B. Pilot cars shall be suitable vehicles in good mechanical condition and shall carry a sign which shall comply with the design and mountings as shown on the standard drawings appended to the Special Provisions, or shown on the plans.

624.03.04 MAINTAIN BASE

A. When the proposal contains an item of "Maintain Base," the provisions of ***Subsection 109.03, "Extra and Force Account Work,"*** shall apply.

624.03.05 EQUIPMENT RENTAL

A. When the proposal contains an item of equipment rental, the use of such equipment shall be as directed by the Engineer or as indicated on the plans.

624.03.70 TEMPORARY STRIPING

A. The temporary traffic striping tape material shall conform to subsection 635.02.01 of the NDOT Standards. Placement of temporary pavement striping shall be by pilot line method and its use limited to fourteen (14) calendar days. The tape shall be four (4) inches wide and four (4) feet long and spaced every forty- (40) feet. The color of the tape shall match the color of the existing line. The double yellow line shall have two pieces of tape side by side with a four (4) inch space between, and spaced to the above increments.

B. Painted temporary striping shall be 4-inches wide and shall be continuous or intermittent in accordance with the MUTCD. Painted temporary striping shall not be used on the final wearing course of the pavement.

C. Existing pavement markings, either painted or raised pavement markers, which are not applicable and are within the transverse limits of the temporary travel lanes shall be removed to the satisfaction of the Engineer. Painting over existing markings will not be allowed.

624.03.71 TEMPORARY BRIDGES FOR VEHICULAR ACCESS

A. Where necessary or required for the convenience of the traveling public or individual residents, businesses or schools, The Contractor shall provide temporary bridges over all unfilled excavations at all street, driveway and alleyway, crossings unless otherwise directed by the Engineer. The bridges shall remain in place until the excavations have been properly backfilled to the satisfaction of the Engineer.

D. Temporary bridges for street crossings shall conform to the requirements of the authority having jurisdiction in each case, and the Contractor shall adopt designs furnished by said authority for such bridges or shall submit designs for approval by said authority as may be required. If plates are used, they must be capable of carrying the heaviest anticipated loads using the roadway, be properly anchored so as to prevent any transverse and/or any longitudinal shifting of the plate and must be certified by a structural engineer registered in the State of Nevada. Refer to the City of Las Vegas Trench Plate Requirements detail in Appendix “B”.

624.03.72 PIPE LAYING OPERATIONS

A. Pipe stored in the street rights of way within a barricaded work zone, with the approval of or at the direction of the Engineer, which is to remain one night or more shall be protected by Barrier Rail. Type B high intensity warning lights will be installed on the barrier rail at intervals not exceeding 25 feet.

E. During working hours, the Contractor shall have no more than three hundred (300) feet of open trench and/or structure excavation nor more than one half (1/2) of an intersection closed to vehicular traffic, except with specific written permission by the Engineer. During non-working hours, the Contractor shall have no more than one hundred (100) feet of open trench and/or structure excavation barricaded in accordance with these supplemental specifications. Pedestrian access crossings suitably equipped with handrails shall be

provided as directed by the Engineer. The cost of such crossings shall be included as a part of the traffic control bid item.

624.03.73 TRAFFIC CONTROL DEVICES

A. Trained and knowledgeable traffic control personnel shall be utilized to insure proper set-up and maintenance of traffic control devices and to assist in the safe movement of vehicles through the traffic control zone.

F. The Contractor from the public right-of-way shall remove all traffic control devices that are not in use or will not be used for a period greater than 24 hours. All traffic control devices that are determined by the Engineer to be unnecessary, confusing, or causing an unsafe condition, shall be removed by the Contractor from the public right-of-way immediately upon written notification by the Engineer. The Contractor shall not, at any time, use the sidewalk area to store unused barricades unless the sidewalk is closed and an approved barricade plan is provided for rerouting the pedestrians.

G. The Contractor shall maintain all barricades and other traffic control devices in clean and effective condition. The Contractor shall replace poorly maintained devices immediately upon notification by the Engineer.

H. The Contractor shall begin placing the barricades in the direction of traffic. The Contractor shall remove the barricades in a direction opposing traffic.

I. **Temporary Stop Signs**: All temporary stop signs shall be installed in a semi-permanent manner in the ground or pavement surface in accordance with Standard Drawing Number 249 of the USD.

624.03.74 TRAFFIC CONTROL SUPERVISOR

A. The Contractor shall designate a Traffic Control Supervisor who shall be responsible for initiating, installing and maintaining all traffic control devices as shown on the traffic and plans, as specified in the MUTCD, and revisions thereto, the USS, these supplemental specifications or as directed by the Engineer. When traffic control devices are on the project site the designated Traffic Control Supervisor shall be available to the Engineer twenty-four (24) hours a day for the duration of the contract. The Traffic Control Supervisor shall be an employee of the Contractor and under the supervision of the Superintendent. The person so designated shall be certified as a worksite traffic control supervisor by the ATSSA.

J. The Traffic Control Supervisor shall be capable of being on-site within thirty- (30) minutes of notification.

K. The traffic control supervisor shall make at least four (4) inspections of all traffic control devices each calendar day as follows:

1. Before beginning work
2. At mid shift
3. Half an hour after the end of the shift
4. Once during the period of non working hours

L. The Traffic Control Supervisor shall make a daily record of traffic control activities including a reference to the barricading in effect that day. The Project superintendent

shall sign the daily record each day attesting to its accuracy. The Contractor shall submit these records to the Engineer on a weekly basis.

624.03.75 REQUIRED PROTECTION FOR OPEN EXCAVATION DURING WORKING AND NON-WORKING HOURS

A. The following requirements apply to any open excavations where the difference in elevation between the pavement and the excavated area is greater than 6":

1. Any open excavations, in the roadway or within eighteen (18) feet of the roadway, which does not provide a 4:1 (horizontal: vertical) slope between the edge of pavement and the bottom of the excavation, shall be protected with portable precast concrete traffic barrier rails and six (6) feet high non-climb fence. All portable precast concrete traffic barrier rails shall be butted tight and pinned in accordance with the requirements of the Nevada Department of Transportation's Standard Drawing R-8.3.3, entitled "Portable Precast Concrete Barrier Rail", which is hereby incorporated into the plans.

2. Any open excavation further than eighteen (18) feet and less than three hundred (300) feet from any building or roadway, shall be, as a minimum, completely fenced with a six (6) foot high non-climb fence.

3. Any open excavation beyond three hundred (300) feet of any building or roadway shall be protected with a three (3) foot high earth berm completely around the excavation. Type II Barricades with Type B high intensity warning lights shall be spotted around the top of the berm after daylight hours.

4. Barrier rails and fencing may be required, during working hours, when determined by the Engineer, to be in the interest of public safety.

M. The following requirements apply to any open excavations adjacent to a sidewalk where the difference in elevation between the back of the sidewalk and the excavated area is greater than 6 inches:

1. The open excavation shall be protected, as a minimum, with a six (6) foot high non-climb fence.

END OF SECTION 624

SECTION 625 – CONSTRUCTION SIGNS

DESCRIPTION

625.01.01 GENERAL

A. This work shall consist of furnishing, erecting, maintaining, relocating, and removing work zone traffic control devices, including signs, channelizing devices, and lighting devices at locations set forth in the contract documents, or as directed by the Engineer, for the protection of the work, workers, and guidance and safety of the motoring and pedestrian public.

B. All work zone traffic control devices shall remain the property of the Contractor upon completion of the contract and shall be removed from the project by the Contractor.

C. All work zone traffic control devices shall conform to the latest edition of the *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD), published by the U.S. Department of Transportation, Federal Highway Administration, as well as the current edition of the Traffic Control Plans for Highway Work Zones for the Clark County Area, unless otherwise indicated on the plans or by the Special Provisions.

D. Regulatory signs shall be mounted so that the bottom of the sign will be a minimum of 5 feet above the ground surface or the pavement.

MATERIALS

625.02.01 GENERAL

A. It is expressly intended that a broad selection of material be granted the Contractor since work zone traffic control devices are in temporary use and new products become commercially available regularly.

1. Sign panels may be constructed of steel, aluminum, wood, or other approved material and be of a sound, durable nature.

2. The materials shall be of such quality to do the job for which they are intended and are subject to approval by the Engineer.

3. Signs and channelizing devices that have become dull, have flaking or peeling paint, are dirty or discolored, or are otherwise marred shall be repaired or replaced with acceptable units.

B. Reflective sheeting for all signs and channelizing devices shall conform to ***Subsection 716.03.01, "Reflective Sheeting."***

C. Reflective sheeting shall be used on all work zone signs and channelizing devices.

625.02.02 SIGN DIMENSIONS

A. Sign dimensions shown in the MUTCD are minimum standard.

1. Increases above this minimum are permissible and desirable where investigation has shown a larger sign is needed for adequate emphasis.

2. In the enlarging of signs, standard shapes and colors shall be used, and standard proportions shall be retained so far as practicable.

CONSTRUCTION

625.03.01 GENERAL

A. Before any detour, temporary route, or work zone is opened to traffic or imposed upon existing traffic, all necessary signs shall be in place.

B. Signs required by road conditions or restrictions shall be removed immediately when those conditions cease to exist or the restrictions are withdrawn.

C. Guide signs directing traffic to and on temporary routes or detours shall be removed when no longer applicable.

D. Signs and barricades shall be maintained in operable condition.

1. Care shall be exercised to keep the sign faces free of dust and splashed mud.

2. Any signs and barricades that become scarred, damaged, or destroyed shall be repaired immediately or replaced, at no additional cost to Contracting Agency and as directed by the Engineer.

E. The responsibility for the protection of the work, workmen, and public traffic will rest with the Contractor and the Contractor shall be liable for damages and injury suffered by reason of the Contractor's operations or any circumstances, conditions, actions, or negligence in connection therewith.

625.03.02 SIGN PLACEMENT

A. Signs shall be placed in conformance with the MUTCD.

B. All temporary stop signs shall be mounted on a post that is embedded in the ground a minimum of 18 inches or to a depth sufficient to prevent overturning by wind loadings and easy removal by vandals as approved by the Engineer with the following possible exceptions:

1. A flagger is used to supplement temporary stop signs. The temporary stop signs shall be post-mounted and embedded in the ground when no flagger is present.

2. Temporary stop signs may be used with a moving construction operation with frequent lane shifts only when construction is in progress and the flagger is present. When no construction is in progress and no flagger is present, the temporary stop signs shall be post-mounted and embedded in the ground.

625.03.03 SIGN SUPPORTS

A. Signs, posts, pole mountings, and sign foundations shall be constructed to hold signs rigidly in a proper and permanent position, and prevent the signs from swaying in the wind, or from being turned or otherwise displaced.

B. A portable or removable type of mounting may be used for signs required intermittently or that are frequently moved. Such a mounting shall be heavy enough not to turn over in the wind, and the base shall not be appreciably wider than the sign.

C. A portable or removable type of mounting for temporary stop signs may only be used in a moving operation during the time when construction personnel are present.

1. Such a mounting shall be heavy enough not to turn over in the wind.

2. Temporary stop signs shall be post-mounted and embedded in the ground after working hours when no flagger is present.

625.03.04 CHANNELIZING DEVICES

A. Projects closed to traffic shall be protected by appropriate channelizing devices, as approved by the Engineer, in conjunction with appropriate work zone warning signs.

B. If weighting of channelizing devices is necessary, sand bags may be used as long as a low center of gravity is maintained as approved by the Engineer.

625.03.05 PORTABLE CHANGEABLE MESSAGE SIGN

A. Portable Changeable Message Signs (PCMS) conforming to the MUTCD, Part 6, Section 6F.60 shall be used to advise the driver of road closures on streets with an 80-foot or greater right-of-way.

B. The PCMS shall be placed far enough in advance of the closed street to allow traffic ample opportunity to detour around the disrupted area.

C. The location and number of PCMS will be determined by the Engineer.

D. Solar powered panels shall be used in residential areas**.**

625.03.06 ARROW DISPLAYS

A. Arrow Displays conforming to the MUTCD, Part 6, Section 6F.61, Type B, shall be used to advise the driver of lane closures when so directed by the Engineer.

B. The Arrow Displays shall be required at the beginning of the taper and placed behind the barricades in the closed lanes, as required by the approved traffic control plan and as directed by the Engineer.

C. Solar powered panels shall be used in residential areas.

END OF SECTION 625

SECTION 626 – FINAL CLEANUP

DESCRIPTION

626.01.01 GENERAL

A. Before final acceptance, the Contractor shall remove or obliterate, insofar as feasible, all objects or disturbances of the ground which mar the landscape and were caused by Contractor's operations, whether or not part of the improvement.

B. This shall be required on all areas used or occupied by the Contractor within or outside the right-of-way limits.

CONSTRUCTION

626.03.01 FINAL CLEANUP

A. Rubbish, excess material, temporary structures, and discarded equipment shall be collected and disposed of as directed by the Engineer.

1. Burning is prohibited.
2. Pits or trenches for equipment setups or camp sites shall be filled and the ground restored, insofar as feasible, to its original conditions, within or outside of the right-of-way limits.
3. Temporary haul roads within the right-of-way limits shall be scarified and bladed to blend with surroundings.
4. Pits from which materials have been obtained shall be dressed and shaped to conform with the surrounding ground.
5. Waste shall be removed from the tops of banks and placed in the bottom of pit.
6. Unless otherwise specified or directed by the Engineer, banks of pits shall be cut to not steeper than 2:1 slopes to blend with the natural contours.
7. Bottoms of pits shall be reasonably smooth.
8. All other disturbances shall be removed or corrected as directed by the Engineer with particular attention to the abatement of any dust hazard.

B. Working areas and backslopes pertaining to the improvement shall be hand raked and loose objects including rocks and clods in excess of 2 inches in any dimension shall be removed from the site.

C. Pavement, curb and gutter, sidewalks, and driveways shall be swept or flushed and presented to the Contracting Agency in condition for maintenance without further work.

END OF SECTION 626

SECTION 627 – PERMANENT SIGNS

DESCRIPTION

627.01.01 GENERAL

A. This work shall consist of furnishing, erecting, relocating, and installing signs, sign supports, and other materials required for highway signs in accordance with the current edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) and these specifications, as shown on the plans, and as directed by the Engineer.

B. This item does not include street name signs or construction signs used for traffic control during construction.

C. The work shall generally consist of:

1. Overhead signs, including concrete foundations, steel sign posts and frames, and aluminum sign panels with reflective sheeting.

2. Ground mounted signs consisting of concrete foundations, steel sign posts, pole mounted signs, aluminum sign panels with reflective sheeting, and appurtenances.

D. This work does not include sign illumination systems.

627.01.02 SHOP DRAWINGS

A. When overhead sign structures are to be furnished, the Contractor shall submit to the Engineer 5 sets of shop drawings for each overhead sign structure for approval.

B. Fabrication of the overhead sign structures shall not commence until the shop drawings have been approved by the Contracting Agency.

C. Shop drawings for other than overhead signs will not be required; however, all signs shall conform to the plans and the MUTCD.

1. For signs which are shown on the Sign Summary Sheets and are not included in the MUTCD, special sign design sheets shall be furnished by the Contracting Agency to the bidders of the project.

2. The special design sheets shall include such information as letter heights, spacing between letters and words, borders, sign radii, and so forth.

3. These signs shall conform to the special design sheets as well as the drawings noted in the plans.

MATERIALS

627.02.01 GENERAL

A. Materials shall conform to ***Section 716, "Sign Materials."***

627.02.02 REFLECTORIZATION

A. All signs shall utilize Type XI retroreflective sheeting for sign background, letters, numerals, symbols, borders, and accessories.

B. All letters, numerals, symbols, borders, and accessories shall be directly applied to the sign background.

627.02.03 LETTERS, NUMERALS, SYMBOLS, AND ACCESSORIES FOR GUIDE SIGNS

A. All names of places and highways on guide signs shall be composed of lower case letters with initial capital letters.

1. The initial capital letters shall be 1-1/3 times the loop height of the lower case letters.

2. Other legends on guide signs shall be in capital letters.

B. The initial capital letters and numerals used shall be Series E, modified by widening the stroke-width to approximately 1/5 the letter or numeral height.

C. Tables of recommended letter spacing can be obtained from the FHWA.

D. Arrows that are used for large directional guides shall be in direct proportion to the arrows shown in the MUTCD.

CONSTRUCTION

627.03.01 PANEL FASTINGS

A. The panel sections shall be provided with suitable fastenings, as shown on the plans, to permit easy attachment to the supporting frames.

1. The fastenings shall be so designed as to carry the full design load with a factor of safety of not less than 1.5.

2. Panel sections shall be provided with closure strips at the joints.

B. Panel fastenings for use on sign panels covered with sign sheeting shall utilize nylon washers for contact between the sheeting and the metal washer.

627.03.02 CLOSURE STRIPS

A. Closure strip shall be anchored by aluminum rivets as shown on the plans.

B. Rivets shall be the same color as the sign face.

C. Closure strips are required only on aluminum sign panels.

627.03.03 INSTALLATION

A. Sign locations indicated on the plans are approximate only. Final determination of sign locations will be made in the field by the Engineer.

B. Signs and sign islands shall be constructed to the lines and grades given by the Engineer and in accordance with the design and locations shown on the plans.

C. All signs shall be erected as specified before, during, or immediately after the completion of bituminous plantmix surface operations.

D. The date of installation, consisting of month and year, shall be permanently stamped on the back of each sign with metal dies and shall be visible only on close inspection. The stamp shall be placed on the lower right hand corner when facing the rear of the sign.

E. Each sign face shall be thoroughly cleaned according to the reflective material manufacturer's recommendations.

1. All undesirable material that is visible on the face of the sign shall be removed.

2. The use of abrasives or other cleaning material that will scratch or otherwise deface the sign shall not be permitted.

F. Sign islands shall be constructed as roadway embankment in conformity with ***Section 203, "Excavation and Embankment."***

1. Structure excavation and backfill shall conform to ***Section 206, "Structure Excavation,"*** and ***Section 207, "Structure Backfill."***

2. Anchor bolts shall be set true to line and grade.

3. Posts shall be plumb.

G. Sign faces of all directional signs facing public traffic and directing such traffic to a portion of the project not yet open to public traffic shall have the message covered.

H. Care shall be exercised at all times in the handling, storing, transporting, and erecting of the signs. Signs that are damaged shall be repaired or replaced at no additional cost to the Contracting Agency.

I. Pipe sign posts may be field cut and drilled to adjust for local conditions when approved by the Engineer.

1. Flame cutting will not be permitted.

2. All field cuts and abraded areas on steel posts shall be thoroughly cleaned and given 2 coats of paint having a high-zinc dust content conforming to Federal Specification MIL-P-21035.

J. Extending the lengths of sign posts to adjust for local conditions by splicing or welding will not be permitted.

627.03.04 TESTS

A. The Contractor shall verify that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency.

B. The Contractor shall furnish the Contracting Agency with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

627.03.05 RELOCATION

A. This work shall consist of temporary or permanent relocation of existing permanent sign panels, posts, and footings as shown on the plans and as directed by the Engineer.

B. Existing sign panels and posts that are removed for relocation shall be stockpiled on the jobsite at locations determined by the Engineer and shall remain the property of the Contracting Agency.

C. The Contractor shall remove and dispose of all concrete from sign posts prior to stockpiling as directed by the Engineer.

D. Temporary relocation of permanent sign panels for public bus or transit stops shall be as indicated on the plans or as directed by the Engineer. Temporary locations for public bus or transit stops shall conform to ***Subsection 107.07, "Traffic and Access."***

E. The Contractor shall exercise care when removing and stockpiling signs for relocation. Signs that are damaged shall be repaired or replaced at no additional cost to the Contracting Agency.

END OF SECTION 627

SECTION 637 - POLLUTION CONTROL

DESCRIPTION

637.01.01 GENERAL

A. This work shall consist of temporary pollution control measures that may be shown on the plans, specified in the Special Provisions, or ordered by the Engineer during the life of the contract.

1. The work shall meet the applicable requirements of the Clark County Department of Air Quality and Environmental Management (DAQEM).

2. The work is intended to provide prevention, control, and abatement of water and air pollution within the limits of the project and to minimize damage to the work, adjacent property, and streams or other bodies of water.

B. The Contractor shall, 7 days prior to the preconstruction conference, submit for acceptance the Contractor's proposed plans and schedules, in duplicate, for accomplishing the prevention of erosion and pollution that may occur due to the Contractor's operations. No work shall be started until the schedules and methods of operations have been accepted by the Engineer.

C. The work shall include furnishing and applying a dust palliative to all completed excavation and embankment grading planes and other disturbed areas within the right-of-way except those areas that are to be paved under the terms of the contract and as directed by the Engineer. The dust palliative item does not include dust control measures required due to construction operations or carrying public traffic through construction or on detours.

D. Dust control work includes creating a Dust Control Mitigation Plan (DCMP), obtaining all necessary approvals for the DCMP, obtaining a Dust Control Permit for Construction Activities, payment of all fees associated with the project dust control, all work necessary to comply with the DCMP, Dust Control Permit, and the requirements of Section 94 of the Clark County Department of Air Quality Regulations, most recently adopted.

E. Any fines or penalties levied by the Clark County Department of Air Quality and Environmental Management due to violations of the project Dust Control Permit requirements are the sole responsibility of the Contractor and shall be paid by the Contactor.

F. The Contractor shall use all necessary Stormwater Runoff Best Management Practices (BMPs) performing the Work so as to not discharge stormwater runoff containing pollutants or sediment into the waters of the United States, including municipal separate storm sewer systems (MS4s) in violation of federal and state laws, rules, and regulations and the City’s water pollution requirements.

G. The Contractor shall:

1. Comply with the provisions of Nevada Revised Statutes, Chapter 445A: Water Pollution Control and City of Las Vegas Municipal Code 14.18; and

2. Adhere to all Federal regulations under 40 CFR 122.26(b)(14).

3. Submit SWPPP Submittal Checklist found in Appendix A of these Specifications to the Owner's Representative. This checklist must be on file prior to the issuance of the Notice to Proceed for construction.

H. All information and forms pertaining to Nevada's Stormwater NPDES Permitting Program can be found on the following website:

http://ndep.nv.gov/bwpc/storm01.htm

I. The City, state and federal regulations identified above are hereby incorporated by reference as preconditions of this Contract. The Contractor shall familiarize itself with these regulations and practices, and is advised that prior to engaging in any construction activities, the Contractor shall submit a Notice Of Intent (NOI) to the Nevada Division of Environmental Protection. A Storm Water Pollution Prevention Plan (SWPPP) must be completed prior to submission of the NOI and must remain on the project site and be updated as necessary for the duration of the project. As applicant, the Contractor is responsible for insuring that all persons on the project site, including contractor and subcontractor personnel, abide by the conditions of the permit. As the applicant, the Contractor is responsible for supplying complete copies of the NOI and SWPPP to all project subcontractors.

J. Upon completion of the project, the Contractor will need to permanently stabilize the construction area and file a Notice Of Termination (NOT) with NDEP to terminate the permit. The Contractor shall provide a copy of the approval letter of termination from NDEP to the Owner. Receipt of this letter will be required prior to acceptance of Contractor's final payment request.

K. Contractor shall apply for, pay for, and gain approval of the required permit from NDEP in a timely manner so as not to affect the project schedule. Contractor shall comply with the requirements of the permit and shall bear all associated costs. If the Owner suffers damages including but not limited to delays and fines as a result of the Contractor's failure to obtain a required permit or for non-compliance with the requirements of the permit, the Contractor shall reimburse the Owner for such damages and the Owner may withhold amounts equal to the damages from the Contractor's payments. Failure of the Contractor to obtain required permits in a timely manner shall not be justification for delay of the issuance of the Notice to Proceed by the Owner.

L. Any fines or penalties levied by the City of Las Vegas, Nevada Division of Environmental Protection, U.S. EPA, or any local, state, or federal agency to violations of the project Stormwater Runoff Management requirements are the sole responsibility of the Contractor and shall be paid by the Contactor.

MATERIALS

637.02.01 GENERAL

A. The binder for dust palliative shall be a resin emulsion that is miscible in water in the proportions hereinafter provided, is noncorrosive, and is effective as a dust palliative.

B. Resin emulsion shall be composed of from 57 percent to 63 percent of semi-liquid petroleum resin and the remainder water to which a suitable emulsifying agent has been added.

1. The binder shall be mixed with additional water at the job site and at the appropriate rate of 4 parts of water to 1 part of binder.
2. The exact rate of mixture shall be determined by the Engineer.
3. The resin emulsion shall be readily miscible with water and when diluted with any hard water in proportions of 1 part emulsion to 10 parts water shall show no signs of breakdown or separation of the petroleum resin base.
4. Resin emulsion that has been stored in closed containers at temperatures above freezing for a period of up to 3 months shall show no signs of separation.
5. Any resin emulsion that has been stored for more than 3 months shall not be used until tested and approved.

CONSTRUCTION

637.03.01 GENERAL

A. The temporary pollution control measures shall be as directed from time to time by the Engineer for the duration of the contract. The Engineer may revise and bring up to date any temporary control measures or instigate any new temporary pollution control measures found necessary as the work progresses.

B. The temporary control measures to prevent pollution of streams or other bodies of water or of the air, and to minimize damage to the work, to adjacent property, and to streams or other bodies of water, as directed by the Engineer and paid for on a force account basis, are in addition to any other measures provided for within the contract that are to be paid for as separate bid items.

C. It is expected that compliance with the requirements will necessitate performance of certain items of work at a different time or in a different manner than originally planned, causing revisions in scheduling of work that may interfere with normal construction practices.

D. Unless otherwise approved by the Engineer, the total area of erodible earth material exposed by the Contractor's operation shall not exceed 750,000 square feet before either temporary pollution control or temporary or permanent erosion control measures are accomplished.

E. Where erosion damage is probably due to the nature of the material or to the season of the year, the Contractor's operations shall be scheduled so that pollution control features will be installed concurrently with or immediately following grading operations.

F. Compliance with this section shall not relieve the Contractor from Contractor's responsibility to comply with the other provisions of the contract, except that the Contractor will be required to replace, at no additional cost to the Contracting Agency, any of the temporary pollution control work that is damaged by action of the elements.

G. All erosion control work required elsewhere in the specifications or on the plans will be paid for under the provisions for the applicable contract items of work therefor.

H. The Contractor shall coordinate temporary pollution control work, as required by the Engineer, with erosion control work specified elsewhere in the contract to ensure that

effective and continuous pollution control is maintained during the construction of the project.

I. The Contractor shall conduct operations to minimize the effects of erosion and air pollution due to the Contractor's operations upon areas within the limits of the project, haul roads, material sites, disposal sites, and upon adjacent properties, streams, and other bodies of water.

J. Mixing of the dust palliative material shall be accomplished by simultaneously placing the binder and water in the spreading equipment or by other mixing methods that will produce equivalent results.

1. The resulting mixture shall be applied with pressure type water distributor trucks equipped with a spray system, or pressure type asphalt distributors.

2. The mixture shall be applied at a total rate of approximately 1/2 gallon per square yard in 2 applications of 1/4 gallon per square yard.

3. The exact rate of application will be determined by the Engineer.

637.03.70 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) PERMIT FOR CONTRACTOR'S STAGING AREAS

A. The following applies to the Contractor's staging areas:

NDEP, Bureau of Water Pollution Control, has issued general permit NVR100000 that covers construction activities within the state of Nevada. The Contractor shall comply with the requirements of the general permit at no extra cost to the Owner. In order to be covered by the permit, the Contractor shall submit, at no extra cost to Owner, a Notice of Intent (NOI) and the required filing fee on the Internet at http://www.ndep.nv.gov/bwpc/storm_cont03.htm.

B. Upon the completion of the construction, Contractor is responsible for permanently stabilizing the staging area, filing Notice of Termination (NOT), and obtaining approval of NOT with NDEP to terminate the permit.

637.03.71 ROCK MULCH

A. Rock mulch, granite based non-organic ground cover, shall be placed 4 inches thick on all disturbed areas [outside of the detention basin] as required by NDEP final stabilization requirements for the purpose of dust control. Unless otherwise specified, rock mulch shall be one inch (1") minus from a local quarry. The Contractor shall provide with a sample of the proposed rock mulch a minimum of forty-eight (48) hours prior to start of work with any relative manufacturer's comprehensive product description, including specifications and installation instructions.

B. Final approval of product samples shall be made by the Owner and Engineer. No work shall proceed until Contractor has coordinated and received approval of the material from NDEP and provided a copy of the written approval to the Owner. Contractor shall then receive written approval from the Owner prior to proceeding with work.

C. All areas to receive rock mulch [outside of the detention basin] shall be treated with pre-emergent herbicide in accordance with the manufacturer's recommendations and approved by the Engineer.

END OF SECTION 637

DIVISION III

MATERIALS DETAILS

NOTE: Where pertinent, a "Manufacturer's Certificate of Compliance" covering materials as specified in this Division may be required and shall be furnished by the Contractor, when requested by the Engineer, at no cost to the Contracting Agency.

SECTION 701 – HYDRAULIC CEMENT

SCOPE

701.01.01 MATERIALS COVERED

A. This specification covers the types of Hydraulic cement as defined by ASTM C150, ASTM C595, and ASTM C1157. Unless otherwise provided, the cement will be used for all Hydraulic cement concrete, mortar, cement treated base, and cement treated subgrade. The type of cement used shall be as listed in Table 1 with the minimum sack requirements in ***Section 501, "Portland Cement Concrete."***

Table 6 - Types of Cement

Type of Cement Permitted
Type II & Fly Ash
Type MS & Fly Ash
Type IP (MS)
Type V
Type HS
Type V & Fly Ash
Type HS & Fly Ash

MATERIALS

701.02.01 GENERAL

A. Unless otherwise specified, the type of cement used shall be at the Contractor's option based on availability, and no additional compensation will be allowed for substitution of any type of cement for another.

B. Cement to be removed and replaced with fly ash shall be a minimum of 20 percent of the weight of cement. Fly ash added at the mixer shall be in an equal proportion to the weight of cement removed.

C. Class F fly ash conforming to the requirements of ***Section 729, "Fly Ash,"*** shall be used.

PHYSICAL PROPERTIES AND TESTS

701.03.01 REQUIREMENTS

D. Type II and Type V Portland cements shall conform to ASTM C150 except as hereinafter provided.

E. Type IP blended hydraulic cement shall conform to ASTM C595 except as hereinafter provided.

F. Pozzolan shall conform to ***Subsection 702.03.04, "Pozzolans (Fly Ash)."***

G. Additionally, Type II, Type V, and Type IP cements shall conform to ASTM C150 with the following requirements:

1. The cement shall not contain more than 0.60 percent by mass of alkalis calculated as Na20 plus 0.658 K20.

2. Type IP, MS, and HS cements that exceed the allowable alkali content may be used if mortar bars made and tested according to Subparagraph 1 above, using the proposed cement and a selected highly alkali-reactive aggregate, show no more than 0.05 percent expansion at 6 months.

END OF SECTION 701

SECTION 702 – CONCRETE CURING MATERIALS AND MIXTURES

SCOPE

702.01.01 MATERIALS COVERED

A. This specification covers concrete curing materials, air-entraining admixtures, water retardants, pozzolans, and hydrated lime. Comply with ***Section 722, "Water"*** for mixing and curing. The Contractor shall submit a request to use any one of the following for approval by the Engineer as prescribed in ***Subsection 702.03.06 "Submittal."***

PHYSICAL PROPERTIES AND TESTS

702.03.01 CURING MATERIALS

A. Curing materials shall conform to the requirements of the following tests, except the curing compound shall not react harmfully with the components of concrete or contain oils, waxes, or other materials which would prevent bonding of traffic marking paints. The film of curing compound shall be continuous, uniform, and free from pinholes, bubbles, or blisters.:

1. Burlap Cloth made from Jute or Kenaf: AASHTO M182.
2. Waterproof Paper for Curing Concrete: AASHTO M171.
3. Liquid Membrane-Forming Compounds for Curing Concrete: ASTM C309.
4. Pigmented Curing Compound for Portland Cement Concrete pavement: ASTM C309, except the loss of water from the surface in the water retention test shall not exceed 1.50 ounces per square foot in 72 hours.
5. White Pigmented Curing Compound for Bridge Decks: ASTM C309. Type 2 Class B resin type and shall be poly-alpha-methyl-styrene with the loss of water from the surface in the water retention test shall not exceed 0.50 ounce per square foot in 24 hours or more nor 1.50 ounces per square foot in 72 hours.
6. Plastic Sheeting: ASTM C171.
7. White Polyethylene Sheeting (film) for Curing Concrete: ASTM C171.

702.03.02 AIR-ENTRAINING ADMIXTURES

A. Air-entraining admixtures shall conform to ASTM C260.

702.03.03 ADMIXTURES OTHER THAN AIR-ENTRAINING

A. These admixtures shall comply with ASTM C494 and shall be clearly marked as to Type A, B, C, D, E, F, or G.

702.03.04 POZZOLANS (FLY ASH)

A. Fly Ash admixture shall conform to ***Section 729, "Fly Ash."***

702.03.05 HYDRATED LIME

A. Hydrated lime shall conform to ASTM C207, Type N.

702.03.06 SUBMITTAL

A. Curing compounds and admixtures shall be tested and certified in accordance with the Table 1 frequency.

1. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and requirements.

2. A test certificate shall be included with the certifying document.

B. The material supplier for Portland cement concrete materials, plantmix bituminous materials, or any material production that requires the use of admixtures shall attach the certificate to the mix design submittal as indicated in Table 1. All subsequent certificates shall be on file and accessible to the Engineer for audit purposes.

C. The Statute of Limitations duration for the record storage shall be as required by the Nevada Revised Statutes.

Table 1 - Quality Control Testing

Material	Certificate	Frequency
All curing materials	Sample and certification	1 per project
All admixture material	Certificate with copy of test for lot used	1 per lot

END OF SECTION 702

SECTION 704 – BASE AGGREGATES

SCOPE

704.01.01 MATERIALS COVERED

A. This specification covers the quality and size of mineral materials used in base courses, trench backfill, or other construction locations.

B. The term Source shall mean any of the following:

1. A permanent commercial location.
2. Contractor manufactured material either commercial or on-site.

704.01.02 REFERENCE CODES AND STANDARDS:

A. Related Interagency Quality Assurance Committee (IQAC) procedures at:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

(IQAC website)

REQUIREMENTS

704.02.01 GENERAL

A. The mineral aggregate shall be the crushed and screened product from approved aggregate deposits, except that Type I aggregate base need not be crushed. The Engineer reserves the right to prohibit the use of aggregates from any source when:

1. The character of the material is such, in the opinion of the Engineer, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.
2. The character of the material is such, in the opinion of the Engineer, that undue additional costs may be accrued by the Contracting Agency.

B. The mineral aggregate shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful adherent coatings. Crushed Portland cement concrete and asphaltic concrete pavement will be permitted, subject to the requirements of these specifications. No materials subject to regulation as hazardous wastes as defined in the Nevada Administrative Code 444.8565 shall be allowed.

704.02.02 IQAC SOURCE QUALIFICATION

A. For expediting of material source and type approvals, a listing of qualified materials has been provided on the IQAC website.

B. Any listed material is considered qualified for use without a material testing submittal. However, this does not relieve the Contractor of project testing of the material as required in these specifications.

C. The IQAC posted materials indicated in Table 1 are subject to reapproval annually for continued posting on the IQAC website. The procedure is annotated in ***Subsection 704.04.02, "IQAC Annual Material Prequalification."***

Table 1 – IQAC Materials that Require Annual Qualification

Type II Aggregate Base
Type II Controlled Low Strength Material (CLSM)

Table 2 – Materials that Require 6-Month Qualification

Type II blended with recycled Portland Cement Concrete

704.02.03 DEFICIENCIES

A. If the product of a deposit is deficient in material passing the No. 16 sieve, filler from other approved deposits may be added at the crushing and screening plants. This is not to be construed as a waiver of any of the requirements contained herein.

PHYSICAL PROPERTIES AND TESTS

704.03.01 PLASTIC LIMITS

A. When specified, aggregates shall conform to the applicable requirements of the following table:

Table 3 – Plastic Limits

Percentage by Weight Passing 200 Sieve	Plasticity Index Maximum
0.1 to 3.0	15
3.1 to 4.0	12
4.1 to 5.0	9
5.1 to 8.0	6
8.1 to 11.0	4
11.1 to 15.0	3

704.03.02 DRAIN BACKFILL

A. This aggregate shall conform to the following requirements:

Table 4 – Drain Rock Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve		
	3-Inch Size	2-Inch Size	3/4-Inch Size
3-Inch	100	--	--
2-Inch	90-100	100	--
1-1/2-Inch	70-100	95-100	--
3/4-Inch	0-50	50-100	100
1/2-Inch	--	--	95-100
3/8-Inch	0-10	0-55	70-100
No. 4	--	0-25	0-70
No. 8	0-5	0-15	--
No. 200	0-3	0-3	0-3

B. Unless otherwise specified in the contract documents, the Contractor may use any of the sizes.

Table 5 – Drain Backfill Durability Acceptance Limits

Source Requirement Test	3-Inch Size	2-Inch Size	3/4-Inch Size
Percentage of Wear (500 Rev.)	45% Maximum	45% Maximum	45% Maximum

704.03.03 TYPE I AGGREGATE BASE

A. This aggregate shall conform to the following requirements:

Table 6 – Type I Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve	
	3-Inch Size	2-Inch Size
3-Inch	100	--
2-Inch	90-100	100
1-1/2-Inch	--	95-100
1-Inch	--	70-90
No. 4	30-65	30-65
No. 16	15-40	15-40
No. 200	2-12	2-12

Table 7 – Type I Acceptance Limits

Project Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 6
Sampling Aggregate from Calibrated Conveyor stream or belt cut[1]	AASHTO T2	--
Plasticity Index	AASHTO T90[2]	Table 3
Liquid Limit	AASHTO T89	35 Maximum
Resistance (R Value)	ASTM D2844	60 Minimum
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum

704.03.04 TYPE II AGGREGATE BASE

A. This aggregate shall conform to the following requirements:

Table 8 – Type II Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	90-100
No. 4	35-65

[1] Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.

[2] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

Table 8 – Type II Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
No. 16	15-40
No. 200	2-10

Table 9 – Type II Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream or belt cut[3]	AASHTO T2	--
Fractured Faces	Nev. T230	70% Minimum
Plasticity Index	AASHTO T90[4]	Table 3
Liquid Limit	AASHTO T89	35 Maximum
Resistance (R Value) or Resilient Modulus	ASTM D2844	78 Minimum for road base
	AASHTO T307	35,000 psi minimum for road base
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum
Total Available Water Soluble Sulfates[5]	ASTM D2791 AWWA 4550 E	Less than 0.3% by dry weight of soil.

B. BLANK

704.03.05 TYPE III AGGREGATE

A. The soluble sulfate content shall not exceed 0.3 percent by dry weight of soil. The mineral shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful coatings. In addition thereto, the material shall conform to the gradation requirements of Type II aggregate base in accordance with ***Subsection 704.03.04, "Type II Aggregate Base,"*** with the following property testing:

Table 10 – Type III Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream of belt cut[6]	AASHTO T2	--
Plasticity Index	AASHTO T 90[7]	Table 3
Liquid Limit	AASHTO T 89	35 Maximum

[3] Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.
[4] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.
[5] Required only for placement around waterline pipe.
[6] Sampling from a stockpile permitted only after approval of the Engineer.
[7] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

Table 10 – Type III Acceptance Limits

Quality Control Test	Test Method	Requirements
No. 200 Sieve	AASHTO T 27	2-15%
Total Available Water Soluble Sulfates[8]	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

704.03.06 CRUSHED ROCK

A. Crushed rock shall be the product from approved aggregate deposits and shall only be used as directed by the Contracting Agency. The mineral aggregate shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful coatings. In addition thereto, the material shall conform to the following gradation requirements:

Table 11 – Crushed Rock Gradation Acceptance Limits

Sieve Sizes	Percentage of Weight Passing
3/8-Inch	100
No. 4	20-80
No. 200	0-15

Table 12 – Crushed Rock Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T 27	Table 11
Sampling Aggregate From Calibrated Conveyor stream of belt cut[9]	AASHTO T 2	----------
Fractured Faces	Nev. T 230	90% Minimum
Plasticity Index	AASHTO T 90[10]	Table 3
Liquid Limit	AASHTO T 89	35 Maximum
Percentage of Wear (500 Rev.)	AASHTO T 96	45% Maximum
Total Available Water Soluble Sulfates[11]	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

704.03.07 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. CLSM shall consist of a low-strength, self-leveling concrete material composed of various combinations of cement, fly ash, aggregate, water, and chemical admixtures. CLSM shall have a design compressive strength at an age of 28 days within the ranges required below for the specified class:

1. Class I - (20 to 150 psi): Specified where the maximum strength is of primary concern due to the desire to have material that can be excavated in the future with relative ease.

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[8] Required only for placement around waterline pipe.
[9] Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.
[10] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.
[11] Required only for placement around waterline pipe.

2. Class II – (100 to 300 psi): Specified where the minimum strength is of primary concern for pipe support.

3. Class Special (as shown in project specifications or drawings): Specified where project unique criteria, such as erosion control, are the primary concern.

4. Class I and Class II CLSM:

   a. The mix shall result in a product having a slump in the range of 6 to 10 inches at the time of placement in the pipe zone. Above the pipe zone, a lesser slump is acceptable.

   b. The Source of Contractor shall submit a mix design for approval by the Engineer prior to placement.

   c. The mix design shall be supported by laboratory test data verifying the potential of the mix to comply with the requirements for these specifications.

5. Class III – Bonded Aggregate Fill (BAF) (20 to 150 psi): Specified where the maximum strength is of primary concern due to the desire to have material that can be excavated in the future with relative ease, and where reduced concrete cure time is desired.

B. CLSM Class I and Class II shall be proportioned in general compliance with the methods outlined in ACI 211.1-91, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete." The product shall be proportioned and mixed in a central plant or mobile mixer. The following materials shall be used:

1. Cement shall meet the requirements of ***Section 701, "Hydraulic Cement."*** Type V cement shall be used unless otherwise specified.

2. Fly ash shall meet the requirements of ***Section 729, "Fly Ash."*** Fly ash not meeting the requirements of **Section 729, "Fly Ash,"** may be used if prior testing indicates to the satisfaction of the Engineer the ability of the CLSM with this fly ash to meet these specifications.

3. Water shall meet the requirements of ***Section 722, "Water."***

4. Aggregates shall be well graded, having 100 percent by total weight passing the 1 inch screen and no less than 6 percent passing the No. 200 sieve. The aggregate shall meet the plastic limits requirements of ***Subsection 704.03.01, "Plastic Limits."***

5. Chemical admixtures shall meet the requirements of ***Subsection 702.03.02, "Air-Entraining Admixtures,"*** and ***Subsection 702.03.03, "Admixtures Other Than Air-Entraining."***

   a. Other admixtures specifically approved for CLSM may be used.

   b. All materials proportions shall be measured and the CLSM mixed in accordance with ***Section 501, "Portland Cement Concrete."***

   c. Other proportion measuring and CLSM mixing systems are acceptable, if control can be demonstrated to be satisfactory to the Engineer.

   d. These other methods include continuous feed, volumetric measurement of proportions, and pug mill and continuous mixing plants.

C. If the CLSM Class I and Class II mixes do not produce a flowable consistency or exhibits excessive bleeding, the mix shall be adjusted.

1. Excessive bleeding is considered to occur when water flows from the CLSM in a manner that causes disturbance or displacement of the exposed surface of the CLSM.

2. Mix adjustments shall include, but not be limited to: aggregate gradation, cementitious material content, admixtures, water content, or a combination of adjustments.

D. The testing procedures of CLSM Class I and Class II for acceptance testing and mix design approval by the IQAC, or if required in the contract special provisions shall be as follows:

1. The material Source, which may be the Contractor, shall cast specimen molds using ASTM D4832 “Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM Test Cylinders.” The type of molds shall be as stated below.

a. Section 6.1 other sizes and type

1) Grout Sample Box must meet ASTM C1019, Note 6 and the following:

a) A Grout Sample Box that has a minimum absorption rate of 1.30% or that both the QA and QC laboratories have the same absorption with a tolerance of 0.2.

b) Creates four specimens with nominal dimension of 3”x3”x6”.

2) The QA and QC must agree in a pre-activity meeting which vendor of grout sample box will be used for the casting mold to comply with Note 6 in ASTM C1019 for proper comparisons.

2. Sampling shall be in accordance with ASTM D4832.

3. The cast specimens shall not be laboratory-cured in a concrete cure room (cure tanks shall not be used). The samples must be cured at the ambient temperature of the laboratory at a range between 65º and 85º degrees F.

4. Compressive strength testing shall be performed in accordance with AASHTO T22 and T23 with samples from each set at the ages of 14and 28 days.

5. A report of the results shall be submitted to the Engineer.

E. Class Special: The compressive strength testing procedures shall be as specified in the project specifications or on the project drawings.

F. **Class III - Bonded Aggregate Fill (BAF):**

1. The material Source shall have it designed under the responsible charge of a Nevada PE, and the mix shall consist of a gap-graded 1/2-inch maximum nominal size crushed gravel. The cementitious material shall be Type V cement and/or fly ash and water for a flowable type consistency.

2. The material shall be plant mixed and placed from a truck or may be placed directly from a continuous feed mobile mixer approved by the Engineer.

3. Due to the gap-graded nature of the material, it shall not be used where water drainage is an issue unless wrapped in an approved geotechnical filter fabric, and in all trench installations shall conform to ***Subsection 208.03.16, "Drain Backfill."***

4. This material does not require concrete cylinder break testing; however, it does require a visual inspection and shall be documented in a report to the Engineer summarizing the inspection to be performed as follows:

   a. After the first batch is placed and initially cured, excavate to the bottom of the pipe or structure.

   b. If a self-supporting vertical face is maintained, the material is functioning properly.

704.03.08 AGGREGATE FOR PORTLAND CEMENT TREATED BASE

A. This aggregate shall conform to the following requirements:

Table 13 – Portland Cement Treated Base Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
3-Inch	100
2-Inch	90-100
No. 4	35-75
No. 200	20

Table 14 – Portland Cement Treated Base Acceptance Limits

Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 13
Sampling Aggregate from Calibrated Conveyor stream or belt cut[12]	AASHTO T2	1/1000 Tons per day or portion thereof
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum

B. Aggregate for cement or lime treated bases will be sampled as follows:

1. Where the material is being mixed at a stationary plant, samples will be taken from the conveyors just prior to delivery to the mixer and prior to adding lime or cement.

2. Where material is being mixed on the roadbed, samples will be taken after the material has been placed on the roadbed and processed and prior to adding cement or lime.

704.03.09 SHOULDERING MATERIAL

A. This aggregate shall conform to the following requirements:

Table 15 – Shouldering Material Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	90-100

[12] Sampling from a stockpile permitted only after approval of the Engineer. The conveyor device shall be calibrated every 3 months and record attached to sample document.

No. 4	35-65
No. 16	15-40
No. 200	2-6

704.03.10 AGGREGATE BASE MATERIAL WITH RECYCLED ASPHALT PAVEMENT (RAP) AND CONCRETE

A. The use of recycled asphalt pavement or recycled concrete for Type II Aggregate Base is permitted with the following requirements:

1. The material must conform to the requirements of ***Subsection 704.03.04 "Type II Aggregate Base***

2. The maximum ratio of crushed concrete to Type II Aggregate Base is 50%. Recycled materials must be substantially free of foreign matter including but not limited to asphalt, base, dirt, reinforcing steel, and have at most 1.5% deleterious material.

3. The maximum ratio of the crushed recycled asphalt concrete pavement (RAP) to Type II Aggregate Base is 30%. The mean oil content shall be 1.2% with a +0.3% tolerance. The Total Oil Content of the blended material (virgin aggregate and RAP) shall not exceed 1.5%.

B. The maximum qualification period is six (6) months for aggregate base materials blended with recycled aggregates. The entire qualification process must be completed prior to the first day of April and the first day of October of each calendar year. The report format, as outlined in ***Subsection 704.04.05 "Report Format"*** shall include the sieve analysis for RAP or recycled concrete stockpile, Blended aggregated, the RAP binder content and blended binder content.

SOURCE QUALITY CONTROL TESTING

704.04.01 GENERAL

A. There are 2 testing aspects to Source material acceptance.

1. Testing by the Source for annual posting on the IQAC website of qualified materials.

2. Contractor project quality control Source testing for non-qualified materials.

B. The acceptance of the Source material shall be at the production plant while the acceptance of the Contractor-placed material is at the project site.

C. Any laboratory submitting to an agency shall be R-18 AASHTO accredited in the appropriate test method in accordance with Table 16, "Source Quality Control Testing Requirements," where applicable and testing reviewed and stamped by a Nevada professional engineer who has responsible charge of the work. The use of a professional engineer by the Source could be the Source staff engineer or third party, but the professional engineer must have responsible charge of the testing and/or inspection.

704.04.02 IQAC ANNUAL MATERIAL PREQUALIFICATION

A. Each individual location or "pit" shall be referred to as a "Source." The responsibility for testing and inspection is the material Source. Material shall be tested, inspected, and

certified in accordance with Table 16 "Source Quality Control Testing Requirements." The Source shall submit to the IQAC agency engineer assigned for that Source. The reviewing agency is listed on the IQAC website page next to the Source material.

B. Test data shall be included with the certifying document.

C. The maximum qualification period is 1 year, or 6 months for aggregate blended with crushed concrete. The entire qualification process shall be completed, in accordance with the sections above, prior to the first day of April, or for aggregates blended with crushed concrete, the first day of April and the first day of October of each year. This includes, but is not limited to, submittal, agency review, all required retesting, and qualification from the IQAC member.

704.04.03 NON-PREQUALIFIED MATERIALS

A. If the material is not posted on the IQAC web page, the Source may elect to submit non-prequalified material to the Engineer for approval prior to use that complies with the above noted specification and shall have been tested within 60 days of the intended use.

704.04.04 SUBMITTAL

A. All tests specified in this section shall be performed.

1. The report(s) shall include any graphical representation of plotted data such as the R-value or the Proctor value(s) along with the pit name and location.

2. The most current ASTM, AASHTO, NDOT, and AWWA methods shall be used when performing the tests.

B. All samples shall be "cut" from the "belt." When circumstances do not allow for sampling during production, the Source shall coordinate with the Engineer to identify an alternative plan for sampling.

C. <u>IQAC Annual Submittal</u>

1. For the purposes of IQAC submittal, the Engineer is the IQAC reviewing agency as noted on the IQAC web page.

2. For the annual submittal by the supplier, the material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.

3. The Engineer shall be notified a minimum of 48 hours prior to obtaining the sample.

4. If the Engineer is not present during the sampling of the material, the results for that sample will not be accepted.

5. Sampling shall be performed during normal working hours for the Engineer.

6. If the Source laboratory results are in compliance with the above noted specifications, Source shall submit the test report to the Engineer within 21 days of sampling requesting the review and approval of the materials for the proposed use of the material.

7. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required. Samples without notification or a

qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.

8. The agency Engineer for a particular pit may accommodate minor adjustments for "tuning" of an operation. This courtesy shall not be extended during the qualification process.

D. Non-prequalified materials (materials not posted on the IQAC list)

1. The material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.

a. The Engineer shall be notified a minimum of 48 hours prior to obtaining the sample.

b. If the Engineer is not present during the sampling of the material, the results for that sample will not be accepted.

c. Sampling shall be performed during normal working hours for the Engineer.

d. If the Source laboratory results are in compliance with the above noted specifications, the Source shall submit the test report to the Engineer within 21 days of sampling with a letter requesting the review and approval of the materials report for the proposed use of the material.

2. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required.

a. Samples without notification or a qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.

b. The Source shall submit the material test report to the Engineer no earlier than 60 days and no later than 14 days prior to use.

3. The qualification is for one project only.

704.04.05 REPORT FORMAT

A. The report shall be prepared and stamped by, or under the direction of, a professional engineer registered in the state of Nevada. The report shall be on the standard IQAC[13] form and shall include the pit name and location. The report shall include the following:

1. Recommendation by the Source Professional Engineer.

2. The testing results in accordance with the appropriate Table 16, "Source Quality Control Testing Requirements," test methods and reporting requirements, along with any graphs and charts.

B. When "no exceptions" are taken, a conditional posting on the web site will be provided by the IQAC within 10 days of the receipt of the submittal.

[13] The form is on the IQAC website, or use an Agency approved form.

C. Discrepancies between test results will be reviewed on a case-by-case basis. The Engineer will notify the aggregate producer of substantial test variations within 10 days of receipt of the qualification submittal.

704.04.06 SAMPLING AND TESTING

A. When the Contractor/Material Source or Engineer acquires aggregate samples at an aggregate production plant, the plant shall provide a calibrated mechanical means for obtaining samples.

1. If a mechanical means is not provided, a belt cut from a stopped conveyor will be required.
2. Any mechanical sampling device shall be approved by the Engineer prior to starting the respective phase of the project, or shall have been approved as part of a prior plant inspection by the Engineer or the Engineer's representative.
3. The sampling device shall be so constructed to provide for simultaneous "cutting" of the entire section of material being discharged or conveyed, and so constructed that small representative samples may be taken frequently and these samples combined to form the complete sample.
4. The reference method for the mechanical procedure shall be a "belt cut" sample taken from a stopped conveyor belt.
5. Samples of the finished product of the plant shall be obtained prior to or as the material leaves the conveyor belt for the bin or stockpile.

B. Test results run from samples taken will be furnished to the Engineer by the Contractor or the Contractor's representative. The results of such tests shall not be the basis for final acceptance of the material.

C. Sampling for final acceptance of materials will be as required in the appropriate USS sections and in general shall comply with the AASHTO requirements, where applicable, and with any exception to the method(s) listed on the IQAC website.

Table 16 – Source Quality Control Testing Requirements[14]

Spec Section	Description	Item	Reference Specification and/or Test Procedure	Frequency
704.03.02, 704.03.03, 704.03.04, 704.03.08	Drain Rock	Submittal	IQAC and/or Agency Requirements	Annually for IQAC Source Approval OR per project
	Type I, Type II Aggregate	Sampling from calibrated conveyor stream or belt cut	AASHTO T2	1/day at plant
	Cement treated base	Sieve Analysis	AASHTO T11 & T27	1/day at plant
		Percentage of Wear (500 Rev.)	AASHTO T96	Annually for Source Approval OR per project

[14] Review the IQAC website for any exceptions to the listed test methods.

Table 16 – Source Quality Control Testing Requirements[14]

Spec Section	Description	Item	Reference Specification and/or Test Procedure	Frequency
704.03.04*, *704.03.05*, *704.03.06	Drain rock, Type II, and Type III aggregate around water pipe	Total Available Water Soluble Sulfates[15]	AWWA 3500-NaD AWWA 4550 E	1/month at plant
704.03.03*, *704.03.04	Type I and Type II Aggregate	Plasticity Index	AASHTO T90[16]	1/day at plant
		Liquid Limit	AASHTO T89	1/day at plant
		Resistance (R Value) or Resilient Modulus	ASTM D2844	Annually for IQAC Source Qualification OR per project
			AASHTO T307	Annually for IQAC Source Qualification OR per project
704.03.07	CLSM Class I & II	Mix Design	***USS* *704.03.07***	Annually for IQAC Source Qualification OR per project
		Compressive Strength	***USS* *208.02.07*** & AASHTO T22, T23	Annually for IQAC Source Qualification OR per project
	CLSM Class III-BAF	Visual Inspection Report	**USS 208.02.07 Split cylinders**	Annually for IQAC Source Qualification OR per project

END OF SECTION 704

[15] Required only for placement around waterline pipe.
[16] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

SECTION 706 – AGGREGATES FOR PORTLAND CEMENT PRODUCTS

SCOPE

706.01.01 MATERIALS COVERED

A. This specification covers the quality and size of aggregates used in Portland cement products.

REQUIREMENTS

706.02.01 GENERAL

A. The mineral aggregate shall be the product of approved deposits. The Engineer reserves the right to prohibit the use of aggregates from any source when:

1. The character of the material is such, in the opinion of the Engineer, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.
2. The character of the material is such that, in the opinion of the Engineer, undue additional costs may be accrued by the Contracting Agency.
3. The mobile mixer shall use aggregate from an approved source. Each mixer shall not change source product without a new mix design. The certificate of the source shall include the appropriate test data.
4. The testing type and frequency shall conform to the tables on the Clark County IQAC website page: http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

B. For mix design approval, the proposed proportions of coarse, intermediate, and fine aggregate, combined mathematically by volume or mass, shall produce a mixture within the grading limits for combined aggregates as shown in Table 1 (not applicable to lightweight concrete):

Table 7 - Grading Limits of Combined Aggregates

Sieve Size	Percentage Passing				
	1-1/2-inch Max.	1-inch Max	3/4-inch Max.	1/2-inch Max	3/8-inch Max.
2-inch	100	--	--	-	-
1-1/2-inch	87-100	100	--	-	-
1-inch	65-90	97-100	100	-	-
3/4-inch	48-82	70-100	80-100	100	-
1/2-inch	--	--	--	90-100	100
3/8-inch	39-57	43-70	46-70	70-90	70-100
No. 4	30-45	32-48	34-50	45-60	47-70
No. 8	23-38	23-42	24-42	38-56	34-55
No. 16	15-33	15-34	17-34	24-38	23-43
No. 30	8-24	8-25	10-25	13-27	15-33
No. 50	4-13	4-15	5-15	7-17	7-20

Table 7 - Grading Limits of Combined Aggregates

Sieve Size	Percentage Passing				
	1-1/2-inch Max.	1-inch Max	3/4-inch Max.	1/2-inch Max	3/8-inch Max.
No. 100	1-5	2-7	2-7	0-6	2-8
No. 200	0-5	0-5	0-5	0-5	0-5

C. If the Contractor prefers a finer gradation for the purpose of slip-form operations, the following gradation is permitted with approval of the Engineer.

Table 8 - Gradation for Slip-Form Operations

Sieve Size	Percentage Passing	
	1-1/2-inch Max.	3/4-inch Max.
2-inch	100	--
1 1/2-inch	87-100	--
1-inch	65-97	100
3/4-inch	48-91	80-100
1/2-inch	--	--
3/8-inch	39-70	46-74
No. 4	30-54	34-54
No. 8	23-38	24-50
No. 16	15-33	17-38
No. 30	8-24	10-29
No. 50	4-13	5-19
No. 100	1-5	2-9
No. 200	0-5	0-5

D. If the Contractor proposes to use an admixture other than an air-entraining agent, Contractor shall state the complete brand name and the quantity proposed to be used per sack of cement.

E. Should the Contractor change Contractor's source of supply, Contractor shall submit in writing to the Engineer the new gradation before their intended use.

F. In addition to the coarse, intermediate, and fine aggregates meeting the individual source requirements, the combined gradation shall meet the following source requirement:

Table 9 - Alkali-Silica Reaction

Source Requirement Test, Combined Aggregates	Test Method	Requirement
Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction	AASHTO T303	0.10% Max. Expansion[1]

G. Previous AASHTO T303 qualified aggregates for concrete mix designs will not automatically qualify for approval. Submit new AASHTO T303 test results with concrete mix design.

[1] This requirement applies to all aggregate used in the concrete bridge structures, including approach slabs, reinforced concrete boxes, walkways, or sidewalks on the bridge structure itself, and all concrete bridge rail.

H. Perform this test on the coarse, intermediate, and fine aggregates together, combined in the same proportions as the proposed mix design.

1. The test may be performed on each size separately and the results combined mathematically.

2. Perform the test using the proposed sources together with proposed job cement and job pozzolan or other admixture, if used.

3. The pozzolan and silica fume quantities will be considered as cement in meeting the requirements of cement in Table 2 of ***Subsection 501.03.04, "Classification and Proportions."***

I. Prior to mix design approval, the Contracting Agency reserves the right to verify the AASHTO T303 test results, using the sources and proportions of materials as indicated by the mix design.

J. Conduct another test upon changes in source of cementitious materials, including fly ash, or changes in cement type or mitigating admixture suppliers.

PHYSICAL PROPERTIES AND TESTS

706.03.01 COARSE AGGREGATE

A. The aggregate shall conform to the following table requirements:

Table 4 - Percentage by Weight Passing Sieve

Sieve Size	Size No. 3 2-inch to 1-inch	Size No. 4 1-1/2-inch to 3/4-inch	Size No. 7 1/2-inch to No. 4	Size No. 57 1-inch to No. 4	Size No. 67 3/4-inch to No. 4	Size No. 357 2-inch to No. 4	Size No. 467 1-1/2-inch to No. 4
2-1/2-inch	100	--	--	--	--	100	--
2-inch	95-100	100	--	--	--	95-100	100
1-1/2-inch	35-70	90-100	--	100	--	--	95-100
1-inch	0-15	20-55	--	95-100	100	35-70	--
3/4-inch	--	0-15	100	--	90-100	--	35-70
1/2-inch	0-5	--	90-100	25-60	--	10-30	--
3/8-inch	--	0-5	40-70	--	20-55	--	10-30
No. 4	--	--	0-15*	0-10*	0-10*	0-5	0-5

*Not more than 5 percent shall pass No. 8 Sieve.

NOTE: Sizes No. 357 and No. 467 shall each be split into 2 sizes. Size No. 357 shall be furnished in stockpile or bunker in Sizes No. 3 (2-inch to 1-inch) and Size No. 57 (1-inch to No. 4.) Size No. 467 shall be furnished in stockpile or bunker in Size No. 4 (1-1/2-inch to 3/4-inch) and Size No. 67 (3/4-inch to No. 4). The two sizes shall be uniformly combined at the mixing plant to comply with the grading requirements of Sizes No. 357 and No. 467 respectively.

Table 5 - Coarse Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	--
Material Passing 200 Sieve	AASHTO T27	1% Maximum

Table 5 - Coarse Aggregate Properties

Tests	Test Method	Requirements
Percentage of Wear (100 Rev.)	ASTM C131	10% Maximum
Percentage of Wear (500 Rev.)	ASTM C131	50% Maximum
Soundness (5 Alternations) (sodium sulfate)	AASHTO T104	9% Maximum Loss
Cleanness Value min.	CALIF 227	71 ***706.03.01.B.1***
Clay Lumps	AASHTO T112	1% Maximum
Potential Reactivity	AASHTO T303	Innocuous ***706.03.01.B.2***

B. Thin or elongated pieces (length greater than 5 times maximum thickness) shall not exceed 15 percent by weight.

1. When 2 or more stockpiles are to be combined, each stockpile shall have a cleanness value of at least 65 with a minimum combined cleanness value of 71 calculated by the percent of material used from each stockpile.

2. If the material from a proposed source fails this test requirement, the material may still be used for concrete aggregate provided that it is incorporated in an approved mix design with an approved Type F or Type N Pozzolan, or with a Type IP cement.

C. If a pozzolan is used for this purpose, use 1 part pozzolan to 4 parts of cement by mass. The pozzolan quantity shall be considered as cement in meeting the required minimum cement content. If a Type IP cement is used for this purpose, the use of pozzolan is not required.

706.03.02 LIGHTWEIGHT AGGREGATES

A. These aggregates shall conform to the following requirements:

Table 6 - Lightweight Aggregate Gradation

	Percentage of Weight Passing Sieve			
Sieve Size	**Fine Natural**	**Fine Lightweight**	**1-inch Size Coarse**	**3/4-inch Size Coarse**
1-inch	--	--	95-100	100
3/4-inch	--	--	--	90-100
1/2-inch	--	--	25-60	--
3/8-inch	100	100	--	20-60
No. 4	95-100	85-100	0-10	0-10
No. 16	45-80	40-80	--	--
No. 50	10-35	10-35	--	--
No. 100	2-12	5-25	--	--
No. 200	0-5	--	--	--

Table 7 - Lightweight Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above ***706.03.02.A.1*** below
Sampling	ASTM D75	--
Unit Weight (loose oven dry) Fine Aggregate 70 lb/ft^3	Nev. T487	Maximum ***706.03.02.A.2*** below
Unit Weight (loose oven dry) Coarse Aggregate 55 lb/ft^3		
Unit Weight (loose oven dry) Combined Fine and Coarse Aggregate 65 lb/ft^3		
Organic Impurities	ASTM C40	Satisfactory ***706.03.02.A.3*** below
Clay Lumps	AASHTO T112	2.0% Maximum
Test for Staining Materials	ASTM D330	Satisfactory ***706.03.02.A.4*** below
Mortar Making Properties of Sand	ASTM C87	95% Minimum ***706.03.02.A.5*** below

1. With the following exceptions: The weight of the test sample for the fine lightweight aggregate shall be in accordance with Table 8, and the aggregate when mechanically sieved shall be sieved for only 5 minutes. The test sample for coarse aggregate shall consist of no less than 0.1 cubic foot of the material used for the determination of unit weight.

Table 8 - Weight of Sieve Test Sample for Fine Lightweight Aggregates

Nominal Weight of Aggregate		Weight of Test Sample	
(lbs/ft^3)	kg/m^3	Grams	Oz.
25-35	401-561	150	5.3
35-45	561-721	200	7.0
45-55	721-881	250	8.8
55-65	881-1042	300	10.6
65-70	1042-1122	350	12.3

2. The unit weight of successive shipments of lightweight aggregate shall not differ by more than 10 percent from that of the sample submitted for acceptance tests.

3. Aggregates tested and showing color darker than the standard shall be rejected unless it can be demonstrated that the discoloration is due to small quantities of materials not harmful to the concrete.

4. Aggregates tested and showing stain darker than "heavy stain" (stain index of 80) shall be tested by chemical procedure, and aggregates that contain 1.5 mg or more of ferric oxide (Fe_2O_3) per 200 gram sample shall be rejected for use.

5. Fine Aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

706.03.03 FINE AGGREGATE

A. This aggregate shall conform to the following requirements:

Table 9 - Fine Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
3/8-inch	100
No. 4	95-100
No. 16	45-80
No. 50	10-35
No. 100	2-12
No. 200	0-5

Table 10 - Fine Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	--
Soundness (5 alternations) (sodium sulfate)	AASHTO T104	10% Maximum Loss
Clay Lumps	AASHTO T112	1.0% Maximum
Lightweight Pieces in Aggregate (less than 2.0 sp. gr.)	AASHTO T113	1.0% Maximum
Organic Impurities	ASTM C40	Satisfactory ***706.03.03.A.2*** below
Mortar Making Properties	ASTM C87	95% Minimum ***706.03.03.A.1*** below

1. Aggregates tested and showing color darker than the standard shall be rejected unless they pass the mortar making properties test in accordance with ASTM C87.

2. Fine aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength of 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

3. If the material from a proposed source fails this test requirement, the material may still be used for concrete aggregate provided that it is incorporated in an approved mix design with an approved Type F or Type N Pozzolan, or with a Type IP cement.

    a. If a pozzolan is used for this purpose, use 1 part pozzolan to 4 parts of cement by mass.

    b. The pozzolan quantity shall be considered as cement in meeting the required minimum cement content.

    c. The limitation on replacement of cement with pozzolans at a minimum of 20 percent in ***Subsection 501.02.03, "Admixtures,"*** is hereby waived to meet this requirement.

    d. If a Type IP cement is used for this purpose, the use of pozzolan is not required.

706.03.04 GROUT AND MORTAR SAND

A. This aggregate shall conform to the following requirements:

B. Sand for grout and mortar shall conform to the size requirements of ***Subsection 706.03.03, "Fine Aggregate,"*** except if the Contractor elects, Contractor may screen the sand over a No. 8 screen to produce the following:

Table 11 - Grout Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
No. 8	100
No. 50	15-40
No. 100	0-10
No. 200	0-5

Table 12 - Grout Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	-----
Organic Impurities	ASTM C40	Satisfactory ***706.03.04.B.2***
Mortar Making Properties	ASTM C87	95% Minimum ***706.03.04.B.1***

1. Aggregates tested and showing color darker than the standard shall be rejected unless they pass the mortar making properties test in accordance with ASTM C87.

2. Fine aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

706.03.05 RIPRAP GROUT

A. The mix design for the placing requirements addresses 2 placement methods:

1. Direct discharge from the transit mixer.

2. Placement by small diameter line pumping methods.

B. Two typical mixtures that would meet the above minimum requirements are as follows:

Table 13 - Proportions for 1.0 Cubic Yard of Grout

	Pump Method Approx. Volume (Cu. Ft.)	Transit Mixer Discharge Approx. Volume (Cu. Ft.)
Pea Gravel	3.5	7.6
Washed Concrete Sand	10.6	7.6
Water	6.5	5.9
Type V cement	3.5	3.1

Table 13 - Proportions for 1.0 Cubic Yard of Grout

	Pump Method Approx. Volume (Cu. Ft.)	Transit Mixer Discharge Approx. Volume (Cu. Ft.)
Fly Ash class F	1.6	1.4
Balance Air	1.3	1.4

C. Factors which shall be considered for a given grout mix are:

1. Fine and coarse aggregates.
2. Consistency.
3. Elapse time between placement and initial set.
4. Length of time between batching and placement during which continuous or intermittent mixing is required.

D. Materials used in the production of riprap grout shall meet the minimum following material standards:

1. Fine and Coarse Aggregate: ASTM C33; ***Section 206, "Structure Excavation."***
2. Portland Cement: ASTM C150, Type V; ***Section 701, "Hydraulic Cement."***
3. Fly Ash: ASTM C618; ***Section 729, "Fly Ash."***
4. Water: ***Section 722, "Water."***
5. Air Entraining Admixture: ASTM C260; ***Section 702, "Concrete Curing Materials and Admixtures."***

E. A trial batch shall be placed for review by the Engineer for final approval for the project.

F. The Engineer shall be provided with a legible ticket with each load of grout delivered to the project site which shall contain the following information:

1. Name of Vendor.
2. Name of Contractor.
3. Number of Cubic Yards in the Load.
4. Actual Weights of Cement and of each Size of Aggregate.
5. Amount of Water Added at the Plant.
6. Amount of Water in the Aggregate.
7. Brand and Type of Cement.
8. Brand and Amount of Admixture.
9. Time and Date of Batching.

END OF SECTION 706

SECTION 707 – JOINT MATERIAL

SCOPE

707.01.01 MATERIALS COVERED

A. This specification covers the quality requirements for poured filler, preformed fillers, and resilient and rubber type gaskets used in the construction of bridges, culverts, sidewalks, and so forth.

PHYSICAL PROPERTIES AND TESTS

707.03.01 JOINTS

A. Materials for joints in concrete structures shall comply with provisions specified below.

707.03.02 POURABLE JOINT SEALER

A. The materials specified in this subsection shall be supplied and installed in weakened plane joints, contraction joints, and construction joints when required by the Engineer and as shown on the drawings.

B. Joint Sealant:

1. 2-component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV).
2. Sealant shall be able to expand and compress plus or minus 25 percent movement as the joint opens and closes.
3. Sealant shall be self-leveling for flat surfaces and non-sagging for sloped and vertical joints.
4. Sealant shall meet or exceed requirements of Table 1 below.

Table 1 - Minimum Requirements for Pourable Joint Sealer

Material Characteristics	Self-Leveling	Non-Sagging
Application Temperature	40 to 100 degrees F	40 to 100 degrees F
Service Range	-40 to 170 degrees F	-40 to 170 degrees F
Curing Rate	Tack-free Time: 1-2 hours Final Cure: 3-5 days	Tack-free Time: 6-8 hours Final Cure: 3 days
Tear Strength (ASTM D624)	--	45 lbs/in
Shore A Hardness (ASTM D2240)	45 ±5 (21-day)	25 ±5
Tensile Properties (ASTM D412):		
Tensile Strength	550 psi (21-day)	120 psi (at break)
Elongation	700% (at break)	500%
Modulus of Elasticity (100%)	150 psi	70 psi
Adhesion in Peel, Concrete Substrate (Fed Spec TT-00227E):		
Peel Strength	>30 pounds	25 pounds
% Adhesion Loss	0%	0%

C. No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

D. Each container shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use.

E. The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the 2 components and extrudes the mixed material into the joint.

1. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed.

2. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

F. Primer:

1. Special material furnished by the manufacturer of the sealant to improve bond of polyurethane sealant to concrete.

2. Primer shall be applied to the sides of the groove and to all exposed vertical surfaces in the joint prior to placing the polyurethane sealant.

3. The primer shall be dry prior to placing the sealant.

4. Contaminated primer shall be removed and replaced.

707.03.03 CHANNEL EXPANSION JOINT (1-INCH OR LESS)

A. The materials specified in this subsection shall be supplied and installed in expansion joints with widths 1-inch or less designed for channels included in Clark County Regional Flood Control District's Master Plan.

B. Joint Sealant:

1. 2-component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV).

2. Sealant shall be able to withstand up to plus or minus 25 percent movement.

3. Sealant shall be self-leveling for flat surfaces and non-sagging for slopes.

4. The sealant shall meet or exceed requirements of Table 1 in ***Subsection 707.03.02, "Pourable Joint Sealer."***

C. No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

D. Each container shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use.

E. The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the 2 components and extrudes the mixed material into the joint.

1. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed.

2. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

F. Joint Filler: Preformed, ASTM D1752, Type I (sponge rubber) or inert, preformed, closed cell, polypropylene material.

G. Bond Breaker Tape:

1. Adhesive backed polyethylene tape meeting or exceeding the following:

a. Adhesive Strength: 35 ounces/inch width.

b. Tensile Strength: 20 pounds./inch width.

c. Mil thickness: 14.

2. Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs.

3. In joints that have considerable width variation, 1 tape may be lapped over another to accomplish total backside coverage.

4. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

H. Backer Rod:

1. Non-absorbent expanded, closed cell polyethylene foam.

2. The backer rod shall be approximately 25 percent larger in diameter than the width of the joint to be sealed.

3. Other back-up materials (paper, rope and open cell foam) are unacceptable.

4. The backer rod shall be compatible with the sealant, and no bond or reaction shall occur between the backer rod and sealant.

707.03.04 EXPANSION JOINT (1-INCH OR LESS)

A. The materials specified in this subsection shall be supplied and installed in expansion joints with widths 1-inch or less designed for structures other than those listed in ***Subsection 707.03.03, "Channel Expansion Joint (1-Inch or Less)."***

B. Joint Sealant:

1. 2-component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV).

2. Sealant shall be able to withstand up to plus or minus 25 percent movement.

3. Sealant shall be self-leveling for flat surfaces and non-sagging for slopes.

4. The sealant shall meet or exceed requirements of Table 1 above.

C. No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

D. Each container shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use

E. The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the 2 components and extrudes the mixed material into the joint.

1. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed.

2. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

F. Joint Filler:

1. Preformed filler conforming to AASHTO M213 or ASTM D1751 (fiber type).

2. Filler material shall be punched or drilled to admit dowels where called for on the plans.

3. Filler for each joint shall be furnished in a single piece for the full depth and width required for the joint unless otherwise specified by the Engineer.

4. When the use of more than 1 piece is authorized for a joint, the abutting ends shall be fastened securely and held in place, by stapling or other positive fastening satisfactory to the Engineer.

G. Bond Breaker Tape:

1. Adhesive backed polyethylene tape meeting or exceeding the following:

a. Adhesive Strength: 35 ounces/inch width.

b. Tensile Strength: 20 pounds./inch width.

c. Mil thickness: 14.

2. Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs.

3. In joints that have considerable width variation, 1 tape may be lapped over another to accomplish total backside coverage

4. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

H. Backer rod:

1. Non-absorbent expanded, closed cell polyethylene foam.

2. The backer rod shall be approximately 25 percent larger in diameter than the width of the joint to be sealed.

3. Other backer materials (paper, rope and open cell foam) are unacceptable.

4. The backer rod shall be compatible with the sealant and no bond or reaction shall occur between the backer rod and sealant.

707.03.05 EXPANSION JOINT (GREATER THAN 1-INCH)

A. The materials specified in this subsection shall be supplied and installed in expansion joints with widths greater than 1-inch.

B. Joint Sealant:

1. Impermeable closed-cell, cross-linked, ethylene vinyl acetate, low density polyethylene copolymer, nitrogen blown foam material.
2. Joint sealant shall have a minimum working movement range of 60 percent compression and 30 percent tension.
3. The sealant shall meet or exceed the requirements listed in Table 2 below.
4. Joint sealant shall have 1/8-inch" deep by 1/8-inch wide grooves spaced at 1/4 inch to 1/2 inch along both sides of the joint and running the entire length of the joint to increase bond surface area.
5. Joint sealant material shall be resistant to degradation due to ultraviolet radiation or shall be coated with a material that provides adequate protection.
6. The joint sealant shall be installed with a width 25 percent greater than width of joint opening at a near neutral condition.
7. All direction changes in joint sealant shall be done using heat welding method.
8. Joint sealant shall be installed using all of manufacturer's recommendations.
9. Joint sealant shall be installed prior to significant joint movement after concrete placement.

C. Contractor shall prevent construction equipment from traversing joint after sealant has been placed or adequate steps shall be taken to protect sealant from construction traffic.

Table 2 - Minimum Requirements for Preformed Joint Sealer

Material Characteristics	Physical Requirements
Service Range	-94 degrees F to 160 degrees F
Tensile Strength	115 lb/in^2
Elongation at break	255%
Tear Resistance (ASTM D624)	16 lb/in^2
Water Absorption (ASTM D3575, Suffix L)	0.2 lb/ft^2
Density	2.8–3.4 lb/ft^3

D. Joint Filler: Inert, preformed, closed cell, polypropylene material.

E. Bond Breaker Tape:

1. Adhesive backed polyethylene tape meeting or exceeding the following:
   a. Adhesive Strength: 35 ounces/inch width.
   b. Tensile Strength: 20 pounds./inch width.
   c. Mil thickness: 14.
2. Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs.
3. In joints that have considerable width variation, 1 tape may be lapped over another to accomplish total backside coverage.
4. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

F. Bonder: 2-component, 100 percent solid epoxy adhesive designed to bond joint material to steel, cured concrete, or wood.

707.03.06 RUBBER GASKETS

A. The ring gaskets shall conform to AASHTO M198.

707.03.07 WATERSTOPS

A. Waterstops shall conform to the following requirements:

1. Natural rubber waterstops shall be manufactured from a stock composed of a high grade compound made exclusively from new plantation rubber, reinforced carbon black, zinc oxide, accelerators, antioxidants, and softeners.

2. This compound shall contain not less than 72 percent by volume of new plantation rubber.

NATURAL RUBBER

Test	Test Method	Requirements
Tension Testing of Vulcanized Rubber	ASTM D412	Tensile strength: 3,500 psi minimum Elongation at breaking: 550 percent Unit stress (300 percent): 1,100 psi minimum Unit stress (500 percent): 2,800 psi minimum
Test for Accelerated aging of Vulcanized Rubber by the Oxygen Pressure Method	ASTM D572	After 7 days in air at 158 degrees F (±2 degrees F) or after 48 hours in oxygen at 158 degrees F (±2 degrees F) and 300 psi, the tensile strength and elongation shall not be less than 65 percent of the original.
Test for Indentation of Rubber by Means of a Durometer	ASTM D2240	55 to 65 hardness

SYNTHETIC RUBBER

Test	Test Method	Requirements
Tension Testing of Vulcanized Rubber	ASTM D412	Tensile strength 2,500 psi minimum Elongation at breaking of 425 percent.
Test for Accelerated aging of Vulcanized Rubber by the Oxygen Pressure Method	ASTM D572	After 7 days in air at 158 degrees F (±2 degrees F) or after 48 hours in oxygen at 158 degrees F (±1 degree F) and 300 psi, the tensile strength and elongation shall not be less than 65 percent of the original.
Test for Indentation of Rubber By Means of a Durometer	ASTM D2240	50 to 70 hardness

POLYVINYL CHLORIDE

Test	Test Method	Requirements
Polyvinyl Chloride Waterstops	Corps of Engr CRD-C 572	Compliance with paragraph 6

707.03.08 ASPHALT PLANK

A. Asphalt plank shall conform to ASTM D517 for Plain Asphalt Plank.

707.03.09 PREFORMED ELASTIC JOINT SEALER

A. Preformed elastic joint sealer and lubricant adhesive shall conform to AASHTO M220.

B. The lubricant adhesive shall be homogeneous and shall remain workable from 5 degrees F to 120 degrees F.

1. Each lot of the adhesive shall be in containers with the manufacturer's name or trademark and the date of manufacture plainly marked.

2. Adhesive shall be stored at a temperature of 50 degrees F to 80 degrees F and shall be used within 270 days after the date of its manufacture.

C. The lubricant adhesive shall conform to the following requirements:

1. Average new weight per gallon, pounds: 7.84 ±5%.

2. Solids content by weight, percent: 22 - 28.

D. Each lot of the preformed elastic joint sealer and lubricant adhesive furnished under these specifications shall be identified as specified herein and shall be products that have been tested by a reputable testing laboratory, recognized by the Contracting Agency.

1. The testing laboratory shall certify that the materials meet these specifications and requirements.

2. The Contractor shall furnish the Contracting Agency with these certifications prior to using the material.

707.03.10 SUBMITTAL

A. Material shall be tested and certified in accordance with the Table 3 frequencies.

1. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and requirements.

2. The test shall be performed in an accredited laboratory such as the American Association for Laboratory Accreditation (A2LA) or other as approved by the Engineer.

3. A test certificate shall be included with the certifying document.

4. Subsequent submittals shall be reviewed by the Contractor for compliance then transmitted to the Engineer.

B. The Statute of Limitations duration for the record storage shall be as required by the Nevada Revised Statutes.

Table 3 - Quality Control Inspection and Testing

Product	Subsection	Reference	Submittal	Frequency
Joint Sealant	***707.03.02*** ***707.03.03***	Table 1 requirements	Certification with copy of tests	1 per lot
	707.03.04	ACI 504R, Table 1, Type IV		
	707.03.05	Table 2 requirements		
Joint Filler	***707.03.03***	Tested per ASTM D1752 Type I	Certification	1 per lot

	707.03.04	AASHTO M213	with copy of tests	
	707.03.05	Inert, preformed, closed cell, polypropylene material	Certification	1 per lot
Backer Rod	707.03.03 707.03.04	Non-absorbent expanded, closed cell polyethylene	Certification	1 per lot
Bond Breaker Tape	707.03.03 707.03.04 707.03.05	Adhesive strength 35 ounces/in width Tensile Strength 20 lb/in width Thickness 14 mil minimum	Certification with copy of tests	1 per lot
Rubber Gaskets	707.03.06	AASTHO M198		
Waterstops Natural and Rubber	707.03.07	ASTM D412 ASTM D572 ASTM D2240		
Waterstops Polyvinyl Chloride	707.03.07	Corps of Engr CRD-C 572		
Asphalt Plank	707.03.08	ASTM D517		
Preformed Elastic Joint Sealer	707.03.09	AASHTO M220		

END OF SECTION 707

SECTION 708 – CONCRETE AND CLAY PIPE AND DRAINS

SCOPE

708.01.01 MATERIALS COVERED

A. This specification covers the quality of clay pipe, nonreinforced concrete pipe, and reinforced concrete pipe used for culverts, siphons, pressure conduits, and storm drains and also the quality of perforated pipe used in underdrains.

1. BLANK

2. Quality control testing and inspection requirements are in ***Subsection 708.04.01, "Production Quality Control Inspection and Testing."***

B. Concrete pipe that is precast shall be manufactured in an annually certified plant.

1. Certification shall be by the American Concrete Pipe Association (ACPA).

2. The quality program from the certification process and this specification shall be initially submitted to the Regional Transportation Commission Specification Subcommittee for approval.

3. Once approved, the facility is considered "Authorized" and submittals of the QC program will not be required on a per-project basis unless required in the project specifications.

C. Design in accordance with AASHTO LRFD Bridge Design Specifications, Section 12, and to withstand a backfill dead load of 120 pounds per cubic foot and an HS-20 live load, unless otherwise shown in the contract or approved by the Engineer. The minimum cover over a pipe shall be placed on the plans and/or specifications being submitted for plan review.

D. The design shall consider any flotation effects with the use of controlled low strength material for backfill.

E. For storm drain application, the design shall consider the abrasion effects of parameters outlined in the Clark County Regional Flood Control District design manual or Federal Highway Administration (FHWA) publication FHWA-DF-88-003, "Federal Lands Highway Project Development and Design Manual."

F. The trench section installation configuration as demonstrated in Figure 1 in ***Section 208, "Trench Excavation and Backfill,"*** shall only be permitted when approved by the Engineer.

G. The designing engineer shall comply with the intent of the pipe material as defined as either rigid or flexible in conformance with the AASHTO LRFD Bridge Design and Construction Specifications and this section.

1. Special attention shall be given to the sidewall material properties as this section assumes a minimum AASHTO A1 or A3 material.

2. Other sidewall material type shall be given special consideration for minimum trench widths, the use of CLSM, or other critical processes that would affect the pipe ability to withstand the load and shall also be noted on the plans and specifications for the project.

H. The type of pipe and applicable installation requirement (trench and embankment) to be used as demonstrated by the design and approved by the Engineer shall be clearly noted on the drawings and specifications along with installation procedures that may differ from this section.

I. The design shall include definition of either rigid or flexible pipe as defined by the South African Standard SABS 0102 as outlined on the Clark County QAQC web page:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

J. The minimum design life before first maintenance on all pipes shall be 50 years. The definition of first maintenance is as follows:

1. **Rigid Pipe or Box - Reinforced Concrete:** Point of exposed reinforcement from normal designed use

2. **Rigid Pipe – Nonreinforced:** The least value of the thickness from designed use by a reduction of 25 percent or 1 inch.

K. Joints shall be specified in accordance with the following:

Table 10- Joint Types

Pipe Type	Joint Type	Description	Test Pressure	Application
Non-pressure	Silt Tight	Mastic or Rubber Gasketed	2.0 psi	Storm
Pressure	Water Tight (pressure)	Rubber Gasketed	10.8 psi	Storm

708.01.02 BASIS OF MANUFACTURED LOT ACCEPTANCE

A. Unless otherwise specified or designated by the Engineer, pipe shall be accepted based on manufacture's tests and inspection as indicated in ***Subsection 708.04.01, "Production Quality Control Inspection and Testing,"*** Table 1.

B. The Contractor shall submit to Engineer manufacturer's Certificate of Compliance for each type of pipe furnished, in accordance with the provisions of ***Subsection 106.05, "Certificate of Compliance,"*** and these specifications.

1. The certificate shall certify that the pipe complies with the specifications and shall include the pipe classification, diameter, and the date of manufacture.

2. The batch test results of each material lot delivered to the project shall be attached to the certificate.

PHYSICAL PROPERTIES AND TESTS

708.03.01 REINFORCED CONCRETE PIPE

A. Reinforced concrete pipe shall conform to the following requirements:

1. **Circular Pipe:** ASTM C76, ASTM C1417.

2. **Elliptical Pipe:** ASTM C507.

B. The above ASTM specifications are clarified and amended as follows:

1. Reinforced Concrete Pipe (RCP) ASTM C76, Basis of Manufactured Lot Acceptance. Unless otherwise specified or designated by the Engineer, pipe shall be accepted based on the authorized status of the facility and visual defects or imperfections as delivered to the site.

2. Reinforced Concrete Arch Pipe (RCAP) ASTM C507, Reinforced Concrete Elliptical Pipe (RCEP) Basis of Manufactured Lot Acceptance. Unless otherwise specified or designated by the Engineer, pipe shall be accepted based on the authorized status of the facility and visual defects or imperfections as delivered to the site.

C. **Materials:**

1. Cement and Fly Ash:

a. Unless otherwise specified, cement shall be Type V, Type IP, or Type V and fly ash, and shall conform to ***Section 701, "Hydraulic Cement."***

b. Fly ash shall be Class F and conform to ***Section 729, "Fly Ash."***

2. Concrete: Unless otherwise specified, Portland cement concrete shall be as specified in ***Section 501, "Portland Cement Concrete."***

3. Synthetic Fibers**:**

a. Polypropylene fibers may be used, with the approval of the Engineer, as a nonstructural manufacturing material.

b. Only Type III synthetic fibers designed and manufactured specifically for use in concrete and conforming to ASTM C1116 shall be accepted.

4. Admixtures: Unless otherwise specified or approved by the Engineer, admixtures conforming to ***Section 702, "Concrete Curing Materials and Admixtures,"*** shall be acceptable for use.

D. All D-load and/or compressive strength requirements shall be met prior to shipment.

708.03.02 NONREINFORCED CONCRETE PIPE

A. This pipe shall conform to ASTM C14 for the specified diameters and strength classes.

708.03.03 PERFORATED CONCRETE PIPE

A. This pipe shall conform to ASTM C444 for the specified diameters and strength classes.

708.03.04 CLAY PIPE

A. This pipe shall conform to AASHTO M65 for pipe with full circular cross section, for the specified diameter and strength class.

B. When specified, the bell shall have integral spacer lugs to provide for an annular opening and self-centering feature.

708.03.09 REINFORCED CONCRETE PRESSURE PIPE

A. This pipe shall conform to AWWA C300, AWWA C301, AWWA C302, and ASTM C361.

TESTING AND INSPECTION

708.04.01 PRODUCTION QUALITY CONTROL INSPECTION AND TESTING

A. Material shall be tested, inspected, and certified in compliance with the Table 2 frequency.

B. The laboratory shall be R-18 AASHTO accredited in the appropriate test method, where applicable, and testing reviewed and stamped by a Nevada professional engineer who has responsible charge of the work.

1. Any structural integrity test shall be reviewed and stamped by a Nevada professional engineer who has responsible charge of the work.

2. Chemical testing does not require a professional engineer's review and stamp.

Review the Clark County web site for any exceptions to the test methods listed below at http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx.

Table 2 – Inspection and Testing

Product/Material	Subsection	Referenced Specification or Test Procedure	Requirement	Frequency
Concrete Pipe				
Plant QC Program	***708.01.01***	ACPA	Certified annually	1 per new plant or revision
Reinforced Concrete Pipe	***708.03.01***	ASTM C76, ASTM C1417	Design submittal	1 per type
		ASTM C76, Section 5.1.2	Basis of manufactured lot acceptance	See Components below
Reinforced Concrete Elliptical Pipe	***708.03.01***	ASTM C507, Section 5.1.1 and ASTM C655, Section 9	Design submittal	1 per type
		ASTM C76, Section 5.1.2	Basis of manufactured lot acceptance	See Components below
Nonreinforced Concrete Pipe	***708.03.02***	AASHTO M315 and ASTM C14	Design submittal	1 per type
		ASTM C14	Basis of manufactured lot acceptance	See Components below
Perforated Concrete Pipe	***708.03.03***	ASTM C444	Design submittal	1 per type
			Basis of manufactured lot acceptance	See Components below
Reinforced Concrete Pressure Pipe (Water)	***708.03.09***	AWWA C300, AWWA C301, and AWWA C302	Design submittal	1 per type
			Basis of manufactured lot acceptance	See Components below

Table 2 – Inspection and Testing				
Product/Material	**Subsection**	**Referenced Specification or Test Procedure**	**Requirement**	**Frequency**
Components				
Cement	***708.03.01***	***Section 701***	Certificate with test of Batch lot	1 per batch or heat lot
Curing Compound and Admixtures	***708.03.01***	***Section 702***		
Fly Ash	***708.03.01***	***Section 729***		
Steel Wire Steel Welded Wire Steel Wire Welded Deformed Steel Wire Welded Wire Deformed		***Section 713***		
Aggregates Coarse and Fine		AASHTO M6 and AASHTO M80	Sieve Analysis	1 per day for QA of External Source
Concrete		***Section 501***	Design submittal	1 per new design and renewal each year
		AASHTO T22	Compressive Strength	1 set per production day per design
Pipe	***708.03.01***	ASTM C655	D-Load testing	Annually per size and class
	708.03.01	Applicable AWWA and ASTM methods	Inspection of diameter, wall thickness, steel area, product marking (size and length), length	Each piece
Pressure Pipe Joint	***708.01.01***	ASTM C497 and ASTM C443	Hydrostatic Test	1 per setup or change

END OF SECTION 708

SECTION 710 – STRUCTURAL AND EYEBAR STEEL

SCOPE

710.01.01 MATERIALS COVERED

A. This specification covers the quality of structural and eyebar steel used in highway structures.

REQUIREMENTS

710.02.01 DEFECTS

A. Finished rolled material shall be free from cracks, flaws, injurious seams, laps, blisters, ragged and imperfect edges, and other defects.

B. Material shall have a smooth, uniform finish, and shall be straightened in the mill before shipment.

C. Material shall be free from loose mill scale, rust pits, and other defects affecting its strength or durability.

D. The Engineer may reject material that Engineer deems unsuitable for the purpose intended even though the material meets the mill tolerances.

710.02.02 CHARPY V-NOTCH TEST

A. All steel used in and designated as main load carrying members subject to tensile stress shall comply with all the requirements specified for Charpy V-notch test in the various AASHTO standards for the steel involved.

B. Sampling and testing procedures shall be in accordance with the applicable AASHTO standards.

PHYSICAL PROPERTIES AND TESTS

710.03.01 CORRUGATED METAL PIPE AND PIPE ARCHES

A. This steel shall conform to AASHTO M270 Grade 36.

710.03.02 HIGH STRENGTH-LOW ALLOY STRUCTURAL MANGANESE VANADIUM STEEL

A. This steel shall conform to AASHTO M270 Grade 50.

710.03.03 HIGH TENSILE STRENGTH BOLTS

A. This steel shall conform to ASTM A325.

710.03.04 STAINLESS STEEL BOLTS

A. This steel shall conform to ASTM A276.

710.03.05 WELDED SEAMLESS STEEL PIPE

A. This steel shall conform to ASTM A53, Grade B.

710.03.06 COLD-FORMED WELDED AND SEAMLESS CARBON STEEL STRUCTURAL TUBING IN ROUNDS AND SHAPES

A. This steel shall conform to ASTM A500, Grade B, except the minimum tensile strength shall be 55,000 psi.

710.03.07 SHEAR STUD CONNECTORS

A. This steel shall conform to ASTM A108, Grade 1015 or Grade 1020.

B. Flux-retaining caps shall be low carbon grade suitable for welding and shall conform to ASTM A109.

710.03.08 PINS AND ROLLERS

A. Pins or rollers 9 inches or less in diameter shall be forged and heat treated cold finished carbon-steel shafting.

B. Pins or rollers more than 9 inches in diameter shall be forged and heat treated in accordance with ASTM A235.

END OF SECTION 710

SECTION 712 – MISCELLANEOUS METAL

SCOPE

712.01.01 MATERIALS COVERED

A. This specification covers the type and quality of miscellaneous metals used on various construction projects.

PHYSICAL PROPERTIES AND TESTS

712.03.01 STEEL CASTINGS

A. This steel shall conform to ASTM A27, Grade 65-35.

712.03.02 GRAY IRON CASTINGS

A. These castings shall conform to ASTM A48, Class 30.

712.03.03 MALLEABLE CASTINGS

A. These castings shall conform to ASTM A47, Grade 32510.

712.03.04 WROUGHT IRON PLATES

A. These plates shall conform to ASTM A42.

712.03.05 BRONZE CASTINGS

A. These castings shall conform to ASTM B22, Copper Alloy No. 863.

712.03.06 WELDING MATERIALS

A. Materials used for welding shall conform to the current Specifications for Welded Highway and Railway Bridges of the American Welding Society and current AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges.

712.03.07 STEEL PILES

A. This steel ("H" piles and sheet piling) shall conform to ASTM A36.

712.03.08 STEEL SHELL FOR PILES

A. This steel shall conform to ASTM A252, Grade 2.

END OF SECTION 712

SECTION 713 – REINFORCEMENT

SCOPE

713.01.01 MATERIALS COVERED

A. This specification covers the quality of bar steel, fabricated reinforcement, and welded steel wire used in the reinforcement of concrete.

PHYSICAL PROPERTIES AND TESTS

713.03.01 BAR STEEL REINFORCEMENT

A. This steel shall conform to the applicable following requirements.

Test	Test Method	Requirements
Deformed Billet-Steel Bars for Concrete Reinforcement	ASTM A615	Grade 40, 60
Axle-Steel Deformed Bars for Concrete Reinforcement	ASTM A996	Grade 40, 60
Spiral Reinforcement	ASTM A615	Grade 60

713.03.02 FABRICATED STEEL BAR OR ROD MATS REINFORCEMENT

A. This steel shall conform to ASTM A184.

713.03.03 WELDED STEEL WIRE FABRIC REINFORCEMENT

A. This steel shall conform to ASTM A185.

713.03.04 PRESTRESSING STEEL

A. Prestressing reinforcement shall be high tensile strength steel wire, high-tensile strength 7-strand wire, or high tensile strength alloy bars as called for on the plans or in the Special Provisions.

B. High-tensile strength steel wire shall conform to ASTM A421, except that steel may be made by the basic oxygen process.

C. High-tensile strength 7-strand wire shall conform to ASTM A416, Grade 270.

D. High-tensile-strength alloy bars shall be stress relieved and then cold stretched to a minimum of 130,000 psi. After cold stretching, the physical properties shall be as follows:

Minimum Ultimate Tensile Strength	145,000 psi
Minimum Yield Strength, Measured by the 0.7 Percent Extension, Under Load Method Shall Be Not Less Than	130,000 psi
Minimum Modulus of Elasticity	25,000,000 psi
Minimum Elongation in 20-bar Diameters After Rupture	4 percent
Diameter Tolerance	+0.03 inch, -0.01 inch

E. Testing Prestressing Reinforcement and Anchorages:

1. All wire, strand, or bars to be shipped to the site shall be assigned a lot number and tagged for identification purposes.

2. Anchorage assemblies to be shipped shall be likewise identified.

F. All samples submitted shall be representative of the lot to be furnished, and, in the case of wire or strand, shall be taken from the same master roll.

G. All of the materials specified for testing shall be furnished free of cost and shall be delivered in time for tests to be made well in advance of anticipated time of use.

H. The Contractor shall furnish for testing the following samples selected from each lot. If ordered by the Engineer, the selection of samples shall be made at the manufacturer's plant by the inspector.

1. **Pretensioning Method.**

   a. For pretensioned strands, samples at lease 5 feet long shall be furnished of each strand size.

   b. A sample shall be taken from each end of every coil.

2. **Post-Tensioning Method.** The following lengths shall be furnished:

   a. For wires requiring heading: 5 feet.

   b. For wires not requiring heading: sufficient length to make up 1 parallel-lay cable 5 feet long consisting of the same number of wires as the cable to be furnished.

   c. For strand to be furnished with fittings: 5 feet between near ends of fittings.

   d. For bars to be furnished with threaded ends and nuts: 5 feet between threads at ends.

3. **Anchorage Assemblies.** 2 anchorage assemblies shall be furnished, complete with distribution plates of each size or type to be used if anchorage assemblies are not attached to reinforcement samples.

713.03.05 COLD-DRAWN STEEL WIRE FOR SPIRAL REINFORCEMENT

A. This steel shall conform to ASTM A82.

END OF SECTION 713

SECTION 714 – PAINT AND PAVEMENT MARKINGS

SCOPE

714.01.01 MATERIALS COVERED

A. This specification covers the quality, color, and number of applications of paint used for painting the various materials of construction.

1. The raw materials for use in the various paint formulas shall conform to the specifications designated by federal or military serial number or paint material code number under the various paint classifications hereinafter specified.
2. Subsequent amendments to the specifications quoted shall apply to all raw materials and finished products.
3. No "or equal" substitutions for any specified material shall be made without written consent of the Engineer.
4. State specification numbers referred to are California State Specifications unless otherwise noted.

B. Comply with ***Section 715, "Galvanizing,"*** for galvanized coatings.

REQUIREMENTS

714.02.01 CERTIFICATES

A. The Contractor shall furnish the Engineer with written certification that all required tests have been satisfactorily completed and that the materials tested comply with all of the requirements. Samples will be taken when required by the Engineer.

B. Prior to using any material, the Contractor shall provide the Engineer with a written "Certification of Compliance" from the manufacturer of the material. The certification shall:

1. Include the manufacturer's name, business address, and location of the manufacturing plant.
2. Identify the specifications and include 1 copy.
3. Show the quantity of materials supplied for each color, batch number, and date of manufacture.

C. Manufacturer's lab test results shall be supplied upon request of the Engineer. No pavement marking material shall be used which is not on the Qualified Products List (QPL) established by the Nevada Department of Transportation (NDOT). The current NDOT QPL is available at http://www.nevadadot.com.

PHYSICAL PROPERTIES AND TESTS

714.03.01 IRON AND STEEL USE ITEM CLASSIFICATIONS

A. **Zinc-Rich Primer, Organic Vehicle Type (State Spec. 8010-61J-36):**

1. This specification covers a 1-package, thermoplastic, organic zinc-rich primer whose mechanism of drying is that of solvent release.

2. This primer is intended for use only on blast cleaned open steel structures exposed to the air.

3. This coating is intended for spray application. Limited application can be made by brushing.

B. **Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27):**

1. This specification covers a wash primer formulated specifically for application prior to painting clean aluminum, galvanized surfaces, or surfaces previously coated with an organic or inorganic zinc-rich primer.

2. This primer is also used on blast cleaned steel when specified and is mandatory as an undercoat under vinyl paint systems.

C. **Vinyl Primer, Red Iron Oxide Type (State Spec. 8010-61J-23):**

1. This specification covers a ready-mixed, vinyl-red oxide paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment Vinyl Wash Primer (State Spec. 8010-61J-27).

2. This paint should be applied alternately with Vinyl Primer, Red Iron Oxide - Titanium Dioxide Type (State Spec. 8010-61J-24) to provide a primer coating which may consist of 1 or more applications of each vinyl primer.

3. Either State Specification 8010-61J-23 or 8010-61J-24 may be used for the initial application.

4. This paint is formulated primarily for spray application.

D. **Aluminum Vehicle Varnish (State Spec. 8010-91B-75):**

1. This specification covers an aluminum vehicle clear varnish and general all purpose phenolic base spar mixing varnish.

2. This varnish should not be used on surfaces and in pigment combinations where yellowing will be objectionable.

E. **Aluminum Paint, Finish Coat, (State Spec. 8010-61J-45):**

1. This specification covers a phenolic resin varnish base aluminum paint, suitable for use as a finish coat.

2. This paint is formulated for use on structural steel and interior and underwater surfaces of steel water tanks and similar exposed surfaces.

3. This paint shall be furnished in 2-compartment containers and shall be mixed fresh each day.

F. **Vinyl Paint, Aluminum Finish Coat (State Spec. 8010-61J-25):**

1. This specification covers a vinyl type aluminum paint for use on properly prepared metal surfaces that have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27) or specified vinyl undercoats.

2. This paint is primarily formulated for spray application.

3. This paint shall be furnished in 2-compartment containers and shall be mixed fresh each day.

G. **Burnt Umber Tint Finish Coat (State Spec. 8010-61J-41):**

1. This specification covers a ready-mixed burnt umber tint paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

H. **Burnt Sienna Finish Coat (State Spec. 8010-61J-53):**

1. This specification covers a ready-mixed burnt sienna paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

I. **Green Finish Coat (State Spec. 8010-61J-47):**

1. This specification covers a ready-mixed green paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

J. **Vinyl Green Finish Coat (State Spec. 8010-61J-40):**

1. This specification covers a ready-mixed green vinyl finish paint for use on properly prepared metal surfaces that have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27), or specified vinyl undercoats.
2. This paint is formulated primarily for spray application.

K. **Vinyl Iridescent Green Finish Coat (State Spec. 8010-91B-43):**

1. This specification covers a ready-mixed iridescent green vinyl finish paint for use on properly prepared metal surfaces that have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27), or specified vinyl undercoats.
2. This paint is formulated primarily for spray application.

L. **Tan Finish Coat (State Spec. 8010-61J-51):**

1. This specification covers a ready-mixed, tan paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

M. **White Tint Base Finish Vinyl Coat (State Spec. 8010-71C-35):**

1. This specification covers a ready-mixed, white tint base, vinyl finish paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).
2. This paint is formulated primarily for spray application.

N. **Enamel; Exterior White, Metal (State Spec. 8010-61J-09):**

1. This specification covers a fast drying, exterior, white enamel, primarily for use on metal, or for other exterior surfaces where gloss and durability are requisite.
2. This paint shall conform to the provisions of Military Specification MIL-E-1115A.

O. **Enamel; Traffic Signal, Lusterless, Black (State Spec. 8010-61J-13):**

1. This specification covers a lusterless, black enamel for use in painting traffic signal hoods, shields, and other surfaces.

2. When used on bare aluminum or zinc, Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27) shall be used first to ensure proper bond.

P. **Enamel; Traffic Signal, Dark Olive Green (State Spec. 8010-41B-A):**

1. This specification covers an enamel for use on signal poles.

2. This paint is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).

Q. **Enamel; Traffic Signal, Yellow (School Bus Yellow):**

1. This specification covers high-gloss enamel for use on signal poles.

2. This paint is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).

3. School bus yellow shall conform to Federal Color No. 13432 as shown in Table V of Federal Standard No. 595a.

R. **Enamel; Traffic Signal, Silver:**

1. This specification covers an enamel for use on signal poles.

2. This paint is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).

3. The silver shall conform to Federal Color No. 17178 as shown in Table IX of Federal Standard No. 595a.

714.03.02 TIMBER USE ITEM CLASSIFICATIONS

A. **Wood Primer Latex Base:**

1. This specification covers a ready-mixed, priming paint for use on unpainted wood or exterior wood work.

2. This paint shall comply, in all respects, with Federal Specification TT-P001984, except that it shall dry hard in not more than 12 hours.

B. **Paint, Latex Base for Exterior Wood, White and Tints:**

1. This specification covers a ready-mixed paint for use on wood surfaces subject to outside exposures.

2. This paint shall comply in all respects with Federal Specification TT-P96D.

3. Unpainted wood shall first be primed with Wood Primer conforming to ***Subsection 714.03.02***, paragraph A, ***"Wood Primer, Latex Base."***

C. **Enamel; Sign Post, Black (State Spec. 8010-61J-08):**

1. This specification covers a gloss black enamel for use on wood or metal.

714.03.03 CONCRETE USE ITEMS

A. Concrete end posts (bridges), raised traffic bars, and miscellaneous concrete specified to receive paint.

Purpose	Number of Coats	Color	General Type	Formulated or Specification
Finish	1	White	Water Thinned	Acrylic Resin or Synthetic Latex Alkyd Emulsion

714.03.04 ALUMINUM USE ITEM

A. Aluminum bridge railing and posts specified to receive paint shall be prepared for painting with a coat of Pre-Treatment, Vinyl Wash Primer conforming to ***Subsection 714.03.01***, paragraph B, "***Pre-Treatment, Vinyl Wash Primer*** (State Spec. 8010-61J-27)."

B. The Contractor may use any of the paint systems specified for use on iron or steel in ***Subsection 714.03.01, "Iron and Steel Use Item Classifications,"*** for painting aluminum, and shall submit to the Engineer for approval a letter indicating Contractor's choice of system as required for iron or steel.

714.03.05 PAINT FOR TRAFFIC STRIPING, PAVEMENT MARKING, AND CURB MARKING - GENERAL

A. These specifications are intended to cover ready-mixed paints of a consistency suitable for use on highway pavements and curbing, either asphaltic or Portland cement concrete type.

B. Reference specifications and standards shall be Federal Specifications, latest revision, as herein noted, or Federal Test Method Standard No. 141, latest revision, as called for and amended in these specifications.

C. Paint shall be homogenous, free of contaminant, and of a consistency suitable for use in the capacity for which it is specified.

1. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint.
2. The dispersion shall be of such nature that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled.
3. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle.
4. Settled pigment shall be easily redispersed, with minimum resistance to the smooth uniform product of the proper consistency.
5. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning, or other requisite qualities of a satisfactory working material.
6. The paint shall possess satisfactory properties, in all respects, that affect its application and curing.

D. All manufactured paint shall be prepared at the factory ready for application. The addition of thinner or other material to the paint after the paint has been shipped will not be permitted unless otherwise specified in the contract Special Provisions.

714.03.06 PAVEMENT MARKINGS

A. **Type 2:**

1. Type 2 pavement marking material shall be a durable retroreflective pavement marking for use on asphalt or concrete pavements transverse markings such as crosswalks and stop bars, and for word/symbol markings, that are subjected to severe wear conditions such as repeated shear action from stop, start, or turn movements.

2. Type 2 materials are as follows:

   a. **Preformed Pavement Marking Tape**: This material shall meet the minimum requirements set forth in ASTM D4505 except as modified below.

   b. Whiteness Index: The daylight color of the white striping shall have a minimum initial whiteness index of sixty (60) as determined in Practice E313. Color shall be determined using 0/45 or 45/0 geometry.

   c. Retroreflectance:

      1) White preformed marking tape shall have the following initial minimum retroreflectance values as measured in accordance with ASTM D4061.

      2) Retroreflectance values shall be expressed as coefficient of retroreflected luminance (R_L) in millicandelas per square foot per footcandle (mcd/ft^2/fc).

Entrance Angle	86.0°	86.5°	88.8°
Observance Angle	0.2°	1.0°	1.05°
***R*$_L$ (mcd/ft^2/fc)**	550	300	250

   d. Skid Resistance: The surface of the retroreflective pavement marking tape shall provide an initial minimum average skid resistance value of 45 BPN when tested in accordance with ASTM E303.

   e. Durability:

      1) The durability of the pavement marking material shall be the percentage of the marking material remaining on the pavement surface in satisfactory working condition.

      2) The initial value shall always be established at 100 percent.

   f. Performance Requirements:

      1) Type 2 pavement marking material, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to the temperature if the pavement surface remains stable.

      2) The material shall be weather resistant and, through normal traffic wear, shall show no fading that will significantly impair the intended use of the marking throughout its useful life.

      3) Pavement marking tape shall show no lifting or shrinkage and shall show no significant tearing, roll back, or other signs of poor adhesion.

      4) Type 2 pavement marking material shall also meet the performance criteria establish in the table below.

Performance Factor*	Heavy Traffic (greater than 6,000 ADT per lane)	Medium and Light Traffic (6,000 ADT or less per lane)
Retained Retroreflectivity	74	40
Durability	90%	75%
Whiteness Index	10	10
Whiteness Index (0.5 million vehicle passes)	20	20

***Values for the performance factors are retained values which shall be determined after the markings have been in place a minimum of one (1) year and subjected to a minimum 4,000,000 vehicle passes per lane.**

g. Installation and Warranty

1) The markings shall be applied in accordance with the manufacturer's instructions.

2) Contractor shall provide to Engineer the manufacturer's written installation instructions and a recommendation for the type of adhesive to be used prior to installation of materials.

3) The marking material and installation shall have a minimum 1-year warranty.

B. **Type 1:**

1. Type 1 pavement marking material shall be a durable retroreflective pliant pavement marking for use on asphalt or concrete pavements for longitudinal markings such as edge lines and lane lines.

2. The color of the marking material shall be white or yellow and conform to standard highway colors.

3. Type 1 materials shall be as follows

a. **Preformed Pavement Marking Tape:** This material shall meet minimum requirements set forth in ASTM D4505 except as modified below:

1) Retroreflectance:

a) White and yellow preformed marking tape shall have the following initial minimum retroreflectance values as measured in accordance with the testing procedures of ASTM D4601.

b) Retroflectance values shall be expressed as coefficient of retroreflected luminance (RL) in millicandelas per square foot per footcandle (mcd/ft2/fc).

	White			Yellow		
Entrance Angle	86.0º	86.5º*	88.8°	86.0º	86.5º*	88.8°
Observance Angle	0.2º	1.0º	1.05°	0.2º	1.0º	1.05°
R_L (mcd/ft^2/fc)	800	600	400	700	500	300

2) Skid Resistance: The surface of the retroreflective pavement marking tape shall provide an initial minimum average skid resistance value of 45 BPN when tested in accordance with ASTM E303.

b. **Preformed Thermoplastic Tape (Yellow Markings Only):**

1) The preformed retroreflective marking material shall consist of a resilient polymer thermoplastic with uniformly distributed retroreflective beads throughout its entire cross section.

2) The markings shall be fusible to asphalt and Portland cement concrete pavements by the normal heat of a propane torch as recommended by the manufacturer.

c. **Paint:**

1) Traffic paint used for pavement markings shall conform to material requirements listed in the following subsections:

a) Subsection 714.03.05, "Paint for Traffic Striping, Pavement Marking, and Curb Marking - General,"

b) Subsection 714.03.07, "Fast Dry Traffic Paint,"

c) Subsection 714.03.09, "Ready-Mixed Traffic Stripe Paints."

2) Requirements for retroreflective beads used with the application of this material are listed in ***Subsection 714.03.12, "Reflective Material."***

d. **Epoxy Paint (Yellow Marking Only):**

1) Epoxy paint marking material shall consist of a 100 percent solid, 2-part system formulated and designed to provide a simple volumetric mixing ration of 2 components.

2) Epoxy paint used for pavement markings shall conform to materials requirements listed in ***Subsection 714.03.10, "Epoxy Paint for Traffic Markings."***

3) Requirements for retroreflective beads used with the application of this material are listed in ***Subsection 714.03.12, "Reflective Material."***

e. **Polyurea Paint:**

1) Polyurea paint marking shall consist of a 100 percent solid, 2-part system formulated and designed to provide a simple volumetric mixing ratio of 2 components.

2) Polyurea paint used for pavement markings shall conform to materials requirements listed in ***Subsection 714.03.10, "Epoxy Paint for Traffic Markings."***

3) Requirements for retroreflective beads and reflective elements used with the application of this material are listed in ***Subsection 714.03.12, "Reflective Material."***

f. Durability:

1) The durability of the pavement marking material shall be the percentage of the marking material remaining on the pavement surface in satisfactory working condition.

2) The initial value shall always be established at 100 percent.

g. Performance Requirements:

1) Type 1 pavement marking material, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to the temperature if the pavement surface remains stable.

2) The material shall be weather resistant and, through normal traffic wear, shall show no fading that will significantly impair the intended use of the marking throughout its useful life.

3) Pavement marking tape shall show no lifting or shrinkage and shall show no significant tearing, roll back, or other signs of poor adhesion.

4) Type 1 pavement marking material shall also meet the performance criteria established in the table below.

Performance Factors	**Heavy Traffic** (greater than 6000 ADT per lane)		**Medium and Light Traffic** (6000 ADT or less per lane)	
	White	**Yellow**	**White**	**Yellow**
Retained Retroreflectivity	200	150	100	100
Durability	98%	95%	93%	93%
Whiteness Index	6	45	6	40

*Values for the performance factors are retained values which shall be determined after the markings have been in place a minimum of one (1) year and subjected to a minimum 4,000,000 vehicle passes per lane.

h. Installation and Warranty:

1) The markings shall be applied in accordance with the manufacturer's instructions.

2) Contractor shall provide to Engineer the manufacturer's written installation instructions and a recommendation for the type of adhesive to be used prior to installation of materials.

3) The marking material and installation shall have a minimum 1-year warranty.

i. Qualified Products List:

1) The Nevada Department of Transportation (NDOT) maintains a Qualified Products List (QPL) of all products available that satisfy the requirements of these specifications and have proven effective in field tests. The current NDOT QPL is available at: http://www.nevadadot.com.

714.03.07 FAST DRY TRAFFIC PAINT

A. Type 2 (Heatable) Fast Dry White, Type 2 (Heatable) Fast Dry Yellow, Type 1 Fast Dry White, and Type 1 Fast Dry Yellow shall comply with any western state specification valid at the time of use in addition to meeting ***Subsection 714.03.05, "Paint for Traffic Striping, Pavement Marking, and Curb Marking – General,"*** and listed on the NDOT QPL.

B. Fast dry traffic paint shall be applied at the film thickness of 15 mils to 20 mils and shall dry to "no traffic pickup" within 3 minutes.

C. The "no traffic pickup" time shall be determined by ASTM D711.

714.03.08 ALL PURPOSE BLACK TRAFFIC PAINT - PAINT FORMULA 235

A. All purpose Black Traffic Paint - Paint Formula 235 shall comply with any western state specification valid at the time of use, and listed on the NDOT QPL.

714.03.09 READY-MIXED TRAFFIC STRIPE PAINTS

A. Where ready-mixed paints are specified, they shall be suitable for use on either asphalt concrete or Portland cement concrete.

714.03.10 EPOXY PAINT FOR TRAFFIC MARKINGS

A. Epoxy traffic paints shall be a 2-component marking material suitable for use on either asphalt concrete or Portland cement concrete.

B. Mixing of 2 components shall be performed as recommended by the manufacturer.

C. Epoxy paint shall only be applied if air temperature is a minimum of 50 degrees F at the time of marking installation.

D. If the manufacturer of the marking material requires a minimum air temperature different than detailed above, the higher temperature shall be used.

E. If material needs heating prior to application, no fumes shall be exuded that are toxic or injurious to persons or property.

F. Epoxy paint shall dry to "no traffic pickup" within 45 minutes.

714.03.11 POLYUREA PAINT FOR TRAFFIC MARKINGS

A. Polyurea traffic paints shall be a 2-component marking material suitable for use on either asphalt concrete or Portland cement concrete.

B. Mixing of 2 components shall be performed as recommended by the manufacturer.

C. Polyurea paint shall be applied if air temperature is a minimum of 40 degrees F at the time of marking application.

D. If the manufacturer of the marking material requires a minimum air temperature different than detailed above, the higher temperature shall be used.

E. If material needs heating prior to application, no fumes shall be exuded that are toxic or injurious to person or property.

F. Polyurea paint shall be dry to “no traffic pickup” within 5 minutes.

714.03.12 REFLECTIVE MATERIAL

A. Reflective material shall consist of retroreflective beads and of the final coat of traffic paint or epoxy paint and polyurea paint prior to setting, so that the beads will have proper adhesion.

B. Special care shall be taken with rapid dry paint and epoxy paint materials.

C. Retroreflective beads shall conform to Federal Specification TT-B-1325B and shall be mechanically applied at a rate recommended by the manufacturer to achieve performance criteria established in ***Section 714.03.06, "Pavement Markings."***

D. Retroreflective beads shall be applied to pavement markings, curbs, and crosswalks by use of a dispensing device developed for this purpose or other methods approved by the Engineer.

E. The Engineer may authorize the use of traffic paint containing pre-mixed retroreflective beads.

1. The type, gradation, quantity, and quality of the pre-mixed retroreflective beads shall be approved prior to the manufacture of the traffic paint.

2. In addition to the specified pre-mixed beads, additional beads may need to be mechanically applied when the traffic paint is applied.

714.03.13 AIR POLLUTION

A. All paint shall meet the requirements of the Clark County Department of Air Quality and Environmental Management (DAQEM).

714.03.14 TEST REPORTS AND CERTIFICATION

A. At the time of delivery of each shipment of material, the Contractor shall, upon request, deliver to the Engineer certified copies of the manufacturer's test report.

B. The test report shall indicate the name of the manufacturer, type of material, date of manufacture, quantity, applicable State Specification Number and specification, manufacturer's lot or batch number, and results of the required tests.

1. The test report shall be signed by an authorized representative of the manufacturer.

2. The certified test reports and the testing required in connection therewith shall be at no cost to the Contracting Agency.

END OF SECTION 714

SECTION 715 – GALVANIZING

SCOPE

715.01.01 MATERIALS COVERED

A. This specification covers the quality and thickness of galvanizing used on various material when called for on the plans or designed in the specifications.

PHYSICAL PROPERTIES AND TESTS

715.03.01 PRODUCTS 1/8-INCH THICK AND THICKER

A. Galvanizing of products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strip shall conform to ASTM A123.

715.03.02 GUARDRAIL ELEMENTS

A. All rail elements shall be galvanized in accordance with AASHTO M180, Type 2.

715.03.03 HARDWARE

A. Bolts, nut, washers, and fastenings shall be galvanized in accordance with ASTM A153.

END OF SECTION 715

SECTION 716 – SIGN MATERIALS

SCOPE

716.01.01 MATERIALS COVERED

A. This specification covers the kind and quality of materials used in the construction and fabrication of traffic control devices used in temporary event zones and for permanent installations.

REQUIREMENTS

716.02.01 GENERAL

A. The following materials shall conform to the requirements as noted:

Material	Section
Portland Cement Concrete	***501***
Reinforcing Steel	***505***

716.02.02 CERTIFICATES

A. The Contractor shall ascertain that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency.

B. The Contractor shall furnish the Engineer with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

716.02.03 SUBMITTALS

A. Before fabrication is started, 5 sets of shop drawings for each overhead sign structure shall be submitted to the Engineer for approval.

PHYSICAL PROPERTIES AND TESTS

716.03.01 REFLECTIVE SHEETING

A. Sheeting for all orange signs and devices shall be Fluorescent Orange with the exception of Type 1, Type 2, and Type 3 barricades, which shall be pre-striped white and non-fluorescent Orange sheeting.

B. Fluorescent Yellow-Green sheeting shall be used on School, Bicycle, and Pedestrian signs, and related supplemental plates, or as directed by the Contracting Agency.

C. Inks and films for symbols, legends and borders on sheeting shall be in accordance with the manufacturer's sheeting specification. Films shall be a durable, transparent, acrylic colored film coated with a transparent pressure-sensitive adhesive.

D. Protective overlay film (anti-graffiti film for non-illuminated signs), shall be a durable, solvent resistant, transparent, fluoropolymer film, coated with a transparent pressure-sensitive adhesive, and applied to the finished sign in accordance with the manufacturer's sheeting specification.

E. **Non-Reboundable Signs and Devices**: Retroreflective sheeting shall conform to ASTM D4956, Type XI. The warranty for the sheeting shall be twelve years for non-fluorescent sheeting, ten years for Fluorescent Yellow and Fluorescent Yellow-Green sheeting, and three years for Fluorescent Orange sheeting,

F. **Reboundable Devices and Delineators**: Retroreflective sheeting shall conform to ASTM D4956, Type IV and Type VI with the following modifications:

1. Minimum Coefficient of Retroreflection (R_A) [cd/fc/ft^2 (cd/lx.m^2)] for both Type IV and Type VI shall conform to the requirements for ASTM D4956, Type VI as shown in Table 716-1

2. Daytime color – the chromaticity coordinates and total luminance factor shall conform to the requirements as described in 23 CFR Part 655 Appendix to Subpart F.

TABLE 716-1 MINIMUM COEFFICIENT OF RETROREFLECTION (R_A)

Observation Angle	Entrance Angle	White	Fluorescent Orange	Fluorescent Yellow	Fluorescent Yellow-Green
0.2°	-4°	500	200	300	400
0.2°	30°	200	80	120	160
0.5°	-4°	225	90	135	180
0.5°	30°	85	34	51	68

G. Fluorescence Luminance Factor (L_F) for all Fluorescent sheeting shall conform to the requirements in Table 716-2.

H. Unless otherwise specified, the Contractor shall use only Type IV, Type VI, and Type XI products listed in the NDOT QPL.

TABLE 716-2 FLUORESCENCE LUMINANCE FACTOR (Y_F)

Color	Y_F Initial Requirement	Y_F Minimum Requirement
Fluorescent Orange	20	15
Fluorescent Yellow	25	20
Fluorescent Yellow-Green	30	20

I. **Field Performance Life Requirement:**

1. The supplier shall warranty that signs supplied shall have an effective retroreflective life of not less than that specified above.
2. The retroreflective sheeting shall be considered unsatisfactory and failing this life requirement if it has deteriorated due to natural causes to the extent that 1 or more of the following is true:
   a. The sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night conditions.
   b. The values for the coefficients of retroreflection for Type IV, Type VI, and Type XI are less than 50 percent of the required values for the same sign when new in accordance with ASTM D4956.
   c. The sign material's integrity or adhesion to the sign substrate has substantially failed.
3. Sheeting which fails the life requirement within the specified required lifetime shall be replaced by the supplier at no cost to the Contracting Agency.
4. Replaced sheeting warranty shall begin at time of replacement and the warranty shall be to the life requirement per sheeting type.
5. All finished signs shall be dated with the month and year of delivery in order to ascertain compliance with the life requirements.

716.03.03 ALUMINUM SIGN PANELS (FOR REFLECTIVE SHEETING)

A. Sheet aluminum for sign panels shall be of 0.100-inch aluminum alloy Alclad 5052-H38 or 6061-T6 and shall conform to ASTM B209.

B. Sign panels for street name signs shall be as required in the Standard Drawings.

C. Sign panel sections shall be fabricated of standard width aluminum sheets not less than 4 feet wide, except that not more than 2 sheets for any 1 sign may be cut not less than 18 inches in width to provide sign widths to nearest 6-inch increments. Panel sections shall run from the top edge to the bottom edge of the sign without horizontal joints.

D. The aluminum shall be free of all corrosion, white rust, and dirt.

1. All sign dimensions, metal gauge, and bolt holes shall conform to the plans and these specifications.
2. Blanks shall be cleaned, degreased, and chromated or otherwise properly prepared according to methods recommended by the sheeting manufacturer.

E. Metal shall not be handled, except by device or clean canvas gloves, between all cleaning operations and the applications of the sign background material. There shall be no opportunity for the aluminum to come in contact with greases, oils, or other contaminants prior to application of the background material.

F. All fabrication, including cutting, shall be completed prior to the cleaning process.

1. Metal panels shall be cut to size and shape and shall be free of defects resulting from fabrication.

2. The surface of all sign panels shall be a plane surface.

716.03.05 OVERHEAD SIGN STRUCTURES AND SIGN FRAMES

N. The materials used in the fabrication of overhead sign structures and footings shall conform to the requirements specified below.

O. **Sign Frames:** Bars, plates, and shapes shall be structural steel conforming to ASTM A36.

P. **Sign Pipe Posts:**

1. Pipe posts shall be welded or seamless steel pipe conforming to ASTM A53, Grade B.

2. At the option of the Contractor, posts may be fabricated from structural steel conforming to ASTM A36 or ASTM A283, Grade D, except that plates more than 1 inch in thickness shall be structural steel conforming to ASTM A373.

Q. **Sign Steel Walkway Gratings:** Steel walkway gratings shall be furnished and installed in accordance with details shown on the plans and the following provisions:

1. Gratings shall be the standard product of an established grating manufacturer.

2. Material for gratings shall be structural steel conforming to ASTM A36.

3. For welded type gratings, each joint shall be full resistance welded under pressure to provide a sound, completely beaded joint.

4. For mechanically locked gratings, the method of fabrication and interlocking of the members shall be approved by the Engineer, and the fabricated grating shall be equal in strength to the welded type.

5. After fabrication, gratings shall be hot-dip galvanized.

6. Gratings shall be free from warps, twists, and other defects affecting their appearance or serviceability.

   a. The tops of the bearing bars and cross members shall be in the same plane.

   b. Gratings distorted by the galvanizing process shall be straightened.

R. **Bolts and Nuts:**

1. Bolts and nuts shall conform to ASTM A307.

2. Bolted connections shall conform to ***Subsection 506.03.07, "Bolts and Bolted Connections."***

S. Bearing plates and gusset or stiffener plates shall be of the sizes and dimensions shown on the plans and shall be galvanized after fabrication.

1. Steel shall conform to ASTM A36.

2. Galvanizing shall conform to ASTM A123.

3. All welding shall conform to ***Subsection 506.03.17, "Welding."***

T. Anchor bolts, nuts, and washers shall be of structural carbon steel conforming ***to Section 710, "Structural and Eyebar Steel,"*** and shall be galvanized in accordance with ASTM A153 or cadmium plated in accordance with ASTM A165, Type TS.

1. The top portion of anchor bolts shall be galvanized or cadmium plated so that the galvanized or cadmium plated portion will extend at least 2 inches into concrete.
2. Anchor bolts shall be of the size, shape, and length shown on the plans.

U. All bolts, nuts, clamps, and metal washers not otherwise noted shall be galvanized or cadmium plated.

1. Cadmium plating shall conform to ASTM A165, minimum thickness as prescribed for grade Type TS.
2. Galvanizing shall conform to ASTM A153.

V. Supporting frame shall be manufactured in accordance with the plans and requirements herein specified.

1. All metal parts shall be galvanized after fabrication, in accordance with ***Section 715, "Galvanizing."***
2. When permission is granted by the Engineer to zinc coat a surface by means other than hot-dip galvanizing, the metalizing process shall be used to place the zinc.
3. Metalizing shall be performed in accordance with AWS specifications and the thickness of the sprayed zinc coat shall be at least 5 mils.

W. Truss frames shall be fabricated to the largest practical sections prior to galvanizing.

1. Splice locations shall be submitted to the Engineer for approval.
2. Contractor shall not commence fabrication until such splice locations are approved.

X. All welding on the fabrication of the structure shall be done by welders qualified in accordance with AWS requirements using the inert-gas shielded-arc method.

1. Welds shall be free from cracks, blow holes, and other irregularities.
2. Welds shall be wire brushed or otherwise cleaned.
3. No field welding on any part of the structural assembly will be permitted.

716.03.06 SIGN HARDWARE, POST, AND RELATED MATERIALS

A. Bearing plates and gusset or stiffener plates shall be of the sizes and dimensions shown on the plans and shall be galvanized after fabrication.

1. Steel shall conform to ASTM A36.
2. Galvanizing shall conform to ASTM A123.
3. All welding shall conform to ***Subsection 506.03.17, "Welding."***

B. Structural I-beam steel shall be galvanized in accordance with ASTM A153 or cadmium plated in accordance with ASTM A165, Type TS.

C. Anchor bolts, nuts, and washers shall be of structural carbon steel conforming to ***Section 710, "Structural and Eyebar Steel."***

1. The top portion of anchor bolts shall be galvanized or cadmium plated so that the galvanized or cadmium plated portion will extend at least 2 inches into the concrete.
2. Anchor bolts shall be of the size, shape, and length shown on the plans.

D. Steel pipe for posts shall conform to ASTM A53, Grade B, and shall be galvanized.

1. Galvanized steel pipe posts shall be of the diameter and length shown on the plans.
2. The top of the posts shall be fitted with a cover.
3. Posts showing damage shall be repaired or rejected.

E. BLANK

F. Aluminum stiffeners, braces, and stringers used as horizontal supporting structural members shall be of aluminum alloy 6061-T6.

1. These extrusions shall have a continuous, inverted "T" slot.
2. The inverted "T" shall accommodate positionable stainless steel clamping devices.
3. The clamping devices shall provide complete freedom of alignment within the slot, forming an interlocking clamp system for fastening the sign to the post.
4. The sign support system described herein shall conform to AASHTO *Standard Specifications for Highway Signs, Luminaires and Traffic Signals*, latest revision, and be rated for minimum wind velocities of 80 mph.
5. All bolts, nuts, clamps, and metal washers in contact with this aluminum channel shall be Stainless Steel Type 304.
6. The system shall be compatible with all I-beam, steel post, and wood post systems.

G. All other bolts, nuts, clamps, and metal washers in contact with other aluminum components shall be galvanized or cadmium plated.

1. Cadmium plating shall conform to ASTM B766, minimum thickness as prescribed for Class 5 Type 3.
2. Galvanizing shall conform to ASTM A153.

H. Cantilever arm brackets shall be used when it is desired to offset the entire length of a sign to 1 side of a post or pole.

1. Cantilever arm brackets shall consist of a stainless steel or aluminum head mounted to an extruded aluminum "TEE" section.
2. The "TEE" section shall have a continuous slot that will accept signs up to 1/8 inch thick.
3. If sign thickness, including aluminum sign panel and reflective sheeting, exceeds the width of the "TEE" section slot, sign panel thickness may be reduced to not less than 0.080 inch, or reflective sheeting may be eliminated in the bracket area, as directed by the Engineer.
4. The heads shall be designed to accept 3/4-inch stainless steel banding.
5. The "TEE"-shaped extrusions shall be made from 6061-T6 aluminum alloy.
6. The cantilever arm brackets shall be used to support the entire length of the sign on both the top and the bottom.
7. The sign shall be attached to the brackets using 1/8-inch rivets spaced according to the hole pattern pre-drilled on the extruded "TEE" section.

8. The cantilever arm brackets shall be compatible with any size and shape of post or pole.
9. The system shall be designed for use on signs up to 72 inches in length with a maximum surface area of 9.5 square feet.
10. Signs with surface area greater than 2 square feet shall be fastened to round posts or poles using 3/4-inch by 0.030-inch stainless steel banding.
11. When mounting to square posts or flat surfaces, compatible stainless steel threaded studs or bolts can be used as well as 3/4-inch by 0.030-inch stainless steel banding.
12. For signs less than 2 square feet in surface area, 5/8-inch banding is acceptable.

END OF SECTION 716

SECTION 721 – OBJECT MARKERS AND GUIDE POSTS

SCOPE

721.01.01 MATERIALS COVERED

A. This specification covers the quality and kind of material used in the construction of object markers and guide posts.

REQUIREMENTS

721.02.01 CERTIFICATES

A. At no additional cost to the Contracting Agency, 2 certificates covering each order of material (plates, reflectors, and posts) shall be furnished by the manufacturer, certifying that the product complies with the specifications.

B. Certificates shall be delivered to the Engineer at the time of, or prior to, delivery of the order.

C. For steel used in posts, the Contractor shall furnish 2 certified copies of mill test reports showing the chemical and physical characteristics from each heat.

PHYSICAL PROPERTIES AND TESTS

721.03.01 METAL POSTS

A. Posts shall be steel conforming to ASTM A570, Grade C.

B. Metal posts shall be galvanized in accordance with ***Section 715, "Galvanizing."***

721.03.02 TARGET PLATES

A. **Base Metal:** Base metal for target plates shall be zinc-coated steel sheet or aluminum sheet.

B. Zinc-Coated Steel Sheet:

1. The zinc-coated steel sheet shall comply with Federal Specification QQ-S-775, Steel Sheet, carbon, zinc-coated Type 1, Classes d and e, except that the zinc-coated surface shall withstand a 180-degree bend on itself at room temperature without flaking the coating.

2. The zinc-coated surface shall be prepared for painting by the application of phosphate coating.

3. Surface preparation shall conform to the following requirements:

   a. The phosphatizing process shall be accomplished without damaging or removing the galvanized coating from the steel base metal.

   b. Any evidence of damage or removal of the zinc coating shall be cause for rejection of the entire lot.

C. Aluminum Sheet:

1. The aluminum shall be prepared for painting with a chemical conversion coating conforming to Federal Specification MIL-C-5541.

2. The coating shall be applied in accordance with the manufacturer's specifications and recommended sequence of operation.

3. Contractor shall furnish 2 copies of certified mill tests of the aluminum sheets to the Engineer.

D. Target plates shall be fabricated from 20 gauge steel sheet or 0.050-inch thick aluminum sheet, alloy 3005-H14.

E. Fabrication of all metal parts shall be accomplished in a uniform and workmanlike manner.

1. Plates shall be cut to size and shape and the holes punched for mounting bolts and reflectors in accordance with the details shown on the plans.

2. Surfaces and edges of the plates shall be free from defects resulting from fabrication.

F. **Paint:**

1. Target plates shall have satisfactory paint adherence.

2. The plates shall be coated with baked enamel conforming to the following provisions:

a. The enamel finish coat for plates shall comply in all respects with Federal Specification TT-E-489, Class B baking type enamel, with the added requirement that the yellowness index of the white enamel shall not exceed 0.08 when tested in accordance with Federal Test Method Standard No. 141, Method 6131.

b. Application of the baking enamel may be by spray, roller, or dip, at the option of the manufacturer. Other methods may be used provided they are approved prior to use.

c. The dry film thickness of the baked enamel coating on the galvanized steel plates shall be not less than 2.0 mils on both front and back surfaces.

d. The dry film thickness on both front and back surfaces of the aluminum plates shall be:

1) Not less than 1.5 mils on each side if enamel is applied by spray or dip method.

2) Not less than 1.0 mil if enamel is applied by continuous roller coat method.

e. The coating shall be uniform throughout and shall be smooth and free from flow lines, streaks, blisters, and other surface imperfections.

G. The finished plates shall be free from dents and defects. The maximum surface deviation from a horizontal plane on which the finished plate lies shall not exceed 0.25 inch.

702.03.03 REFLECTORS

A. **Photometric Requirements:**

1. Each reflective delineator shall have the following minimum brightness values at 2 degrees divergence expressed as candlepower per foot candle.

2. Measurements shall be conducted in accordance with standard photometric testing procedures for reflex reflectors of the Society of Automotive Engineers.

Angle of Incidence	Silver-White		Yellow	
	Divergence Angle			
	0.2	0.5	0.2	0.5
	Brightness (cd/ftcd)			
0 degrees	9.0	3.8	5.3	2.3
15 degrees	8.0	3.4	4.4	2.0
30 degrees	5.4	2.9	2.7	1.2
45 degrees	2.6	1.1	1.0	0.5

3. The brightness of the reflective sheeting, totally wet by rain, shall not be less than 90 percent of the above values.

4. Wet performance measurements shall be conducted in conformance with standard rainfall tests specified in MIL-R-13689A.

B. **Durability.** The delineator surface shall readily be refurbished by cleaning and clear overcoating in accordance with the manufacturer's recommendations.

END OF SECTION 721

SECTION 722 – WATER

SCOPE

722.01.01 MATERIALS COVERED

A. This specification covers the quality of water from non-potable sources for use in preparing cement concrete or soil-cement mixtures, and for wetting embankment, backfill, subgrade, and gravel base and surfacing courses.

REQUIREMENTS

722.02.01 GENERAL

A. All water for embankments, backfill, subgrade, gravel base, landscaping, and surface courses and cement concrete curing shall be free from an excessive amount of acids, alkali, oil, and other substances which, in the opinion of the Engineer, will cause damage to the above mentioned items.

PHYSICAL PROPERTIES AND TESTS

722.02.02 CONCRETE USE

A. Samples submitted for tests shall consist of 2 quarts of water, obtained and shipped in clean glass containers carefully packed and labeled.

B. Tests shall be made in accordance with AASHTO T26.

C. Any indication of unsoundness, marked change in time of setting, or a reduction of more than 10 percent in strength from results obtained with concrete mixtures containing the water of satisfactory quality shall be sufficient cause for rejection of the water under tests.

END OF SECTION 722

SECTION 725 – ELASTOMERIC BEARING PADS

SCOPE

725.01.01 MATERIALS COVERED

A. Elastomeric bearing pads shall be preformed pads formed by casting or extruding natural rubber or neoprene under pressure and heat.

B. The pads shall be cast or extruded in a single, integral layer to the required thickness, unless pads with nonelastic lamination are called for on the plans.

C. All components of a laminated pad shall be molded together into an integral unit and all edges of the laminates shall be covered by a minimum of 1/8 inch of elastomer, except at laminate restraining devices and around holes that will be entirely closed on the finished structure.

D. Laminates shall be of the material and thickness called for on the plans.

REQUIREMENTS

725.02.01 CERTIFICATE OF INSPECTION

A. The material furnished will be evaluated for acceptance on the basis of the manufacturer's Certified Report of Test or Analysis indicating compliance with these special properties, but the Engineer may obtain test specimens on request.

B. Contractor shall furnish to the Engineer 3 copies of the manufacturer's Certified Report of Test or Analysis before use of the material in the work.

C. Test specimens, when required, shall be in accordance with ASTM D15, Part B.

PHYSICAL PROPERTIES AND TESTS

725.03.01 GENERAL

A. The pads shall conform to the following physical properties:

	Natural Rubber	Neoprene
Grade (Durometer)	60	60
Physical Properties:		
Hardness, (ASTM D 2240)	60 ±5	60 ±5
Tensile Strength, min. psi, (ASTM D412)	2,500	2,500
Ultimate elongation, min. percent	400	350
Heat Resistance, 70 hours at 158°F (ASTM D573):		
Hardness, max. points change	10	15
Tensile strength, max. percent change	-25	-15
Ultimate elongation, max. percent change	-25	-40
Compression Set (ASTM D395, Method B):		
22 hours at 158°F, max. percent	25	--
22 hours at 212°F, max. percent	--	35

	Natural Rubber	Neoprene
Ozone (ASTM D1149), 20 percent strain 100°F ±2°F, mounting procedure ASTM D518, Procedure A:		
225 pphm ozone in air by volume, 48 hours	No cracks	---
100 pphm ozone in air by volume, 100 hours	--	No cracks
Adhesion (ASTM D429, Method B):		
Bonds made during vulcanization, pounds per inch	40	40

END OF SECTION 725

SECTION 726 – ROADSIDE MATERIALS

SCOPE

726.01.01 MATERIALS COVERED

A. This specification covers the materials used in erosion control, landscaping, and irrigation systems.

REQUIREMENTS

726.02.01 CERTIFICATES AND SAMPLES

A. **Planting Soil:**

1. Before imported planting soil is brought on the jobsite, a 10-pound sample shall be submitted to the Engineer for approval.
2. The sample shall be accompanied by a current report, furnished by the Contractor, from a recognized testing laboratory indicating the particle size, clay content, the pH factor, electrical conductivity, and analysis of salt concentrate.

B. **Fertilizer:** The fertilizer containers shall have the manufacturer's guaranteed statement of analysis clearly marked, all in accordance with state and federal laws.

C. **Organic Material:**

1. Before bulk organic material is brought to the jobsite, a 10-pound sample shall be submitted to the Engineer for approval.
2. The sample shall be accompanied by a current report, furnished by the Contractor, from a recognized testing laboratory indicating the moisture retention capacity, organic matter (based on dry weight), mineral matter (ash), silica (acid insoluble ash), nitrogen (based on dry weight), pH factor, and the amount of Douglas Fir bark.

D. **Plants:**

1. All plants shall be nursery grown, healthy, vigorous, well-rooted, shall be true to type or name as shown on the plans, and shall conform to ANSI Z60.1, No. 1 grade.
2. Plants shall be tagged in accordance with the most recent standard practice recommended by the American Association of Nurserymen and the latest edition of Standardized Plant Names, American Joint Committee on Horticultural Nomenclature.
3. All plants shall comply with federal and state laws requiring inspection for plant diseases and infestations.
4. Inspection certificates required by law shall accompany each shipment of plants, and all plant shipments shall be inspected and passed by the Nevada Department of Agriculture.
5. All shipments of pine nursery stock shall meet all applicable state and federal quarantine regulations.

E. **Seeds:** The Contractor shall furnish to the Engineer duplicate copies of a statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before the date of delivery on the project.

F. **Irrigation Materials:**

1. The Contractor shall ascertain that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency.

2. The Contractor shall furnish the Engineer with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

G. All materials shall be approved prior to use.

PHYSICAL PROPERTIES AND TESTS

726.03.01 PLANTING SOIL

A. Planting soil shall consist of friable soil of loamy character.

B. The soil shall be obtained from well-drained arable land and shall be free from subsoil, refuse, roots, heavy or stiff clay, stones larger than 1 inch in largest dimension, coarse sand, sticks, brush, litter, and other deleterious substances.

C. Requirements for planting soil shall be as follows:

Organic Matter	0.1 to 1.0% by dry weight of soil
Particle Size	3/8 inch (0.953 centimeters) maximum
Clay Content	20% maximum (by weight)
pH Factor	6.5 to 8.0
Electrical Conductivity	0.5 to 1.0 mmhos. per centimeter of the saturation paste extract

726.03.02 FERTILIZER

A. Fertilizer and agricultural minerals shall be a standard commercial grade of organic or inorganic fertilizer of the kind and quality specified in the contract documents.

1. Fertilizer may be separate or in a mixture containing the percentage of total nitrogen, available phosphoric acid, and water-soluble potash in the amounts specified.

2. All fertilizers and agricultural minerals shall be furnished in standard, unopened containers with weight, name of plant nutrients, and manufacturer's guaranteed statement of analysis clearly marked, all in accordance with state and federal laws.

B. Acceptable commercial fertilizer and agricultural minerals will be specified in 1 of the following forms:

1. A dry, free-flowing, granular material suitable for application by agricultural fertilizer spreaders.

2. A soluble fertilizer and agricultural mineral ground to a fineness that will permit complete suspension of insoluble particles in water, suitable for application by power sprayers.

3. A granular or pelleted fertilizer and agricultural mineral suitable for application by blower equipment.

4. A non-volatile liquid fertilizer or agricultural mineral.

726.03.03 ORGANIC MATERIAL

A. Organic matter shall be processed, composted, fine-ground bark of White Fir, Pine, or Redwood, or a mixture of these in any proportion.

B. Organic matter shall be free of lumps and clods and shall be fine enough so that 100 percent of the material will pass a 1/2-inch screen and 85 percent will pass a No. 6 screen.

C. Requirements for organic material shall be as follows:

Moisture Retention Capacity	35 percent minimum
Organic Matter Based on Dry Weight	95 percent minimum
Mineral Matter (Ash)	5 percent maximum
Silica (Acid Insoluble Ash)	3 percent maximum
Nitrogen Based on Dry Weight	0.8 percent minimum
pH Value Based on 1:5 Solution	4.0 to 6.0 maximum
Douglas Fir Bark	0 percent

726.03.04 MULCH

A. **Hay or Straw:**

1. All hay or straw mulch materials shall be in an air-dried condition free of noxious weeds, weed seeds, and other materials detrimental to plant life.

2. Unless otherwise specified in the contract documents, hay or straw mulch material shall be of approved field grasses or legumes indigenous to the area.

B. Mulch shall also conform to the following requirements:

Moisture Content	12.0% ± 3.0%
Organic Matter (Oven-Dried Basis)	99.6% ± 0.2%
Ash Content	0.8% ± 0.2%
Water Holding Capacity (Grams of Water/ Grams of Fiber)	1,150 minimum

C. **Wood Cellulose Fiber:**

1. Wood cellulose fiber mulch shall be specially processed wood fiber containing no growth or germination inhibiting factors.

2. Mulch shall be dyed a suitable color to facilitate inspection of the placement of the material.

D. **Wood Chips and Shavings:**

1. Wood chips and shavings shall be manufactured from any clean wood free of infestations.

2. Chips from kiln-dried or air-dried material will not be acceptable.
3. Chips shall be produced by machinery equipped with knives or blades which cut rather than shred or break the material.
4. Chips shall be graded so that substantially all chips are from 1/2 inch to 3 inches in length, 1/2 inch to 1-1/2 inches in width, and from 1/8 inch to 1/2 inch in thickness.

E. **Bark:**

1. Bark shall be 100 percent bark derived from the bark of White Fir, Red Fir, or Pine and shall contain no Douglas Fir.
2. The bark shall be granular or chunky in nature with all particles between 1-1/4 inches and 2-1/2 inches in diameter.

726.03.05 JUTE MATTING

A. Jute matting shall be of a uniform, open, plain weave of undyed and unbleached single jute yarn.

B. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than 1/2 its normal diameter.

C. Jute matting shall be furnished in rolled strips as follows:

1. Length shall be approximately 50 yards.
2. Matting width shall be 48 inches with an average weight of 0.92 pounds per square yard. A tolerance of ±1 inch in width and of 5 percent in weight will be allowed.

726.03.06 PLANTS

A. All plants shall be nursery grown, representative specimens of their species, and shall be true to type or name as shown on the plans.

B. All plants shall be uniform in growth, in healthy condition, and free from insects, pests, diseases, and injuries, and without evidence of being or having been in a wilted condition.

726.03.07 SEEDS

A. Grasses, legumes, or cover crop seed shall be furnished in standard containers on which shall be shown the following information:

1. Date of Test.
2. Seed Name.
3. Lot Number.
4. Net Weight.
5. Percentage of Purity.
6. Percentage of Germination (in the case of legumes, percentage of germination shall include hard seed).
7. Percentage of Weed Seed Content and Inert Material, clearly marked for each kind of seed, in accordance with applicable state and federal laws.

8. No noxious weed seed present.

B. Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

C. Seed shall be at least 95 percent pure and shall have a minimum of 85 percent germination.

726.03.08 TREE TIES

A. Tree ties shall be strips of vinyl-coated nylon, durable, non-hardening, long-life material approximately 1 inch wide and approximately 10 mils thick, or other suitable material approved by the Engineer.

B. A 10-gauge galvanized wire encased in at least 1/2-inch rubber hose may be used when permitted by the Engineer.

726.03.09 PIPE AND FITTINGS

A. **Plastic Pipe:**

1. Plastic pipe, shall be PVC 1120 or 1220 pressure pipe as shown in the irrigation system legend on the plans.
2. All PVC pipe shall be extruded from 100 percent virgin material and shall be NSF approved, except plastic pipe for soaker lines shall be flexible PVC conforming to ASTM D2287.
3. Fittings for PVC plastic pipe shall be rigid polyvinyl chloride, standard weight, Schedule 40, and shall be solvent weld type except as shown on the plans.
4. Fittings for PVC pipe shall have higher bursting pressure than the pipe.
5. All plastic pipe shall be continuously and permanently marked with the following information:
    a. Manufacturer's name and trademark.
    b. Pipe size.
    c. Pipe class.
    d. Type of pipe.
    e. Working pressure at 73.4 degrees F.
    f. National Sanitation Foundation (NSF) rating.
6. All PVC plastic pipe shall be homogeneous throughout; smooth inside and outside; and free from cracks, holes, foreign materials, dents, wrinkles, and blisters.

B. **Delivery:** Plastic pipe shall be delivered to the site in unbroken bundles packaged to provide adequate protection for the pipe ends.

726.03.10 CONTROL TUBING

A. Control tubing shall be PVC tubing meeting NSF rating in the size specified on the plans.

726.03.11 GATE VALVES

A. Gate valves, when called for on the plans, shall be heavy-duty bronze conforming to ASTM B62.

726.03.12 QUICK COUPLER VALVES

A. Quick coupler valves shall have a service rating not less than 150 psi for non-shock cold water.

B. Body of the valves shall be a single-piece construction of sand-cast semi-red brass alloy No. 5-A as given in ASTM B584.

726.03.13 MASONRY

A. Hollow load-bearing concrete masonry blocks shall conform to ASTM C90.

B. Hollow non-load-bearing concrete masonry blocks shall conform to ASTM C129.

END OF SECTION 726

SECTION 727 – CONCRETE SURFACE FINISHING MATERIAL

SCOPE

727.01.01 MATERIALS COVERED

A. This specification covers the types and quality of concrete surface finishing materials.

PHYSICAL PROPERTIES AND TESTS

727.02.01 REQUIREMENTS

A. Bonded grout finishing material shall conform to the provisions specified below.

B. Except as noted herein, tests shall be made in accordance with test method indicated. Federal standard test methods are as contained in FED-STD-141, most current edition.

C. Viscosity: 110-115 K.U., using pin paddle. (Federal Standard. Method No. 4281)

D. Total Solids (Federal Standard Test Method No. 4042):

1. By weight: 65% minimum.
2. By volume: 48% minimum.

E. Flexibility (Federal Standard Test Method No. 6221):

1. Pass 1/8-inch mandrel when spread 12 mils wet on a tin panel and air dried 16 hours at 120 degrees F.
2. Panel shall show no mud cracking and no loss in adhesion to the panel when bent.

F. Water Resistance: No softening when tested as follows (ASTM D1647):

1. Spread a 12-mil film on tin panel and allow to air dry 48 hours.
2. Immerse in water for 16 hours and allow to dry for 8 hours.
3. There shall be no effect on the material.

G. Weatherometer Durability (Federal Standard Test Method No. 6152):

1. Expose a 12-mil film applied to asbestos cement board for 500 hours in an Atlas Twin-Arc weatherometer.
2. There shall be no erosion, cracking, softening, or other visible defects in the coating.

END OF SECTION 727

SECTION 728 – EPOXY

SCOPE

728.01.01 MATERIALS COVERED

A. These specifications are intended to specify epoxy that will meet service requirements for street and highway construction.

B. Epoxy shall be furnished as 2 components that shall be mixed together at the site of the work.

REQUIREMENTS

728.02.01 SAMPLING AND TESTING

A. Epoxy shall not be used prior to sampling and testing unless its use is permitted prior to said sampling and testing in accordance with the provisions in ***Subsection 106.05, "Certificate of Compliance."***

B. All tests will be conducted in accordance with the latest test methods of ASTM International and Federal Test Method Standard No. 141.

728.02.02 CERTIFICATES

A. Without expense to the Contracting Agency, 2 certificates covering each order of material shall be furnished by the manufacturer, certifying that the product complies with the specifications.

B. Certificates shall be delivered to the Engineer in charge at the jobsite at the time of, or prior to, delivery of the order.

728.02.03 PACKAGING, LABELING, AND STORING

A. Each component shall be packaged in steel containers not larger than 5 gallons in volume.

B. When the components are to be mixed at a ratio of 2 parts Component A to 1 part Component B, by volume, the container containing Component B shall be 1/2 the volume of the container containing Component A.

C. The containers shall have lug-type crimp lids with ring seals, shall be new, shall be not less than 24 gauge, shall otherwise meet U.S. Department of Transportation Hazardous Materials Shipping Regulations, and shall be well sealed to prevent leakage.

D. If a lining is used in the containers, it shall be of a character to resist any action by the components.

E. Each container shall be clearly labeled with the designation (Component A or Component B), manufacturer's name, date of manufacture, batch number (a batch shall consist of a single charge of all components in a mixing chamber), all directions for use specified elsewhere, and the following warning:

CAUTION

This material will cause dermatitis if it is allowed to come in contact with the skin or eyes. Use gloves and protective creams on the hands. Should this material contact the skin, wash thoroughly with soap and water. Do not attempt to remove this material from the skin with solvents. If any gets in the eyes, flush for 10 minutes with water and secure immediate medical attention.

F. Attention is directed to the characteristics of some epoxy components to crystallize or thicken excessively prior to use when stored at temperatures below 35 degrees F. Any material that shows evidence or crystallization or a permanent increase in viscosity or settling of pigments that cannot be readily redispersed with a paddle shall not be used.

728.02.04 DIRECTIONS FOR USE

A. At the time of mixing, Component A and Component B shall be at a temperature between 60 degrees F and 85 degrees F, unless otherwise specified.

B. Any heating of the adhesive components shall be done by application of indirect heat.

C. Immediately prior to mixing, each component shall be thoroughly mixed with a paddle. Separate paddles shall be used to stir each component.

D. Immediately prior to use, the 2 components shall be thoroughly mixed together in the specified ratios.

1. When mixed, all adhesive, except coal tar modified epoxy, shall have a uniform gray color without black or white streaks.

2. No solvent shall be added to any epoxy.

E. After mixing, all epoxies shall be placed in the work and any overlaying or inserted material that is to be bonded to the work by the epoxy shall also be placed before thickening of the epoxy has begun.

F. Surfaces upon which epoxy is to be placed shall be free of rust, paint, grease, asphalt, and loose and deleterious material.

G. When epoxy is used as a binder to make epoxy concrete or mortar, the 2 components of epoxy shall be thoroughly mixed together before the aggregate is added and, unless otherwise specified, the mix proportions shall consist of 1 part binder to approximately 4 parts aggregate, by volume.

H. Aggregate for use in epoxy concrete and mortar shall be clean and shall have a moisture content of not more than 0.50 percent when tested in accordance with ASTM D2216.

I. All surfaces against which epoxy concrete and mortar are to be placed shall be primed with a coat of the epoxy used just prior to placing the mortar.

PHYSICAL PROPERTIES AND TESTS

728.03.01 BINFER (ADHESIVE), EPOXY RESIN BASE

A. **Classification:**

1. This specification covers a low viscosity, liquid polysulfide extended epoxy formulated primarily for use in making high-strength epoxy concrete and epoxy mortar, in fastening metal anchors in vertical holes in concrete, and in pressure grouting of cracks in concrete.
2. Thick sections of this epoxy are not suitable for use in freeze-thaw environments.
3. Epoxy Resin Base Binder (Adhesive) shall conform to AASHTO M235 or ASTM C881.

B. **Directions for use:**

1. The ingredients in Component A and Component B shall be thoroughly dispersed such that each component forms a fluid mixture.
2. The mixing ratio is 2 parts by volume of Component A to 1 part by volume of Component B.
3. No more material shall be mixed than can be used within 10 minutes from the time mixing operations are started.

728.03.02 COAL TAR MODIFIED EPOXY RESIN

A. **Classification:**

1. This specification covers a low viscosity, liquid coal tar extended epoxy formulated primarily for use with a cover of aggregate as a black seal and skid resistant surfacing for Portland cement concrete and for use in making low strength epoxy concrete and epoxy mortar.
2. This epoxy is suitable for use in freeze-thaw environments.
3. Coal Tar Modified Epoxy Resin shall conform to ASTM C881.

B. **Directions for use:**

1. Equal parts, by weight or volume, of Component A and Component B shall be mechanically batch mixed, or continuously mixed in automatic paving equipment that provides continuous metering, mixing, and application at a controlled rate.
2. If the components are to be batch mixed, mixing shall be performed with a propeller type stirrer, or other power driven agitator attached to a 1/2 inch heavy duty drill.
3. Care shall be exercised to thoroughly incorporate material at the sides and bottom of the mixing container.
4. When mixed in batches, the mixing time shall be 5 minutes at 60 degrees F to 80 degrees F or 3 minutes at 80 degrees F to 100 degrees F and the batch size shall not exceed 5 gallons.
5. The mixed material will set quickly if allowed to remain in large mass, due to the heat generated as the 2 components react.
6. Pot life in large quantities (1 gallon to 5 gallons) is approximately:

Material Temperature	Pot Life (Measured from Beginning of Mixing)
60-70 degrees F	18 minutes
70-80 degrees F	12 minutes
80-90 degrees F	10 minutes
90-100 degrees F	8 minutes

728.03.03 EPOXY RESIN ADHESIVE FOR BONDING NEW CONCRETE TO OLD CONCRETE

A. **Classification:**

1. This specification covers a low viscosity paste polysulfide extended epoxy formulated primarily for use in bonding new Portland cement concrete to old Portland cement concrete and in fastening metal anchors in horizontal holes in concrete.
2. This epoxy is available in 2 types:
   a. Type I for general use.
   b. Type II for use when cure temperatures are below 60 degrees F, or when a faster cure is required.
3. Thick sections of this epoxy are not suitable for use in freeze-thaw environments.
4. Epoxy Resin Adhesive shall conform to AASHTO M235 or ASTM C881.

B. **Directions for use:**

1. The ingredients in Component A and Component B shall be thoroughly agitated so each component forms a uniform paste.
2. The mixing ratio is 2 parts by volume of Component A to 1 part by volume of Component B.
3. When measuring individual Component A and Component B, stir and tap the measuring containers to remove possible air voids.
4. Do not mix more material than can be spread within 8 minutes from the time mixing operations are started.
5. The spreading rate shall be sufficient to thoroughly coat the surface.
6. Spread the mixed adhesive by brush or roller over thoroughly cleaned concrete at a rate not exceeding 40 square feet per gallon.
7. On very rough surfaces, the spreading rate shall be 25 square feet per gallon.
8. The new concrete shall be placed against the adhesive coating on the old concrete within 15 minutes after spreading at temperatures below 90 degrees F or within 10 minutes at temperatures above 90 degrees F.

728.03.06 BINDER (ADHESIVE), EPOXY RESIN BASE, ALKYLBENZENE EXTENDED

A. **Classification:**

1. This specification covers a medium viscosity, liquid alkylbenzene extended epoxy formulated primarily for use with aggregate as a gray seal and skid-resistant surfacing for Portland cement concrete and for preparing low-strength epoxy mortar and epoxy concrete.
2. This epoxy is suitable for use in freeze-thaw environments.
3. Alkylbenzene Extended Epoxy Resin Base Binder (Adhesive) shall conform to ASTM C881.

B. **Directions for use:**

1. The mixing ratio is 1 part by volume of Component A to 1 part by volume of Component B.
2. No more material shall be mixed than can be used within 10 minutes from the time mixing operations are started.

728.03.07 BINDER (ADHESIVE), EPOXY RESIN BASE, FAST SETTING

A. **Classification:**

1. This specification covers a medium viscosity, liquid rapid set epoxy formulated primarily for use in making high-strength epoxy concrete and epoxy mortar where low curing temperatures are expected or when a fast cure is required.
2. This epoxy is not formulated for use in bonding of new Portland cement concrete to old Portland cement concrete.
3. This epoxy is suitable for use in freeze-thaw environments.
4. Fast Setting Epoxy Resin Base Binder (Adhesive) shall conform to ASTM C881.

B. **Directions for use:**

1. The mixing ratio is 2 parts by volume of Component A to 1 part by volume of Component B.
2. Aggregate shall be added immediately after Component A and Component B are thoroughly mixed.
3. The epoxy mortar or concrete shall be placed as soon as possible.
4. The useful work life of the mortar will depend on temperature, but shall be about 10 minutes to 15 minutes at 75 degrees F.
5. All surfaces shall be primed with mixed epoxy.

728.03.08 BINDER (ADHESIVE), EPOXY RESIN BASE, FAST SETTING, ALKYLBENZENE EXTENDED

A. **Classification:**

1. This specification covers a medium viscosity, liquid rapid set, alkylbenzene extended epoxy formulated primarily for use with aggregate as a gray seal and as a skid-resistant surfacing for Portland cement concrete and for use in making low-strength

epoxy concrete and epoxy mortar where low curing temperatures are expected or when a fast cure is required.

2. This epoxy is suitable for use in freeze-thaw environments.

3. Fast Setting Epoxy Resin Base Alkylbenzene Extended Binder (Adhesive) shall conform to ASTM C881.

B. **Directions for use:**

1. The mixing ratio is 1 part by volume of Component A to 1 part by volume of Component B.

2. Do not mix more material than can be used within 10 minutes from the time mixing operations are started.

3. When applying resinous seal, the aggregate shall be sprinkled in the epoxy film not later than 5 minutes after epoxy is applied to the road surface.

728.03.09 EPOXY SEALANT FOR INDUCTIVE LOOPS

A. **Classification:**

1. This specification covers a high viscosity, liquid epoxy formulated primarily for use in sealing inductive wire loops and leads imbedded in asphalt concrete and Portland cement concrete for traffic signal controls and vehicle counters.

2. This epoxy is to be used for repair work on existing spalls, cracks, and other deformations in and around saw cuts and housing inductor loops and leads.

3. The rapid cure allows minimum traffic delay.

4. This sealant is suitable for use in freeze-thaw areas and can be used on grades up to 15 percent without excessive flow of material.

5. Epoxy Sealant for Inductive Loops shall conform to ASTM C881.

B. **Directions for use:**

1. Saw cuts shall be blown clean and dry with compressed air to remove all excessive moisture and debris.

2. For repairing damaged saw cuts, all loose, spalled material shall be cleaned away from saw cut, chipping back to sound asphalt concrete or Portland cement concrete, and all loose material cleaned from loop wires.

3. The mixing ratio is 1 part by volume of Component A to 1 part by volume of Component B. No more material shall be mixed than can be used within 10 minutes from the time mixing operations are started.

728.03.10 EPOXY ADHESIVES FOR PAVEMENT MARKERS

A. **Rapid-Set Epoxy Adhesive:**

1. This specification covers a high viscosity, rapid set epoxy formulated primarily for use in bonding pavement markers to Portland cement concrete and asphalt cement.

2. The epoxy used under this specification shall conform to AASHTO M237, Type I.

3. Tests for requirements for AASHTO M237 shall be performed in accordance with AASHTO T237.

B. **Standard-Set Epoxy Adhesive:**

1. This specification covers a high viscosity, rapid set epoxy formulated primarily for use in bonding pavement markers to Portland cement concrete and asphalt cement.
2. The epoxy used under this specification shall conform to AASHTO M237, Type II.
3. Tests for requirements for AASHTO M237 shall be performed in accordance with AASHTO T237.

728.03.11 BINDER (ADHESIVE), STRUCTURAL EPOXY

A. **Classification:**

1. This specification covers a multipurpose, 2-component, moisture tolerant, structural epoxy adhesive, formulated primarily for bonding new concrete to asphalt cement pavement.
2. This epoxy is formulated for hot weather concrete placements requiring a bonding adhesive and is suitable for minimum substrate and ambient temperature of 40 degrees F.
3. Physical properties shall meet the criteria a minimum of 2,200 psi and heat deflection temperature at 14 days shall be a minimum of 108 degrees F.

B. **Directions for use:**

1. The epoxy shall not be mixed with more material than can be used within 60 minutes at 73 degrees F or 30 minutes at 100 degrees F from the time mixing operations begin.
2. Surface shall be clean and sound.
3. Surface may be dry or damp, but shall be free of standing water, dust, curing compound, and other contaminants.

END OF SECTION 728

SECTION 729 – FLY ASH

SCOPE

729.01.01 MATERIALS COVERED

A. This specification covers the quality of fly ash used in Portland cement products.

REQUIREMENTS

729.02.01 REQUIREMENTS

A. Fly ash shall conform to ASTM C618 for Class F, with the following exceptions:

1. The maximum loss of ignition shall be 6 percent.
2. The sulfate resistance factor, R, shall not exceed 1.5, where

$$R = \frac{(\%\ CaO - 5)}{\%\ Fe_2O_3}$$

B. Certification that the fly ash used in Portland cement concrete conforms to ASTM C618 shall be provided by the supplier of the fly ash.

C. Copies of the certification shall be provided to the Engineer by the supplier of the fly ash or supplier of the Portland cement concrete fly ash upon request.

D. The certification provided is to be a maximum of 30 days old.

END OF SECTION 729

APPENDIX A – SWPPP CHECKLIST

LAS VEGAS VALLEY STORMWATER QUALITY MANAGEMENT PROGRAM
CONSTRUCTION PERMIT SUBMITTAL CHECKLIST

(Applies to all Grading, Site Development, Building, and Encroachment Permits and plans including Final, Parcel, Subdivision, Site Drainage and Erosion and Sediment Control Plans)

Owner / Operator (applicant) Information

Name:_____

Address:_____

City:_____ State:___ Zip Code:_____ Phone:_____

Project Name: _____

Project Address/Location:_____

Signature:_____Date:_____

Total area of land disturbance =_____acres, _____square feet (must match permit application).

If the area of land disturbance is one acre or more, the applicant must submit a copy of their Notice of Intent (NOI) to Nevada Division of Environmental Protection (NDEP) to be regulated under Stormwater General Permit NVR100000 and submit a copy of the receipt for payment of the annual fee or the letter of authorization from NDEP (address attached). Once payment has been received by NDEP, the applicant is immediately covered under the State's permit.

☐ 1. Copy of NOI attached
☐ 2. Copy of receipt **or** letter of authorization attached

By submitting a copy of the NOI and the receipt or authorization from NDEP, the applicant acknowledges that they are aware of the requirements set forth in the State's General Permit and have developed and will implement a site specific Stormwater Pollution Prevention Plan (SWPPP). The applicant further acknowledges that they are aware of the Las Vegas Valley Construction Site BMP Guidance Manual and the required performance standards set forth in Section 3.2 of the manual. To ensure compliance with these performance standards, the applicant shall submit a completed Performance Standards Compliance Checklist, indicating the BMPs that implement standards 1 – 12. It is recommended that the applicant also attach a copy of the checklist to their SWPPP.

☐ Copy of Performance Standards Compliance Checklist completed (see reverse side)

Yes	No	
☐	☐	Were calculations required for sizing of diversion channels and/or sediment retention basins? If the answer is yes, pursuant to NRS 625.565, a Nevada Registered Professional Engineer must review and stamp plans, such as grading plans and reports that require engineering calculations.

In addition to the submittal requirements specified above and in the ordinances, the following shall be included as a set of standard notes to be depicted on all site plans that disturb one acre or larger:

☐ Standard notes from Section 3.5 of the Las Vegas Valley Construction Site BMP Guidance Manual on design plans

To submit a Notice of Intent (NOI), contact:
Nevada Division of Environmental Protection
Bureau of Water Pollution Control
901 South Stewart Street
Suite 4001
Carson City, NV 89701-5249
Phone: (775) 687-9429
Fax: (775) 687-4684
Web: http://ndep.nv.gov/bwpc/index.htm

LAS VEGAS VALLEY STORMWATER QUALITY MANAGEMENT ROGRAM
CONSTRUCTION PERMIT SUBMITTAL CHECKLIST

The checklist that follows identifies the BMPs that can be used at construction sites to meet each of the Performance Standards of the Las Vegas Valley Construction Site BMP Guidance Manual (BMP Guidance Manual). You must select at least one BMP for each performance standard to meet the minimum requirements. Please refer to the BMP Guidance Manual to assist you in selecting BMPs for your site. It is the responsibility of the person who fills out this checklist to ensure that the BMPs selected are included in the contract bid documents and implemented at the site. If your project or site has characteristics that make meeting a performance standard infeasible or inapplicable (e.g. size of site, slope of site), please explain these characteristics at the bottom of the form.

Performance Standard	Check if Selected	BMPs	Comments
1. Schedule construction and minimize clearing and grading	☐	PL-1 Site Design	
	☐	PL-2 Scheduling	
	☐	PL-3 Phased Construction	
	☐	PL-4 Topsoil Reuse	
	☐	EC-3 Protect Trees/Vegetation	
	☐	Other or N/A (explain)	
2. Stabilize disturbed areas	☐	EC-1 Erosion Control Mats	
	☐	EC-2 Mulching	
	☐	EC-7 Dust Control	
	☐	EC-12 Surface Roughening	
	☐	SPC-6 Revegetation	
	☐	Other or N/A (explain)	
3. Protect slopes	☐	EC-9 Diversion Dikes	
	☐	EC-4 Pipe Slope Drains	
	☐	EC-12 Surface Roughening	
	☐	EC-7 Dust Control	
	☐	EC-1 Erosion Control Mats	
	☐	SPC-6 Revegetation	
	☐	SPC-1 Organic Filter Barriers	
	☐	SPC-2 Sand Bag Barrier	
	☐	SPC-3 Gravel Filter Berms	
	☐	Other or N/A (explain)	
4. Design conveyance for non-erosive velocities	☐	EC-9 Diversion Dikes	
	☐	SPC-4 Check Dams	
	☐	EC-11 Outlet Protection	
	☐	Other or N/A (explain)	
5. Protect waterways, natural drainages and storm drains	☐	PL-1 Site Design	
	☐	EC-9 Diversion Dikes	
	☐	EC-3 Protect Trees/Vegetation	
	☐	SPC-1 Organic Filter Barriers	
	☐	SPC-2 Sand Bag Barriers	
	☐	SPC-3 Gravel Filter Berms	
	☐	SPC-5 Silt Fence	
	☐	SPC-8 Temporary Stream Crossing	
	☐	EC-11 Outlet Protection	
	☐	SPC-7 Storm Drain Inlet Protection	
	☐	Other or N/A (explain)	

Performance Standard	Check if Selected	BMPs	Comments
6. Install sediment traps / retain eroded sediments on-site	☐	SPC-4 Check Dams	
	☐	SPC-1 Organic Filter Barrier	
	☐	SPC-2 Sand Bag Barrier	
	☐	SPC-3 Gravel Filter Berm	
	☐	SPC-5 Silt Fence	
	☐	SPC-9 Temporary Sediment Traps	
	☐	SPC-8 Temporary Sediment Basins	
	☐	Other or N/A (explain)	
7. Remove accumulated sediment	☐	Use Standard Note No. 5	
	☐	Other or N/A (explain)	
8. Control site entrances and exits	☐	EC-5 Stabilized Site Entrance	
	☐	EC-6 Construction Road Stabilization	
	☐	SPC-11 Entrance/Exit Tire Wash	
	☐	GH-6 Road Sweeping/Trackout Cleaning	
	☐	Other or N/A (explain)	
9. Manage materials and wastes	☐	GH-2 Solid Waste Management	
	☐	GH-5 Spill Containment Plan	
	☐	Other or N/A (explain)	
10. Manage equipment and vehicles	☐	GH-3 Equipment Maintenance Procedures	
	☐	GH-4 Designated Washdown Area	
	☐	Other or N/A (explain)	
11. Stabilization of inactive disturbed areas	☐	PL-4 Topsoil Reuse	
	☐	EC-2 Mulching	
	☐	EC-7 Dust Control	
	☐	SPC-6 Revegetation	
	☐	Other or N/A (explain)	

Explanation why performance standard(s) cannot be met:

SPECIFICATIONS

May 2018

SKYE CANYON DETENTION BASIN 2

PREPARED FOR:

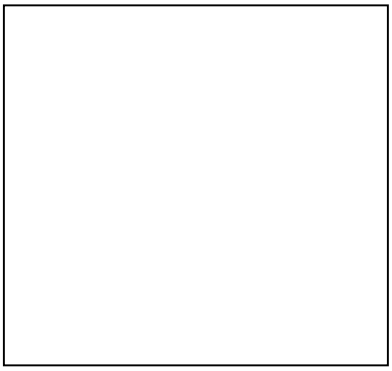
NINETY-FIVE MANAGEMENT LLC

PREPARED BY:

SLATER HANIFAN GROUP

SKYE CANYON DETENTION BASIN 2

SPECIFICATIONS



NOTE: THE ENGINEERS' APPROVAL AND SUBSEQUENT SEAL IS LIMITED TO THE FOLLOWING PORTIONS OF THESE DOCUMENTS AS PREPARED BY OR UNDER THE DIRECT SUPERVISION OF THE ENGINEER:

(1) SPECIFICATIONS, PAGES SP-100-1 THROUGH SP-729-1

ALL OTHER ATTACHMENTS, INCLUSIONS, ENCLOSURES, SCHEDULES, FORMS, GRAPHICS, ETC. WERE PREPARED BY OTHERS AND NOT UNDER THE DIRECT SUPERVISION OF THE ENGINEER.

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SECTION 100 – GENERAL PROJECT REQUIREMENTS

100.01 REFERENCE SPECIFICATIONS AND DRAWINGS

A. Work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications or the applicable codes. Wherever references are made in the contract, standards or codes in accordance with which work under this contract is to be performed or tested, the latest edition or latest revision(s) of the standards or codes shall apply.

B. **"Uniform Standard Drawings for Public Works Construction, Clark County Area, Nevada Volume I and Volume II"**, also referred to as the "Uniform Standard Drawings" or "USD" and shall be adhered to except where otherwise provided herein or otherwise shown on the Contract Drawings. Copies may be obtained from the Regional Transportation Commission of Southern Nevada, 600 S. Grand Central Parkway, Suite 350, Las Vegas, Nevada 89106 or online at www.rtcsouthernnevada.com

C. **"Manual on Uniform Traffic Control Devices"**, also referred to as "MUTCD" and shall be adhered to except where otherwise provided herein or otherwise shown on the Contract Drawings. Copies may be obtained from the U.S. Government Printing Office, Washington, D.C. 20402 or online at mutcd.fhwa.dot.gov

D. **"State of Nevada Department of Transportation Standard Specifications for Road and Bridge Construction"**, also referred to as the "NDOT Standard Specifications" or the "State of Nevada Standard Specifications" and shall be adhered to when specifically referenced herein or as shown on the Contract Drawings. NDOT is located at 123 E. Washington Blvd., Las Vegas, Nevada 89101; Phone (702) 385-6500 or online at www.nevadadot.com/business/contractor/standards/

E. **"State of Nevada Department of Transportation Standard Plans for Road and Bridge Construction"**, also referred to as the "NDOT Standard Drawings" or the "State of Nevada Standard Plans" and shall be adhered to when specifically referenced herein or as shown on the Contract Drawings. NDOT is located at 123 E. Washington Blvd., Las Vegas, Nevada 89101; Phone (702) 385-6500 or online at www.nevadadot.com/business/contractor/standards/.

F. **"Nevada Work Zone Traffic Control Handbook"**, also referred to as the "Work Zone Handbook". Copies may be obtained from Lisa Cody, University of Reno Nevada, (775) 784-1433.

G. **"American Society for Testing and Materials"**, also referred to as the "ASTM". ASTM is located at 100 Barr Harbor Drive, Conshohocken, Pennsylvania, 19428-2959; Phone (610) 832-9585 or online at www.astm.org

H. **"Uniform Design and Construction Standards for Water Distribution Systems"**, also referred to as the "Water District Standards" or "UDACS". Copies may be obtained from the Las Vegas Valley Water District, 1001 South Valley View Boulevard, Las Vegas, Nevada 89153 or online at http://www.lvvwd.com/html/eng_udacs.html

I. **"LVVWD Design Guidance Documents"**, Copies may be obtained from the Las Vegas Valley Water District, 3700 W. Charleston Blvd., Las Vegas, Nevada 89153.

J. **"Design and Construction Standards for Wastewater Collection Systems – Southern Nevada Current Edition"**, also referred to as the "Sewer Specifications" or "DCSWCS". Issued by the Clark County Water Reclamation District, 5857 E. Flamingo Blvd., Las Vegas, Nevada, 89122; Phone (702) 668-8160.

END OF SECTION 100

SECTION 101 – DEFINITIONS AND TERMS

101.01 ABBREVIATIONS

AGA	American Gas Association
AI	The Asphalt Institute
AIEE	American Institute of Electrical Engineers
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ATSSA	American Traffic Safety Services Association
CFR	Code of Federal Regulations
CPM	Critical Path Method
CRSI	Concrete Reinforcement and Steel Institute
EPA	Environmental Protection Agency (USA)
IMSA	International Municipal Signal Association
IPCEA	Insulated Power Cable Engineers' Association
ITB	Instructions to Bidders
NBFU	National Board of Fire Underwriters
NCPI	National Clay Pipe Institute
NDEP	Nevada Department of Environmental Protection
NDOT	Nevada Department of Transportation
NOAA	National Ocean and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRS	Nevada Revised Statutes
OSHA	Occupational Safety and Health Standards
PCA	Portland Cement Association
SSPC	Steel Structures Painting Council
UBC	Uniform Building Code, International Conference of Building Officials
USS	Uniform Standard Specifications for Public Works' Construction Off-Site Improvements, Clark County Area Nevada
USD	Uniform Standard Drawings for Public Works' Construction Off-Site Improvements, Clark County Area Nevada, Volumes I & II

101.02 ADDENDUM

A. A supplemental addition or deletion to the contract documents prior to the advertised bid opening.

101.05 AWARD

A. The acceptance by the Owner of a bid.

101.06 BASE COURSE

A. The layer or layers of specified or selected material of designated thickness on a subgrade to support a surface course.

101.07 BIDDER

A. An individual, partnership, firm, corporation, or any acceptable combination thereof, or joint venture, submitting a bid for the advertised work.

101.12 CHANNEL

A. A natural or artificial water course.

101.16 CONTRACTOR

A. The person, firm, partnership, corporation, permittee, subdivider, or other entity who has entered into a contract or agreement with the Owner. Where work is done under permit issued by the Owner, the permittee shall be construed to be the Contractor. Also,a subdivider who does land development and other work under contract with the Owner.

101.18 CULVERT

A. Any structure not classified as a bridge which provides an opening under the roadway.

101.19 DETOUR

A. A temporary route for traffic around a closed portion of road.

101.22 DRAWINGS

A. That part of the Contract Documents prepared or approved by the Contracting Agency which graphically shows the scope, intent, and character of the Work to be performed by the Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

101.23 EMPLOYEE

A. Any person working on the project mentioned in the contract of which these specifications are a part, and who is under the direction and control, or received compensation from the Contractor or the Contractor's subcontractor.

101.24 ENGINEER

A. The signing engineer on record drawings or other person designated by the Owner acting directly and through the signing engineer’s duly authorized representative.

101.25 EQUIPMENT

A. All machinery and equipment, together with the necessary supplies for upkeep and maintenance, also tools and apparatus necessary for the proper construction and acceptable completion of the work.

101.27 FRONTAGE ROAD OR FRONTAGE STREET

A. A local street or road auxiliary to and located generally on the side of an arterial highway for service to abutting property and adjacent areas and for control of access.

101.31 HYDRAULIC CEMENT

A. An inorganic material or a mixture of inorganic materials that sets and hardens by chemical reaction with water by formation of hydrates, and is capable of doing so under water.

101.32 INSPECTOR

A. The Engineer's or Contracting Agency's authorized representative assigned to make detailed inspections of contract performance.

101.34 LABORATORY

A. The testing laboratory of the Contracting Agency or of any other testing laboratory which may be designated by the Engineer.

101.36 MATERIALS

A. Any substances specified for use in the construction of the project and its appurtenances.

101.41 PAVEMENT STRUCTURE

A. The combination of base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

101.44 PLANS

A. The approved project plans and Standard Drawings, profiles, typical cross sections, and supplemental drawings, or exact reproductions thereof, which show the location, character, dimensions, and details of the work to be performed. All such documents are to be considered as a part of the plans whether or not noted in the Special Provisions.

B. In the above definition, the following terms are defined as follows:

1. Standard Drawings - The Standard Drawings of the Contracting Agency.

2. Project Drawings - The Project Drawings are specific details and dimensions peculiar to the work and are supplemented by the Standard Drawings insofar as the same may apply.

101.45 PROFILE GRADE

A. The trace of a vertical plane intersecting the top surface of the proposed structural section as shown on the plans. Profile grade means either elevation or gradient of such trace according to the context.

101.46 PROJECT

A. The specific improvement to be constructed together with all appurtenances and construction to be performed thereon at the prices quoted.

101.50 QUALITY ASSURANCE (QA)

A. Planned and systematic operations conducted to ensure that the operations and/or product meets specifications. QA encompasses the Engineer's review and oversight of the Contractor's "Quality Control"; verifying the results of "Quality Control"; and inspecting for conformance to plans and specifications. QA is the responsibility of the "Engineer."

101.51 QUALITY CONTROL (QC)

A. Planned and specified operations necessary to construct items that will meet the requirements for quality and performance as specified. QC includes, but should not be limited to controlling the quality of raw materials, produced materials assemblies, components, finished product, and construction process. QC is the responsibility of the "Contractor."

101.52 RIGHT-OF-WAY OR EASEMENT

A. A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to a highway or other improvements.

101.60 SIDEWALK

A. That portion of the roadway primarily constructed for the use of pedestrians.

101.61 SPECIAL PROVISIONS

A. Special Provisions means the written descriptions of the requirements for the Work incorporated as a part of the Contract.

101.62 SPECIFICATIONS

A. The directions, provisions, and requirements contained in the Specifications and supplemental specifications as modified by the Special Provisions. Whenever the term "these specifications" is used in this book, it means the provisions set forth in this book.

101.64 SUBCONTRACTOR

A. Any individual, firm, or corporation to whom the Contractor, with the consent of the Contracting Agency, sublets any part of the contract.

101.66 SUBSTRUCTURE

A. All of that part of the structure below the bearings of simple and continuous spans, skewbacks or arches, and tops of footings or rigid frames, together with backwall, wingwalls, and wing protection railings.

101.67 SUPERINTENDENT

A. The Contractor's authorized representative in responsible charge of the work, present on the work at all times during the progress to supervise and direct the construction, to receive and fulfill instructions from the Engineer, and to accept orders for changed and extra work.

101.68 SUPERSTRUCTURE

A. The entire structure except the substructure.

101.70 SUPPLEMENTAL SPECIFICATIONS

A. Additions and revisions to the Specifications that are approved subsequent to the issuance of the published specifications.

101.72 SURFACE COURSE

A. The top layer of an improvement.

101.75 UNSUITABLE MATERIAL

A. Soils that fail to meet the AASHTO Soil Classification System (AASHTO M145) A-1 through A-7 classifications; are highly organic; or are determined to be contaminated.

101.76 UTILITY

A. Tracks, overhead or underground wires, pipelines, conduits, ducts, or structures, sewers, or storm drains owned, operated, or maintained in or across a public right-of-way or private easement.

101.79 BOARD

A. Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the Contractor is required to submit to the Engineer for approval. Working Drawings are not part of the Contract Documents.

B. In order to avoid cumbersome and confusing repetition of expressions in these specifications, it is provided that whenever anything is, or is to be, done, if, as, or, when, or where "contemplated, required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable suitable, accepted, satisfactory, unsatisfactory, sufficient, insufficient, rejected, or condemned," it shall be understood as if the expression were followed by the words "by the Agency."

101.81 AGENCY

A. The governing body to which a work or facility will be dedicated upon successful completion. Agency may be one or more of the following entities: City of Las Vegas, Nevada; City of North Las Vegas, Nevada; Las Vegas Valley Water District, Las Vegas, Nevada; Clark County Sanitation District, Las Vegas, Nevada; Clark County, Nevada; and state of Nevada Department of Transportation.

101.83 CERTIFIED ENVIRONMENTAL MANAGER (CEM)

A. One who is certified by Nevada Department of Environmental Protection as an Environmental Manager.

101.85 DEWATERING

A. The removal and/or lowering of any surface or subsurface water by a method chosen by the Contractor and acceptable to the Engineer, which results in a ground moisture content which enables construction to be carried out under relatively dry and stable conditions. Unless specifically indicated elsewhere in these specifications, no separate payment will be made for dewatering but shall be included in other items of work.

101.88 NOMINAL DIAMETER

A. The inside diameter of a standard pipe as specified by the manufacturer.

101.91 SERVICE CONNECTION LATERAL

A. All or any portion of a utility, including pipe, conduit, wire, cable or duct, including meters between a utility distribution (or collection) line and an individual customer or customers.

END OF SECTION 101

SECTION 104 – SCOPE OF WORK

104.00 LOCATION AND SCOPE OF WORK

A. LOCATION: Iron Mountain Road and Puli Drive

B. SCOPE OF WORK: The project is located at the intersection of Iron Mountain Road and Puli Drive, with improvements extending approximately 2,630 feet south of Iron Mountain Road along the Puli alignment. The project consists of a 76.3 acre-foot detention basin with a portion of the interior slope soil cement lined, an emergency overflow spillway structure, a debris dewatering tower, a basin outlet structure consisting of 60-inch RCP storm drain pipe, a 750 linear foot concrete collector channel into a 205-foot long by 25-foot min. wide by 4.5-foot high chute and baffle block south stilling basin, a 85-foot long by 25-foot to 60-foot wide by 4.5-foot high chute and baffle block north stilling basin, approximately 800 linear foot of 7-foot wide by 6-inch height concrete low flow u-channels, Type II and concrete access roads/ramps around the entire perimeter and into the detention basin, graded native path for NV Energy access, a flood threat recognition station, riprap erosion control, block and cable fencing around the basin perimeter and flood warning signs.

104.05 RIGHTS IN AND USE OF MATERIALS FOUND ON THE PROJECT

A. The Contractor with the approval of the Engineer, may use on the project such stone, gravel, sand, or other material determined suitable by the Engineer, as may be found in the excavation and will be paid for both the excavation of such materials at the corresponding contract unit price and also at the contract unit price for the pay item for which the excavated material is used. At no additional cost to the Owner, the Contractor shall replace with other acceptable material all of that portion of the excavation material so removed and used which was needed for use in the embankments, backfills, approaches, or otherwise. No charge for the materials so used will be made against the Contractor. The Contractor shall not excavate or remove any material from within the project location which is not within the grading limits, as indicated by the slope and grade lines, without written authorization from the Engineer.

B. Unless otherwise provided, the material from any existing old structure may be used temporarily by the Contractor in the erection of the new structure. Such material shall not be cut or otherwise damaged except with the approval of the Engineer.

END OF SECTION 104

SECTION 105 – CONTROL OF WORK

105.01 AUTHORITY OF THE ENGINEER

A. The Engineer will decide all questions that may arise as to the quality and acceptability of materials furnished and work performed and as to the rate of progress of the work; and all questions that may arise as to the interpretation of the plans and specifications.

B. The Engineer will have the authority to suspend the work wholly or in part due to the failure of the Contractor to correct conditions unsafe for the workmen or the general public; for failure to comply with the technical provisions of the contract; for failure to carry out orders; for such periods as the Engineer may deem necessary due to unsuitable weather; and for conditions considered unsuitable for the prosecution of the work.

C. Whenever the Contractor fails to carry out orders of the Engineer, the Engineer will have executive authority to enforce such orders and the Engineer's decision shall be final.

D. Decisions of the Engineer shall be subject to appeal to the Board, whose decisions shall be final and conclusive.

E. The Engineer shall not direct Contractor’s means, methods, techniques, sequences or procedures of construction, or the safety precautions and program incident thereto and will not be responsible for Contractor’s failure to perform the work in accordance with the Contract.

F. Engineer will not be responsible for the acts or omissions of the Contractor, or any Subcontractor or any of his or their agents or employees or any other persons at the site or otherwise performing any of the work.

105.02 PLANS AND WORKING DRAWINGS

A. The contract plans and drawings do not purport to show all the details of the work. These documents are intended to illustrate the character and extent of the performance desired under the contract; therefore, they may be supplemented or revised from time to time, as the work progresses, by the Engineer or (subject to approval of the Engineer) by the Contractor. The Contractor will keep one set of plans available on the work at all times.

B. The plans may be supplemented by such working drawings as are necessary to adequately control the work. Working drawings for structures shall be furnished by the Contractor. Working Drawings shall include stress sheets, shop drawings, erection plans, fabrication sheets, falsework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data required by the Engineer. Unless otherwise specified, all working drawings shall be submitted in triplicate 10 days prior to start of related work and approved by the Engineer. Such approval shall not relieve the Contractor of any of the Contractor's responsibility under the contract for the successful completion of the work. It is mutually agreed that the Contractor shall be responsible for agreement of dimensions and details as well as for conformity of the Contractor's working drawings with the approved plans and specifications.

D. The Contractor shall make submittals for all materials prior to use. All submittals shall be via electronic communication (pdf at ≥ 300 dpi) unless otherwise approved by the Engineer.
   1. All submittals made and signed by the Contractor shall be accompanied by a submittal coversheet with the Contractor's review stamp and the Contractor's standard transmittal form, containing, at a minimum, the bid item to which the submittal pertains. All submittals are to be numbered by specification section then sequential submittal number (e.g. 203-001, 203-002, etc.).
   2. Any submittals not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for re-submittal.
   3. Items submitted by anyone other than the Contractor will be returned, without action, for resubmission by the Contractor.
   4. All submittals shall be carefully reviewed by an authorized representative of the Contractor prior to submission to the Engineer.
   5. Each submittal shall be dated, signed and certified by the Contractor as being correct and in strict conformance with the Contract Documents.
   6. All non-certified submittals will be returned to the Contractor without action taken by the Engineer and any delays caused thereby shall be the total responsibility of the Contractor.

E. The Contractor shall submit any City of Las Vegas acceptance letters for asphalt concrete, aggregate and Portland Cement Concrete in lieu of test data.
   1. If the asphalt concrete, aggregate or Portland Cement Concrete mix designs are not on the current IQAC list of approved materials, a mix design for asphalt or Portland Cement Concrete or test data must be signed and approved by a Nevada Licensed P.E.
   2. The Contractor shall establish its bid price according to the mix designs that are delineated on the current IQAC list of approved materials.
   3. Any additional costs arising from mix designs submitted by the Contractor that are rejected for not meeting the IQAC criteria for any reason whatsoever shall be borne solely by the Contractor.
   4. All mix designs are to be submitted thirty (30) days prior to anticipated material placement.

F. The Engineer's review of working drawings submitted by the Contractor will cover only general conformity to the drawings, specifications and special provisions, external connections and dimensions which affect the layout. Unless otherwise specified within the Special Provisions, allow Owner fifteen (15) Working Days for each submittal review.
   1. The Engineer's review does not indicate a thorough review of all dimensions, quantities and details of the material, equipment, devices or items shown.
   2. The Engineer's review of submittals shall not relieve Contractor from responsibility for errors, omissions, or deviations, or responsibility for compliance with the Contract Documents.
   3. Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

G. If a submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS AS NOTED", formal revision and resubmission of said submittal will not be required.

H. If a copy of the submittal is returned to the Contractor marked "AMEND – RESUBMIT", or "REJECTED – RESUBMIT" the Contractor shall revise said submittal and shall resubmit to the Engineer.
   1. When corrected copies are submitted, the Contractor shall indicate any revisions not made and any revisions made other than those called for by the Engineer on previous submissions.
   2. Manufacture, fabrications or purchasing of items prior to final acceptance is at the Contractor's own risk.

105.03 CONFORMITY WITH PLANS AND SPECIFICATIONS

A. Work performed and materials furnished shall be in conformity with the lines, grades, cross sections, dimensions, and materials requirements, including tolerances, shown on the plans or indicated in the specifications.

B. In the event the Engineer finds the materials or the finished product in which the materials are used not in conformity with the plans and specifications, but that acceptable work has been produced, the Engineer shall then make a determination if the work shall be accepted and remain in place. In this event, the Engineer will document the basis of acceptance by plans modification concurred in by the Agency.

C. In the event the Engineer finds the materials or the finished product in which the materials are used or the work performed are not in conformity with the plans and specifications and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by the Contractor at no additional cost to the Owner.

D. In the event the Contractor desires to perform work that does not conform with the plans and specifications, the Contractor will make a written request to the Engineer for review and approval.

E. As a minimum, the written request will address the following:
   1. The Contractor will demonstrate that the performed work is of equal or greater value than the work specified in the plans and specifications.
   2. Various requests may require the seal and signature of approval from a licensed Nevada Professional Engineer. Prior to submitting a request, the Contractor shall inquire as to whether the Owner will require the approval of an Engineer, and if so, the Contractor will be responsible for the associated costs of this review.

105.04 COORDINATION OF PLANS, SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS, AND SPECIAL PROVISIONS

A. The specifications, supplemental specifications, plans, special provisions, and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. These documents are intended to be

complementary and to describe and provide for a complete work. In case of discrepancy, the following precedence will govern:

1. Permits from other agencies as may be required by law.
2. Plans.
3. Specifications.

B. Change orders, supplemental agreements, and approved revisions to plans and specifications will take precedence over Items 2 and 3 listed above. Detailed plans shall have precedence over general plans.

C. The Contractor shall take no advantage of any apparent error or omission in the plans or specifications. In the event the Contractor discovers such an error or omission, the Contractor shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications.

105.05 COOPERATION BY CONTRACTOR

A. The Contractor will be supplied with a minimum of 4 sets of approved plans and contract assemblies including specifications, one set of which the Contractor shall keep available on the work at all times. Additional copies of plans and specifications may be obtained by the Contractor upon written request to the Owner.

B. The Contractor shall give the work constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer, the Agency's inspectors, and other contractors in every way possible.

C. The Contractor shall provide his own mobile telephone, capable of making and receiving both local and long distance calls to allow communication with the Engineer and Resident Project Representative at all times. The contractor shall provide his own electronic device capable of receiving and sending e-mails from the field. The Contractor shall also provide his own electric power, potable water, construction water and sanitary facilities required in the performance of the work under the contract. All costs associated with these items shall be the responsibility of the Contactor. :

D. The prime Contractor shall have on the work at all times, as the Contractor's agent, a competent superintendent capable of reading and thoroughly understanding the plans and specifications and thoroughly experienced in the type of work being performed, who shall receive instructions from the Engineer or the Engineer's authorized representatives. Such superintendent shall be designated in writing before starting work. The superintendent shall have full authority to execute orders or directions of the Engineer without delay, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. Such superintendent shall be furnished irrespective of the amount of work sublet.

E. Whenever the Contractor or the Contractor's authorized representative is not present on any particular part of the work where it may be desired to give direction, orders will be given by the Engineer to the Contractor's superintendent, foreman, or other person in

charge of the operation, who is present, and these orders shall have the same force and effect as if given to the Contractor or the Contractor's designated representative.

F. Any order given by the Engineer, not otherwise required by the specifications to be in writing, will on request of the Contractor be given or confirmed by the Engineer in writing.

105.06 COOPERATION WITH UTILITIES

A. The Permittee, in the case of private contract, and the Agency, in the case of cash contract or Special Improvement District contract, will search known substructure records which describe the location of utility substructures, and will indicate on the plans for the project those substructures, except for service connections, which may affect the work.

B. Where underground main distribution conduits such as water, gas, sewer, electric power, telephone, or cable television are shown on the plans, the Contractor, shall assume that every property parcel will be served by a service connection for each type of utility.

C. At least 2 working days before entering on the work, the Contractor shall notify all the utility owners to mark or otherwise indicate the approximate location of their subsurface facilities including, but not limited to, structures, main conduits, and service connections. This requirement will not apply to sewer and storm drain installations where their location and depth are shown on the plans for the project.

D. It shall be the Contractor's responsibility to determine the location and depth of all utilities, including service connections, for which approximate locations have been marked by the respective owners and which the Contractor believes may affect or be affected by the Contractor's operations. If no pay item is provided in the contract for this work, full compensation for such work shall be considered as included in the prices bid for other items of work.

E. The Contractor shall not interrupt the service function or disturb the supporting base of any utility without authority from the owner or an order from the Agency.

F. Where protection is required to ensure support of utilities, the Contractor shall, unless otherwise provided, furnish and place the necessary protection at no additional cost to the Owner.

G. Upon learning of the existence and location of any utility omitted from or shown incorrectly on the plans, or not properly marked, the Contractor shall immediately notify the Engineer in writing.

H. The Contractor shall immediately notify the Owner and the utility owner if the Contractor disturbs or damages any utility. The Contractor shall bear the costs of repair or replacement of any utility damaged if properly located as provided.

I. When placing concrete around or contiguous to any utility installation, the Contractor, at no additional cost to the Contracting Agency, shall (1) furnish and install a 2-inch cushion of expansion joint material or other similar resilient material; or (2) provide a sleeve or other opening which will result in a 2-inch minimum clear annular space between the concrete

and the utility; or (3) provide other acceptable means to prevent embedment in or bonding to the concrete. The standards of the affected utility company shall prevail. Where concrete is used for backfill or for structures which would result in embedment, or partial embedment, of a metallic utility installation, or where the coating, bedding, or other cathodic protection system is exposed or damaged by the Contractor's operations, or as may be required by the work, the Contractor shall notify the Engineer and arrange to secure the advice of the affected utility owner regarding the procedures required to maintain or restore the integrity of the system.

J. Unless otherwise specified, the Contractor shall remove all interfering portions of utilities shown on the plans or indicated in the bid documents as "abandoned" or "to be abandoned in place." Before starting removal operations, the Contractor shall ascertain from the Contracting Agency whether the abandonment is complete, and the costs involved in the removal and disposal shall be absorbed in the bid for the items of work necessitating such removals.

K. When feasible, the owners responsible for utilities within the area affected by the work shall complete their necessary installations, relocations, repairs or replacements before commencement of work by the Contractor. Utilities that are relocated in order to avoid interference with the proposed permanent work shall be protected in their relocated position and the cost of such protection shall be absorbed in the various items of the contract.

L. A utility company installing a new line is responsible for relocation of other utility company facilities if the new line conflicts with existing locations.

M. When the plans or specifications provide for the Contractor to alter, relocate, or reconstruct a utility, all costs for such work shall be included in the bid for the items of work necessitating such work. Temporary or permanent relocation or alteration of utilities requested by the Contractor for the Contractor's own convenience shall be the Contractor's responsibility, and the Contractor shall make all arrangements and bear all costs.

N. The utility owner will relocate service connections as necessary within the limits of the work or within temporary construction or slope easement unless otherwise specified. When directed by the Engineer, the Contractor shall arrange for the relocation of service connections as necessary between the meter and property line, or between a meter and the limits of temporary construction or slope easements. The Contractor may, for the Contractor's own convenience or to expedite the work, agree with the owner of any utility to disconnect and reconnect interfering service connections. The Agency will not be involved in any such agreement.

O. The Contractor shall notify the Agency of the Contractor's construction schedule insofar as it affects the protection, removal, or relocation of utilities.

P. The Contractor will not be entitled to damages attributable to utility relocations or alterations if correctly located, noted, and completed.

Q. When necessary, the Contractor shall so conduct the Contractor's operations as to permit access to the work site and provide time for utility work to be accomplished during the progress of the contract work.

R. The Owner and Engineer do not guarantee that all existing utilities are shown on the contract drawings, or that the utilities are shown in their exact locations. The Owner may or may not have indicated utility service connection laterals on the Contract Drawings. The Contractor shall be responsible for verifying that each utility has responded to each notification.

S. During all time periods when any utility valve, manhole, vault, or pull box may be buried or otherwise rendered inaccessible, the Contractor shall have personnel and equipment on standby (respond within 1 hour) to uncover any valve, manhole, vault or pull box when requested by the Engineer or owning agency.

1. All utility valves, manholes, vaults, or pull-boxes which are buried shall be conspicuously marked in a fashion acceptable to the owner and Engineer by the Contractor to allow their location to be determined by the Engineer or utility personnel under adverse conditions, (inclement weather or darkness).

2. All cost for providing standby personnel and equipment and for uncovering buried facilities shall not be paid for separately but shall be considered incidental to the items of work associated with the burial.

If, during the course of paving operations, the Contractor paves over water and/or gas distribution valves, the Contractor shall have no more than 48 hours to remove the asphalt over the valves and adjust the valves to grade. The Contractor shall be responsible for adequately marking all such valves prior to paving operations so as to readily locate them after paving. Adjustment of valves may require a temporary adjustment to dense grade prior to the permanent final adjustment to the top of finish grade.

T. The Contractor shall pothole to determine the exact vertical and horizontal location of all existing utilities indicated on the Drawings, or marked in the field, crossing or potentially impacting the proposed reinforced concrete box, pipeline, mains, and laterals, at least (10) days in advance of the construction of any underground facility.

1. Contractor shall provide Engineer all pothole information obtained including measurements, dimensions, elevations, types and sizes of utilities within one working day following the potholing.

U. During the performance of contract work, the owner of any utility affected by the work shall have the right to enter, when necessary, upon any portion of the work for the purpose of maintaining service and of making changes in, or repairs to said utility.

W. The Contractor shall not shut off the water supply to a hydrant, nor in any way, prevent access to a fire hydrant until he has secured permission to do so from the proper authorities.

105.07 COOPERATION BETWEEN CONTRACTORS

A. The Agency reserves the right at any time to contract and perform other or additional work on or near the work covered by the contract.

B. When separate contracts are let within the limits of any one project, each Contractor shall conduct Contractor's work so as not to interfere with or hinder the progress or completion of the work being performed by the other Contractors. Contractors working on the same project shall cooperate with each other as directed.

C. Each Contractor involved shall assume all liability, financial or otherwise, in connection with Contractor's contract and shall protect and save harmless the Contracting Agency from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced by Contractor because of the presence and operations of other Contractors working within the limits of the same project.

D. The Contractor shall arrange Contractor's work and shall place and dispose of the materials being used so as not to interfere with the operations of other Contractors within the limits of the same project. Contractor shall join Contractor's work with that of the others in an acceptable manner and shall perform the work in proper sequence to that of the others.

105.08 CONSTRUCTION STAKES, LINES AND GRADES

A. Construction staking work shall be required of the Contractor, as indicated in ***Section 622 "Construction Surveying by the Contractor"*** of these Specifications, and shall conform to all requirements therein.

105.09 RECORD DOCUMENTS

A. General Instructions
   1. Ensure entries are complete and accurate. Current Progress Record Documents shall be available for review by the Owner, Owner's Consulting Engineer and the Owner's Construction Management Consultant (if applicable) at all times during the progress of the work.
   2. Store Progress Record Documents separate from documents used for construction.
   3. Neatly record information concurrent with construction progress. Maintain Progress Record Documents in a clean and orderly manner. The Contractor shall not conceal any work until the required record information has been recorded on the record document set. The Contractor shall bear the cost of uncovering any prematurely concealed work for required record documentation.
   4. Progress Record Documents shall be made available to the Owner, the Owner's Consulting Engineer and the Owner's Construction Management Consultant (if applicable) for review at the site, at progress meetings and during Owner's review of the monthly progress bill requesting payment
   5. Failure of the Contractor to maintain a current record of information on the Progress Record Documents shall entitle the Owner to withhold payment until corrected. The release of payment to the Contractor shall be contingent upon the Contractor's diligent performance as required herein.

B. Progress Record Documents - The Contractor shall maintain the following documents, which constitute the Progress Record Documents, at the job site during construction:
   1. Drawings – Owner shall provide a full size copy of the approved set of drawings on bond paper for use as the Progress Record Document drawings prior to starting the work.
      a. The Contractor will supplement the drawing set with approved drawings submitted as deferred submittals. The Contractor shall insert approved Addenda and revision sheets in front of the original sheet
      b. The Contractor shall legibly mark each sheet to record actual construction including (but not limited to):
         i. Measured horizontal and vertical locations of underground installations, utilities and appurtenances referenced to permanent surface improvements;
         ii. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work;
         iii. Field changes of dimension and detail;
         iv. Details not on original Contract Drawings
   2. Specifications – The Contractor shall legibly mark and record at each product section description of actual products installed, including (but not limited to) the following:
      a. Manufacturer's name and product model and number
      b. Product substitutions or alternates utilized;
      c. Changes made by addenda and modifications.
   3. The Contractor shall keep copies of and maintain a record of all Change Orders and any other modifications to the Contract.
   4. The Contractor shall keep copies of and maintain a record of all reviewed Shop Drawings, Product Data and Samples.
   5. The Contractor shall keep copies of and maintain a record of all Manufacturer's instructions for assembly, installation and adjusting.

C. Final Record Documents - Upon completion of the work, including all punch list items and prior to Release of Retention, the Contractor shall provide to Owner a complete set of Final Record Documents. The Final Record Documents shall include (but not limited to) the following:
   1. Final Drawings
      a. The Contractor will supplement the drawing set with approved drawings submitted as deferred submittals. The Contractor shall insert approved Addenda and revision sheets in front of the original sheet including any revisions required for completion of the punch list
      b. The Contractor shall legibly mark each sheet to record actual construction including, (but not limited to):
         i. Measured horizontal and vertical locations of underground installations, utilities and appurtenances referenced to permanent surface improvements;
         ii. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work;
         iii. Field changes of dimension and detail;
         iv. Details not on original Contract Drawings;
         v. Changes made during completion of the punch list.

c. The Contractor shall mark each sheet as “Record” or “As-Built”

2. Specifications
   a. Manufacturer’s name and product model and number
   b. Product Substitutions or alternates utilized
   c. Changes made by Addenda and modifications
   d. Changes made during completion of the punch list.
3. Contractor shall keep copies of and maintain a record of all Change Orders and any other modifications to the Contract including any changes made during completion of the punch list.
4. The Contractor shall keep copies of and maintain a record of all reviewed Shop Drawings, Product Data and Samples including any additional shop drawings, product data and samples required for completion of the punch list.
5. The Contractor shall keep copies of and maintain a record of all Manufacturer’s instructions for assembly, installation and adjusting and any Manufacturer’s instructions for assembly, installation and adjusting required for completion of the punch list.

105.10 DUTIES OF THE INSPECTOR

A. Inspectors for the Agency will be authorized to inspect all work done and all materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector will not be authorized to issue instructions contrary to the plans and specifications, or to act in any capacity for the Contractor.

105.11 INSPECTION

A. All materials and each part or detail of the work shall be subject to inspection by the Engineer. The Engineer shall be provided acceptable access to all parts of the work and shall be furnished with such information and assistance by the Contractor as required to make a complete and detailed inspection.

B. Any work done or materials used without inspection by an authorized Engineer’s representative may be ordered removed unless the material meets the specifications and shall be replaced at no additional cost to the Owner unless the Engineer representative failed to inspect after having been given notice in writing that the work was to be performed. If the noninspected work or material proves acceptable the work or material may remain, but any expenses entailed in a late inspection shall be the Contractor's.

C. If the Engineer requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing and the replacing of the covering, or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing and replacing of the covering, or making good of the parts removed will be at no additional cost to the Owner.

D. When facilities of any unit of government or political subdivision or of any railroad corporation or public utility corporation are adjusted or constructed as a part of the work covered by this contract, its respective representatives shall have the right to inspect the work. Such inspection shall in no sense make any unit of government or political subdivision or any railroad corporation or public utility corporation a party to this contract, and shall in no way interfere with the rights of either party thereunder.

E. A full time third party special inspector and testing agency shall be hired and provide weekly reports to the City of Las Vegas Building Department – Offsite Inspections and Testing. The special inspector and testing agency is required to be listed on the current Quality Assurance Agency list issued by Clark County Building Department for the applicable work and inspection. City of Las Vegas is required to review and verify the list of special inspectors and agencies hired by the owner, prior to the start of construction. The current Quality Assurance Agency list of approved personnel is found at the below webpage.

http://www.clarkcountynv.gov/building/engineering/Approved%20Listings/qaainsp_list.pdf

105.12 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK

A. All work which does not conform to the requirements of the contract will be considered as unacceptable work, unless otherwise determined acceptable under the provisions in ***Subsection 105.03, "Conformity with Plans and Specifications."***

B. Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause, found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner.

C. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the plans, or as given except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at no additional cost to the Owner.

D. Upon failure on the part of the Contractor to comply forthwith with any order of the Engineer, made under the provisions of this article, the Owner will have authority to cause unacceptable work to be remedied or removed or replaced and unauthorized work to be removed and to withhold the costs from any money due or to become due to the Contractor.

105.13 LOAD AND SPEED RESTRICTIONS

A. The Contractor shall be responsible for all damage to the work caused by Contractor's hauling equipment.

B. In hauling material for incorporation in portions of the project, loads which are in excess of the limits set by the Agency will not be permitted on any existing bridge or new and

existing bituminous base and surface, cement treated base, or Portland cement concrete paving which is to remain in place for vehicular traffic within the project or between the project and the pits or other sources of materials. Load limits established by the Contracting Agency for the project shall be complied with regardless of the source of materials, whether from described pits, approved pits, or commercial sources. Unless otherwise stated in the Special Provisions, the maximum loads shall not exceed the limits set forth in Chapter 484, "Traffic Laws," of the Nevada Revised Statutes and all acts amendatory thereto or supplementary thereto.

C. Construction loads greater than legal loads may be carried over any new bridge structure within the project providing the Contractor complies with all of the following limitations and provisions:

1. Concrete in any such structure shall have attained designed strength as shown on the structure plans.

2. The gross load of the vehicle shall not exceed 108,000 pounds.

3. Gross load on any individual axle shall not exceed 48,000 pounds.

4. The gross load on any individual set of tandem axles spaced not more than 6 feet apart shall not exceed 72,000 pounds.

5. The center to center spacing of individual axles or center to center spacing of pairs of tandem axles shall not be less than 14 feet.

6. No more than one lane of vehicles shall operate over any structure.

7. The speed of any vehicle approaching or traveling on any structure shall not exceed 10 mph.

8. The roadway surface approaching any structure shall be kept smooth and uniformly graded for 150 feet each side of the structure and shall be maintained to provide a uniform transition onto the structure.

9. A cover of 6 inches $\pm$ 1 inch shall be placed and maintained on the decks of all structures. Cover material shall not include rocks of diameter greater than 2 inches.

D. The limitations specified in items 2, 3, 4, 5, 6, 7, 8, and 9 above may be waived for all reinforced concrete box culverts providing that the depth of fill compacted and in place over the reinforced concrete box culvert is equal to or greater than the distance between inside faces of outside walls measured along center line of roadway. Fill may be placed not to exceed profile grade elevation.

E. Construction loads greater than legal loads may be carried over structures within the project which have spans of 10 feet to 20 feet only when the Contractor complies with the above Subparagraph C, numbers 3 through 9, inclusive; however, the limitations as set forth in Subparagraph C, numbers 3 through 5, inclusive, may be waived by the Engineer for reinforced concrete box structures which are adequately supported by shoring. The

Contractor shall submit Contractor's proposed shoring details and the actual loads and axle spacings to the Engineer for review prior to the planned hauling. Approval will be based on a review of the shoring details and a physical inspection of the shoring complete and in place.

F. The Engineer shall make sufficient checks to satisfy Engineer that the Contractor is complying with all limitations, and any violation shall result in denying the Contractor use of the structure until the violation has been corrected to the satisfaction of the Engineer.

G. The provision that the Contractor may haul construction loads greater than legal loads on new structures shall not relieve the Contractor of Contractor's responsibility for all damage caused by Contractor's hauling equipment.

H. The Engineer may, for the protection of the traveling public, establish speed limits on or adjacent to the project. Such limitations of speed shall be strictly observed by the Contractor.

105.14 MAINTENANCE DURING CONSTRUCTION

A. The Contractor shall maintain the work during construction and until the project is accepted, except as provided for in ***Subsection 107.15, "Relief from Maintenance and Responsibility."*** This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that the roadway and structures are at all times, to be kept in a condition satisfactory to the Engineer.

B. In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

C. Except as provided for in ***Subsection 107.15, "Relief from Maintenance and Responsibility,"*** all costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various pay items and the Contractor will not be paid an additional amount for such work.

D. The Contractor shall maintain a temporary AC patch over backfilled pipe trenches, subject to traffic, during the course of the project to the satisfaction of the Engineer.

1. The temporary patch shall be permanently repaired or removed as soon as the Contractor's operations allow. Temporary asphalt patching will not be allowed to remain longer than 30 calendar days before permanent paving is placed.

2. Should areas of temporary pavement fail and become hazardous, the Contractor shall repair at the Engineer's direction and at the Contractor's expense.

105.15 FAILURE TO MAINTAIN ROADWAY OR STRUCTURE

A. If the Contractor, at any time, fails to comply with the provisions of ***Subsection 105.14, "Maintenance During Construction,"*** the Engineer will immediately notify the Contractor in writing of such noncompliance. If the Contractor fails to remedy unsatisfactory

maintenance within 24 hours after receipt of such notice, the Engineer may immediately proceed to maintain the project, and the entire cost of this maintenance will be deducted from money due or to become due the Contractor.

B. If a condition develops that is dangerous to public safety in the opinion of the Engineer, such condition may be immediately remedied with whatever means is available and the cost of this maintenance will be deducted from money due or to become due to the Contractor.

105.16 FINAL ACCEPTANCE

A. Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer will make an inspection. Upon receipt of Record Drawings, and if all construction and final cleanup provided for and contemplated by the contract are found completed to Engineer's satisfaction, the inspection shall constitute the final inspection and the Engineer will so advise the governing body or commission. The Contractor will be notified in writing of the acceptance of the contract as of the date of the final inspection. Such notice will not be given to the board or commission until all work, including required Record Drawings has been completed to the satisfaction of the Engineer.

END OF SECTION 105

SECTION 106 – CONTROL OF MATERIALS

106.01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS

A. The Contractor shall furnish all materials required to complete the work.

B. No materials or supplies under this contract shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage, conditional sale contract or other security interest, or other agreement by which an interest is retained by the seller. The Contractor warrants that Contractor has good title to all materials and supplies used by the Contractor in the work, free from all liens, claims, or encumbrances.

C. Only materials conforming to the requirements of the specifications shall be incorporated in the work except as provided in ***Subsection 105.03, "Conformity with Plans and Specifications."***

D. The materials furnished and used shall be new, except as may be provided elsewhere in these specifications, on the plans or in the Specifications. The materials shall be manufactured, handled, and used in a workmanlike manner to ensure completed work in accordance with the plans and specifications.

E. The Contractor shall furnish the Engineer a list of the Contractor's sources of materials. The list shall be submitted to the Engineer prior to any official "Notice to Proceed" and in sufficient time to permit proper inspecting and testing of materials to be furnished from such listed sources in advance of their use.

F. The listings of materials that are posted on the Interagency Quality Assurance Committee (IQAC) web page are automatically considered a qualified source. However, this does not remove the responsibility of the Contractor to provide inspection and testing on the project as specified herein. The address for the IQAC webpage is:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

G. If it is found after trial that sources of supply for previously approved materials do not produce uniform and satisfactory products, or if the product from any source proves unacceptable at any time, which includes IQAC listed materials, the Contractor shall furnish satisfactory materials from other sources.

H. The Contractor shall furnish without charge such samples as may be required by the Engineer. The primary inspection and testing shall be made by the Contractor or the Contractor's designated representative, with Engineer oversight. However, it is understood that such inspections and tests, if made at any point other than the point of incorporation in the work, in no way shall be considered as a guarantee of acceptance of such materials nor of continued acceptance of material presumed to be similar to that upon which inspections and tests have been made.

I. Manufacturer's warranties, guarantees, instruction sheets, and parts lists, which are furnished with certain articles or materials incorporated in the work, shall be delivered to the Engineer before acceptance of the completed contract.

J. Contractor's reports and records of inspections made and tests performed shall be submitted to the Engineer as required in these specifications. The Engineer's inspection and testing records, when available at the site of the work, may be examined by the Contractor.

106.02 LOCAL MATERIALS

A. Local material is defined as rock, sand, gravel, earth, or other mineral material, other than local borrow or selected material, obtained or produced from sources in the vicinity of the work specifically for use on the project. Local material does not include materials obtained from established commercial sources.

B. Local materials shall be furnished by the Contractor from any source the Contractor may elect, except when a mandatory source is designated in the Special Provisions.

C. Aggregates for base, surface, and concrete may be the products of approved commercial producers, provided they meet specification requirements.

D. The furnishing of local materials from any source is subject to the provisions of ***Subsection 106.03, "Possible Local Material Sources."*** Material deposits shall not be excavated at locations where their resulting scars will present an unsightly appearance from any street or highway, unless such excavation is approved in writing by the Engineer.

E. Generally, local material deposits will not be approved if located within 1,000 feet of right-of-way line. In any case the Contractor's pit operations shall not encroach within 25 feet of the right-of-way. Payment will not be made on material obtained in violation of these provisions.

F. The Contractor shall, at no additional cost to the Contracting Agency, make any and all arrangements necessary for hauling over local, public, or private roads or property from any source. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals; for doing all the work involved in conforming to the provisions in this subsection; and for furnishing and producing materials from any source shall be considered as included in the price paid for the contract item of work involving such material and no additional compensation will be allowed.

G. The Contractor or the Contractor's representative shall attest to the content of the submitted materials that have been reviewed against the Contract Documents, and that the materials are in compliance thereto. Submitted materials that are to be evaluated as “Or Equal” or “Substitution” shall include sufficient information to enable the Engineer to make the determination for approval.

106.03 POSSIBLE LOCAL MATERIAL SOURCES

A. If the Contractor desires to use materials from local sources the Contractor shall, at no additional cost to the Owner, acquire the necessary right to take material and shall obtain all other necessary permits and approvals and shall comply with all the requirements and stipulations in effect by other governing agencies having jurisdiction over the area, and pay all costs involved, including any which may result from an increase in length of haul. All costs of exploring and developing, including inspection and testing such alternate sources shall be borne by the Contractor and the use of material from such sources will not be permitted until representative samples taken by the Engineer have been approved and written authority issued for the use thereof.

B. The Contractor's attention is especially directed to Title 43, "Code of Federal Regulations," Part 23, "Surface Exploration, Mining and Reclamation of Lands," which pertains to all exploration, developing, and obtaining material from said alternate deposits located upon land under the jurisdiction of the Bureau of Land Management.

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K. Where the Owner has obtained the right to remove materials from lands owned or controlled by the U.S. Government, by withdrawal or otherwise, and these areas are set forth as optional or mandatory local material sources in the Special Provisions, the Contractor on the project may enter and remove materials for use on subject project only without further permission. The Contractor may not enter on or remove materials from any other areas withdrawn or otherwise obtained by the Contracting Agency from the U.S. Government which are not specifically designated for the project without prior written approval from the Contracting Agency.

L. Should the Contractor enter upon any of the areas withdrawn or otherwise obtained by the Contracting Agency from the U.S. Government, it shall be the Contractor's responsibility to determine the rights of others in the area. The Contractor shall not encroach on easements of others without their written permission and shall assume the responsibility for any damages due to the Contractor's entering said area. In addition, the Contractor shall be bound by the terms, conditions, and reservations contained in the approved application for withdrawal.

M. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and producing specified materials from possible local material sources, including the construction of any access roads or fences and any clearing, grubbing, and stripping of material sources, and all processing of whatever nature and extent required, shall be considered as included in the price paid for the contract item of work involving such material and no additional compensation will be allowed.

106.04 SAMPLES AND TESTS

A. Sampling for final acceptance of materials will be as required in the appropriate specifications sections, contract special provisions, and in general shall comply with the AASHTO requirements, where applicable, and with the following sampling criteria:

1. Aggregates for roadmix bituminous mixtures (including base or surface) will be sampled after the material has been placed on the roadbed and processed and prior to adding the bituminous binder.

2. Aggregate for plantmix bituminous open-graded will be sampled from the laydown machine, or by “belt-cut” sample at the production plant at the Engineer’s discretion.

3. Aggregate for screenings will be sampled from the loaded truck just prior to placing, or by “belt-cut” sample at the production plant at the Engineer’s discretion.

4. Aggregate for plantmix bituminous mixtures (base or surface) will be sampled for acceptance behind the paver. Samples for plasticity tests will be taken at the bins.

5. Sampling of bituminous materials, intended for use in prime, tack or seal coats, surface treatments, and base, binder, or surface course mixtures shall be done after the bituminous material has arrived at job destination and before or at the time of unloading the materials.

    a. Two samples shall be taken from each railroad tank car or truck transport of material by the Contractor or the Contractor's designated representative under the observation of and complying with the requirements and in a manner approved by the Engineer. Where delivery is made in smaller hauling units than those cited above such as a distributor, or where the contents of a storage tank are sampled, the required 2 samples shall be taken to represent a maximum of 10,000 gallons. The Contractor shall take the samples during the established job working hours, unless arrangements are made for a representative of the Contracting Agency to witness the taking of the samples at another time.

    b. All sampling devices and sample containers shall be furnished by the Contractor. Immediately after filling the sample container, it shall be tightly sealed, properly marked for identification, and presented to the Engineer.

    c. One of the 2 samples, taken from each load, shall be submitted to the Contractor's Material Source laboratory for testing and the other sample retained by the Engineer. If the first sample tested complies with requirements, the second may be discarded.

    d. Where less than 80 percent of the asphalt deliveries are used on the project, samples shall be taken just prior to delivery to the mixer. Samples shall be taken for every 25 tons of asphalt delivered to the project.

6. Tests for the aforementioned materials produced under conditions other than contemplated herein shall be taken at the time and place deemed by the Engineer to be most appropriate.

7. All field and laboratory testing technicians shall be Nevada Alliance for Quality Transportation Construction (NAQTC) certified, including ACI certification. Information regarding training, examinations and certification is available from the Nevada T2 Center/257, NAQTC, University of Nevada, Reno, 1664 N. Virginia Street, Reno, Nevada, 89557-0179.

106.05 CERTIFICATE OF COMPLIANCE

A. The Engineer may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance stating that the materials involved comply in all respects with the requirements of the specifications. The certificates shall be signed by the manufacturer of the material or the fabricator of assembled materials. A Certificate of Compliance shall be furnished with each lot of material delivered to the work and the lot so certified shall be clearly identified in the certificate with attached applicable test results for that lot in accordance with the specification section.

B. All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance

shall not relieve the Contractor of responsibility for incorporating material in the work which conforms to the requirements of the plans and specifications and any such material not conforming to such requirements will be subject to rejection whether in place or not.

C. The Agency reserves the right to refuse to permit the use of material on the basis of a Certificate of Compliance.

D. The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

106.06 CITED SPECIFICATIONS

A. The Nevada Department of Transportation has developed test methods for testing the quality of materials and work. These test methods are identified by the prefix Nev. followed by the serial number. Copies of individual test methods are available at the Materials Division, Nevada Department of Transportation, Carson City, Nevada.

B. Whenever a reference is made in the specifications to a test method by Nev. or Cal. number, it shall mean the test method in effect on the date of the advertisement for bid.

C. Whenever a reference is made in the specifications to a specification or test designation either of ASTM International, AASHTO, federal specifications, or any other recognized national organization, and the number or other identification accompanying the test designation representing the year of adoption or latest revision of the test is omitted, it shall mean the test method in effect on the date of advertisement for bid.

D. When requested by the Engineer, the Contractor shall furnish, without charge, samples of all materials entering into the work, and no material shall be used prior to approval by the Engineer, except as provided in ***Subsection 106.05, "Certificate of Compliance."*** Samples of material from local sources shall be taken by or in the presence of the Engineer; otherwise, the samples will not be considered for testing.

106.07 PLANT INSPECTION

A. The Engineer may inspect the production of material or the manufacture of products at the source of supply. The Contractor and material producer shall assure the Engineer of their cooperation and assistance to perform plant inspection prior to production of materials for the project. The Engineer or the Engineer's authorized representative shall have free entry at all times to such parts of the plant as concerns the manufacture or production of the materials. Adequate facilities shall be furnished free of charge to make the necessary inspection.

B. It is understood that the Owner reserves the right to retest all materials prior to incorporation into the work which have been tested and accepted at the source of supply after the same have been delivered and to reject all materials which, when retested, do not meet the requirements of these specifications, or the requirements of the contract documents.

106.08 STORAGE OF MATERIALS

A. Materials shall be so stored as to ensure the preservation of their quality and fitness for the work. When considered necessary by the Engineer, materials shall be stored in waterproof buildings, placed on wooden platforms or other hard, clean surfaces, and not on the ground, and shall be covered when directed.

B. Stored materials, even though approved for use before storage, may be inspected prior to their use in the work, and materials shall meet the requirements of the specifications at the time of this proposed use. Stored materials shall be located so as to facilitate their prompt inspection.

C. Upon approval of the Engineer, that portion of the right-of-way not required for public travel may be used for storage purposes and for placing of the Contractor's plant and equipment, but any additional space required therefor shall be provided by the Contractor at no additional cost to the Owner. Private or public property shall not be used for storage purposes without written permission of the owner or lessee.

D. All storage sites shall be restored to their original condition by the Contractor at no additional cost to the Owner. This shall not apply to the stripping and storing of top soil or to other material salvaged from the work or specifically prescribed under the specifications. Construction materials may not be stored in streets, roads, or highways for more than 5 days after unloading. All materials or equipment not installed or used in the construction within 5 days after unloading shall be stored elsewhere by the Contractor at no additional cost to the Owner unless the Contractor is authorized additional storage time.

E. Construction equipment shall not be stored at the work site before its actual use on the work nor for more than 5 days after it is no longer needed on the work unless the Contractor is authorized additional storage time. Time necessary for repair or assembly of equipment may be authorized by the Engineer.

F. Excavated material, except that which is to be used as backfill in the adjacent trench, may not be stored in public streets, roads, or highways unless otherwise permitted. After placing backfill, all excess material shall be removed immediately from the site.

106.09 HANDLING MATERIALS

A. All materials shall be handled in such manner as to preserve their quality and fitness for the work.

B. Aggregates shall be transported from the storage site to the work in tight vehicles so constructed as to prevent loss or segregation of materials after loading and measuring in order that there may be no inconsistencies in the quantities of materials intended for incorporation in the work as loaded, and the quantities as actually received at the place of operation.

106.10 GUIDANCE ANALYSIS OF NONCOMPLYING MATERIALS

A. In the event of a non-compliance of a produced or placed material, the Contractor is responsible for submitting a recommendation report to the Engineer for the determination of the basis of acceptance of the material by the Engineer based on AASHTO R-9, this section, and/or other industry practices as approved by the Engineer. This report shall be performed by a Nevada Professional Engineer. The receiving of the report by the Engineer does not imply acceptance of the report recommendations.

B. The policy of the Engineer is that a project shall have been constructed "... in reasonably close conformity with the approved plans and specifications..." to be eligible for full payment of the material and installation. However, there will be instances when test results, as a result of the above noted variability may indicate apparent nonconformance

to the specification limits, yet the construction product may be acceptable for the use intended at full or reduced pay. In these cases, an analysis of the materials and/or materials test results will be necessary by the Contractor through a professional engineer before payment is made.

C. As a general guidance and unless otherwise stipulated in other specification sections or contract Special Provisions, if more than 10 percent of the test values for any construction product are outside of the applicable specifications, there may be a question of "reasonably close conformity." In these cases, an analysis of the test values should be made to determine the magnitude and extent of the nonconforming materials.

106.11 OWNER FURNISHED MATERIAL

A. The Contractor shall furnish all materials required to complete the work, except those specified to be furnished by the Owner. Material furnished by the Owner will be delivered or made available to the Contractor at the points specified in the Special Provisions.

B. The cost of handling and placing all materials after they are furnished to the Contractor shall be considered as included in the contract price for the item in connection with which they are used.

C. The Contractor will be held responsible for all material furnished to the Contractor, and deductions will be made from any money due to the Contractor to make good any shortages and deficiencies, from any cause whatsoever, and for any damage which may occur after such delivery and for any demurrage charges. The responsibility by the Contractor includes any project inspection and testing that is required in these specifications.

END OF SECTION 106

SECTION 107 – LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.01 LAWS TO BE OBSERVED

A. The Contractor shall keep fully informed of all federal and state laws, all local bylaws, ordinances, and regulations, and all orders and decrees of bodies or tribunals having jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, bylaws, ordinances, regulations, orders, and decrees, and shall protect and indemnify the Contracting Agency and its representative against any claim or liability arising from or based on the alleged violation of any such law, bylaw, ordinance, regulation, order, or decree, whether by the Contractor, the Contractor's employees, or agents.

107.02 PERMITS, LICENSES, AND TAXES

A. The Contractor shall obtain all permits and licenses, and give all notices necessary and incident to the due and lawful prosecution of the work, including vehicular registration or prorate registration and carrier licensing as applicable. Privilege taxes are in addition to the above fees.

B. The Contractor shall obtain Grading and/or Stockpile permits for on-site storage or disposal of materials from the City of Las Vegas Building Department prior to beginning the work.

C. It shall be the Contractor's responsibility to determine if the permit requirements of Section 637 “Pollution Control” shall be required.

D. The Contractor shall obtain a permit from the Las Vegas Valley Water District to use a hydrant as a water source.

E. The contract documents detail the right-of-way and construction easement/AEPs and in some cases staging areas the contractor may occupy during the duration of the project and traffic control requirements associated with the occupation of said areas. If the contractor desires to use any areas outside the limits described in the drawings and specifications, he shall be responsible for meeting the requirements of Title 19 (The Zoning Code) or applicable requirements for jurisdictions outside of the City. The contractor shall obtain all permits required for the use of private property and provide copies to the City prior to any use of the site. If a temporary commercial permit is required for work performed on private property, the Contractor shall ensure that a temporary commercial permit is obtained through the City of Las Vegas Planning Department or other applicable jurisdictions prior to any use of the site. All work, fees, and scheduling associated with compliance to this subsection shall be borne entirely by the contractor and shall not be a justification for delay claims.

107.03 PATENTED DEVICES, MATERIALS, AND PROCESSES

A. If the Contractor employs any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement

with the patentee or owner. The Contractor and the surety shall indemnify and save harmless the Owner, and affected third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which the Owner may be obliged to pay by reason of any alleged infringement, at any time during the prosecution or after the completion of the work.

107.04 RESTORATION OF SURFACES OPENED BY PERMIT

A. The right to construct or reconstruct any utility service in the public right-of-way, or to grant permits for same, at any time, is hereby expressly reserved by the Agency or the proper authorities of the municipality or other political subdivision in which the work is done and the Contractor shall not be entitled to any damages either for the digging up of the street or for any delay occasioned thereby.

B. Any individual, firm, or corporation wishing to make an opening in the highway or street must secure a permit from the proper authority. The Contractor shall allow parties bearing such permits, and only those parties, to make openings in the highways or streets. The Contractor shall, when ordered by the Engineer, make in an acceptable manner, all necessary repairs due to such openings, and such necessary work will be paid for as extra work, or as provided in these specifications, and will be subject to the same conditions as original work performed.

C. The Owner, the Contractor, and each of such workmen, contractors, and others shall coordinate their operations and cooperate to minimize interference.

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107.05 SAFETY

A. General: Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The name and telephone number of the Contractor's safety officer shall be provided to the Contracting Agency. He shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. All employees engaged in the work and the other persons who may be affected thereby;
2. All the work and all materials or equipment to be incorporated therein, whether in storage or on the project site, and
3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of the work.

B. Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect, install, employ and maintain, as required by the

conditions and progress of the work, all necessary safeguards. Contractor's duties and responsibilities for the safety and protection of the work shall continue until such time as all the work is completed and a "Notice of Completion" has been issued to the Contractor by the Engineer.

C. Trench Safety: Trench Safety shall be per Subsection 208.03.01.

107.06 SANITARY PROVISIONS

A. The Contractor shall provide and maintain in a neat, sanitary condition, such accommodations for the use of the Contractor's employees as may be necessary to comply with the requirements and regulations of the Southern Nevada Health District and of other bodies or tribunals having jurisdiction thereover. The Contractor shall commit no public nuisance.

107.07 TRAFFIC AND ACCESS

A. The Contractor's operations shall cause no unnecessary inconvenience. The access right of the public shall be considered at all times. Unless otherwise authorized, traffic shall be permitted to pass through the work, or an approved detour shall be provided.

B. Safe and adequate pedestrian and vehicular access shall be provided and maintained to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, hospitals, and establishments of similar nature. Access to these facilities shall be continuous and unobstructed unless otherwise approved by the Engineer.

C. Safe and adequate pedestrian zones and pedestrian crossings of the work at intervals not exceeding 300 feet shall be maintained unless otherwise approved by the Engineer.

1. When the Contractor’s construction operations encroach upon a sidewalk, walkway, or crosswalk area, the Contractor shall take special precautions to protect the pedestrian's safety including provisions to separate pedestrian traffic from the work area and vehicular traffic.
    a. When pedestrian traffic is routed onto the roadway, at other than existing crosswalk locations, the Contractor shall use portable precast concrete barrier rails to separate the pedestrian traffic from the work area and vehicular traffic.
    b. All portable precast concrete barrier rails shall be butted tight and pinned in accordance with the requirements of the NDOT Standard Drawing R-8.7.1, entitled “Portable Precast Concrete Barrier Rail.”

D. Safe and adequate access shall be maintained to existing bus or transit stops throughout duration of road construction in accordance with the following minimum requirements:

1. Unless otherwise specified in the Special Provisions, no public bus or transit stop shall be temporarily closed without the written consent of the Regional Transportation Commission of Southern Nevada (RTC) General Manager or the RTC General Manager's designee. The Contractor shall not close down any two consecutive bus

stops on routes for buses traveling in the same direction. The RTC shall be notified at least 10 working days prior to the proposed temporary closure of any bus or transit stop, including those listed in the Special Provisions.

2. No bus stops at transfer points shall be closed during construction. Bus stops at transfer points can, however, be temporarily relocated with the approval of the RTC.

3. Temporary bus stops may be considered upon approval by the RTC. The Contractor may call the RTC with any questions. A map of bus stop locations may be obtained from the RTC. If bus or transit stop is temporarily relocated, the existing bus or transit stop sign panels shall be relocated to temporary bus or transit stops and shall remain until temporary stop is removed. Temporary relocation of sign panels shall conform to ***Subsection 627.03.05, "Relocation."*** The Contractor shall relocate existing bus-stop signs at designated areas into existing sidewalk, and the sign relocation shall be incidental to other items of work.

4. The Contractor shall maintain access that is in conformance to the requirements of the Americans with Disabilities Act to and from bus or transit stops which remain open at all times during construction.

E. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time. If backfill has been completed to such extent that safe access may be provided, and the street is opened to local traffic, the Contractor shall immediately clear the street and driveways and provide and maintain access.

F. The Contractor shall cooperate with the various parties involved in the delivery of mail and the collection and removal of trash and garbage to maintain existing schedules for these services.

G. Grading operations, roadway excavation, and fill construction shall be conducted by the Contractor in a manner to provide a satisfactory surface for traffic. When rough grading is completed, the roadbed surface shall be brought to a smooth, even condition satisfactory for traffic.

H. Unless otherwise authorized, work shall be performed in only one half the roadway at one time. One half shall be kept open and unobstructed until the opposite side is ready for use. If one half a street only is being improved, the other half shall be conditioned and maintained as a detour.

I. The Contractor shall absorb in the Contractor's bid all costs for the above requirements.

J. The Contractor shall comply with all applicable state, county, and city requirements for closure of streets. Traffic work zone technicians on the project shall be certified in the work zone traffic control at least at the "Technician" level by ATSSA, IMSA, or NICET. The Contractor shall provide barriers, guards, lights, signs, temporary bridges, flagmen, and watchmen, advising the public of detours and construction hazards. The Contractor shall also be responsible for compliance with additional public safety requirements that may arise

during construction. The Contractor shall furnish and install, and upon completion of the work, promptly remove all temporary signs and warning devices.

K. Notifications:

1. The Contractor shall cooperate with, and give written notice to all emergency agencies, public entities, each resident, homeowner, homeowner association, business or school that will be affected by any part of the construction process, particularly concerning temporary interruptions to vehicular access.

2. This notice of the approximate schedule and explanation of work shall be distributed at least fourteen (14) days prior to commencement of work in the area.

3. A second written notice, as well as a verbal notice, including door-to-door communication shall be made at least twenty-four (24) hours prior to construction to remind all affected parties of the construction to take place.

4. The Contractor shall notify by phone the following agencies:

METRO DISPATCH	702-795-3111
FIRE DEPARTMENT DISPATCH	702-382-3001
AMBULANCE DISPATCH CENTER	702-384-3400
RTC – Bus Stop Closures, when applicable Contact Carl Scarborough, per SP 624.01.71	702-676-1608
RTC TRANSIT, when applicable	702-676-1731
CLARK COUNTY SCHOOL DISTRICT	702-799-8100 X 5395
NEVADA DEPT. OF TRANSPORTATION (NDOT), when applicable	702-385-6588
CLV - DEPT. OF PUBLIC WORKS	
PUBLIC INFORMATION SPECIALIST	702-229-6581
TRAFFIC ENGINEERING DIVISION	702-229-6327
UNITED STATES POSTAL SERVICE	1-888-275-8777
REPUBLIC SERVICES	702-735-5151 X 314

5. The Owner shall receive a copy of all notifications for acceptance.

L. All costs involved shall be absorbed in the Contractor's bid. All barricades, warning signs, lights, temporary signals, and other protective devices shall conform with the Traffic Control Plans for Highway Work Zones for the Clark County Area and the current edition of the Manual on Uniform Traffic Control Devices.

M. Construction materials may not be stored in streets, roads or highways for more than five days after unloading. All materials or equipment not installed or used in the construction within five days after unloading shall be stored elsewhere by the Contractor at his expense unless he is authorized additional storage time.

N. Construction equipment shall not be stored at the work site before its actual use on the work nor for more than five days after it is no longer needed on the work. Time necessary for repair or assembly of equipment may be authorized by the Engineer.

O. Excavated material, except that which is to be used as backfill in the adjacent trench, may not be stored in public streets, roads or highways unless otherwise permitted. After placing backfill, all excess material shall be removed immediately from the site.

B. Wherever possible the contractor shall use high early strength concrete for final utility grade adjustments to facilitate reopening the road to traffic.

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107.10 EXPLOSIVES

A. Explosives may be used only when authorized in writing by the Engineer, or as otherwise stated in the Special Provisions. Explosives shall be handled, used, and stored in accordance with all applicable regulations.

B. The Engineer's approval of the use of explosives shall not relieve the Contractor from the Contractor's liability for claims caused by the Contractor's blasting operations.

C. All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the Engineer and in general not closer than 1,000 feet from the road or from any building or camping area or place of human occupancy.

D. The Contractor shall notify each public utility company having structures or pipelines in proximity to the site of the work of the Contractor's intention to use explosives. Such notice shall be given in writing a week in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury.

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107.12 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE

A. The Contractor shall be responsible for the preservation from injury or damage resulting directly or indirectly from the work under the contract of all public and private property, crops, trees, vegetation, monuments, fences, highway signs and markers, etc., along and adjacent to the project, and shall use every precaution necessary to prevent damage to waterlines,

sewers, and other underground structures, to poles, wires, cables, and other overhead structures, whether shown on the plans or not, shall protect carefully from disturbance or damage all land monuments and property marks until the Engineer has witnessed or otherwise referenced their location, and shall not remove them until directed. The Contractor shall not willfully or maliciously injure or destroy trees or shrubs, and the Contractor shall not remove or cut trees or shrubs without proper authority.

B. The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the work resulting from any act, omission, neglect, or misconduct in the Contractor's manner or method of executing said work, or at any time due to defective work or materials, and such responsibility shall not be released until the project shall have been completed and accepted.

C. The Contractor shall be responsible for the preservation of archeological and paleontological objects, including all ruins, sites, buildings, artifacts, fossils, or other objects of antiquity encountered during construction. When such objects are encountered, the Contractor shall immediately cease operations and notify the Engineer that such objects exist. Construction operations shall be rescheduled to avoid the section until the removal of the artifacts or the gathering of historical data has been accomplished by the appropriate authority. When directed by the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper authorities.

D. Extension of contract time will be allowed for any delay to the Contractor due to preservation of archeological and paleontological objects.

E. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the work, or in consequence of the nonexecution thereof on the part of the Contractor or the Contractor's agents, suppliers, or subcontractors, the Contractor shall restore at no additional cost to the Owner such property to a condition similar or equal to that existing before such damage or injury was done by repairing, rebuilding, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner. In case of failure on the part of the Contractor to restore such property or make good such damage or injury within 10 days, the Owner may, upon 48 hours' written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost thereof shall be deducted from any money due, or which become due the Contractor under the contract.

F. The Contractor shall restrict the movement of the Contractor's vehicles and other construction equipment and personnel to the construction area and designated roads. Every precaution shall be taken to prevent the marking of the natural ground with equipment tracks or other means outside of the staked area and in median areas where it is not required to disturb the existing ground. Where such markings of the natural ground are caused either by the Contractor's equipment, personnel, or operations, the Contractor, at no additional cost to the Contracting Agency, shall eradicate such marks to the satisfaction of the Engineer.

G. All roads used for construction operations shall be spaced at least 1,000 feet apart from flat bottom ditches and material deposits, except that such roads may also be located in ditch and dike areas. When roads are located in ditch and dike areas, equipment shall not be allowed to travel outside the area occupied by said ditch or dike, except as provided for in ***Subsection 203.03.13, "Channels."*** The crossing of median areas shall be at structures or areas approved by the Engineer.

H. Where there is a high potential for erosion and subsequent water pollution, the area of erosive land that may be exposed by construction operations at any one time shall be held to a minimum, and the duration of the exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion control features shall be constructed concurrently with other work and at the earliest practicable time.

I. Disturbance of the lands and of waters that are outside the limits of the construction as staked is prohibited, except as may be found necessary and approved by the Engineer.

J. Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the site in the performance of the work. Drainage facilities shall be adequate to prevent damage to the work, the site and the adjacent property.

K. Contractor shall prevent erosion of soil on the site and adjacent property resulting from his construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation or other operation that will disturb the natural protection of the soil.

107.13 FIRE PROTECTION

A. There shall be no open burning unless approval has been given in writing by the Clark County Air Pollution Control Officer and the Engineer has concurred. Before setting any fires whatsoever, the Contractor shall notify the responsible agency having jurisdiction for the area concerned. The Engineer shall have authority to enforce correction of any condition which is, in the Engineer's opinion, unsafe.

107.14 DISPOSAL OF MATERIAL OUTSIDE PROJECT RIGHT-OF-WAY

A. The Contractor shall make the Contractor's own arrangements for disposal of materials outside the project right-of-way at no additional cost to the Owner.

B. When any material is to be disposed of outside the project right-of-way, the Contractor shall first obtain a written permit from the property owner on whose property the disposal is to be made, and the Contractor shall file in writing with the Engineer said permit or the certified copy thereof together with a written release from the property owner absolving the agency of any and all responsibility in connection with the disposal of material on said property.

C. When material is disposed of as above provided and the disposal location is visible from the project, the Contractor shall dispose of the material in a neat and uniform manner to the satisfaction of the Engineer.

D. Unless otherwise provided in the Special Provisions, full compensation for all costs involved in disposing of material as specified in this section, including all costs of hauling, shall be considered as included in the price paid for the contract items of work involving such materials and no additional compensation will be allowed therefore.

107.15 RELIEF FROM MAINTENANCE AND RESPONSIBILITY

A. Upon the written request of the Contractor, or upon order of the Engineer, the Contractor may be relieved of the duty of maintaining and protecting certain portions of the work as described below, which have been completed in all respects in accordance with the requirements of the contract and to the satisfaction of the Engineer, and thereafter except with the Engineer's consent, the Contractor will not be required to do further work thereon. In addition, such action by the Engineer will relieve the Contractor of responsibility for injury or damage to said completed portions of the work resulting from use by the public traffic or from the action of the elements or from any other cause, but not from injury or damage resulting from the Contractor's own operations or from the Contractor's negligence.

B. Portions of the work for which the Contractor may be relieved of the duty of maintenance and protection as provided in the above paragraph include but are not limited to the following:

1. A bridge or other structure of major importance.

2. A complete unit of a traffic control signal system or of a highway or street lighting system.

3. Non-project facilities constructed for other agencies.

C. However, nothing in this subsection providing for relief from maintenance and responsibility will be construed as relieving the Contractor of full responsibility for making good defective work or materials found at any time before the formal written acceptance of the entire project by the Contracting Agency.

107.16 CONTRACTOR'S RESPONSIBILITY FOR THE WORK AND MATERIALS

A. Until the acceptance of the contract, the Contractor shall have the charge and care of the work and of the materials to be used therein and shall bear the risk of injury, loss, or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution or from the nonexecution of the work, except as provided in ***Subsection 107.15, "Relief from Maintenance and Responsibility."***

B. The Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the work or the materials occasioned by any cause before its completion and acceptance and shall bear the expense thereof, except as otherwise expressly provided in ***Subsection 203.03.11, "Slides and Slipouts,"*** for Object Markers and Guide Posts, and except for such injuries, losses, or damages as are directly and proximately caused by acts of the federal government or the public enemy. The Contractor shall, at no additional cost to the Contracting Agency, provide suitable drainage for the project and erect such temporary structures as are necessary to protect the work or materials from damage.

C. The suspension of the work from any cause whatever shall not relieve the Contractor of the Contractor's responsibility for the work and materials as herein specified. If ordered by the Engineer, the Contractor shall, at no additional cost to the Owner, properly store materials which have been fully or partially paid for and furnished by the Owner. Such storage by the Contractor shall be on behalf of the Owner and the Owner shall at all times be entitled to the possession of such materials, and the Owner shall promptly return the same to the site of the work when requested. The Contractor shall not dispose of any of the materials so stored except on written authorization from the Engineer.

107.17 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICE

A. At points where the Contractor's operations are adjacent to properties of railroad, telegraph, telephone, and power companies, or are adjacent to or in conflict with other property or utilities, damage to which might result in considerable expense, loss, or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.

B. The Contractor shall not begin any operations which may interfere with or impair the normal service being rendered by public or private utility operations, until such operators have been notified, and shall cooperate with the owners of any underground or overhead utilities in their removal and rearrangements operations in order that these operations may progress in a reasonable manner, and that duplication of rearrangements work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted. The Contractor will be held responsible for the protection of the property of public or private utilities within the limits of the work.

C. In general, the repair and adjustment of street structures such as waterlines, sewers, telephone, telegraph, gas, and electric lines, above or below the ground, will be made by the owners thereof as specified in ***Subsection 105.06, "Cooperation with Utilities."*** When included in the proposal, the adjustment of sewer manhole frames and covers, inlets and catch basin frames and covers and the like, will be within the Contractor's responsibility. The Contractor shall see that they are adjusted to conform to the lines, grades, and typical cross sections as shown on the plans, or as prescribed, without respect to whether the repairs and the roughing-in work have been performed by the Contractor or others.

D. Pipes or other construction shall be maintained in continuous service as far as practicable and shall be properly protected and supported. In no case shall interruption of the water service be allowed to exist outside of working hours.

E. Fire hydrants shall be accessible at all times to the fire department. No material or other obstruction shall be placed closer to a fire hydrant than permitted by ordinances, rules, or regulations, or within 15 feet of the fire hydrant in the absence of such ordinances, rules, or regulations.

F. The Contractor shall give notice in writing to the proper authorities in charge of streets, gas, water pipes, sewer lines, electric, and other conduits, railroads, poles, manholes, catch

basins, and all other property that may be affected by the Contractor's operations, at least 48 hours before breaking ground.

G. In the event of interruption to water or utility services as a result of accidental breakage, the Contractor shall promptly notify the proper authority. The Contractor shall cooperate with said authority in the restoration of service as promptly as possible.

H. Attention is directed to ***Subsection 105.06, "Cooperation with Utilities."***

I. All utility valves, manholes, vaults, pull boxes, etc., which are buried, shall be conspicuously marked by the Contractor to allow their location to be determined by the Engineer or utility personnel under adverse conditions (i.e. inclement weather or darkness).

107.18 FURNISHING RIGHT-OF-WAY

A. The Owner will be responsible for the securing of all right-of-ways shown in the plans. Any exceptions will be indicated in the contract.

B. Contractor shall provide copy of necessary permits and written consent from property owner(s) prior to entering or occupying any lands outside the right-of-way or easement or where no Authorization to Enter Property exists.

107.19 BLANK

107.20 NO WAIVER OF LEGAL RIGHTS

A. The Contracting Agency shall not be precluded or estopped by any measurements, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefor, from showing the true amount and character of the work performed, and materials furnished by the Contractor, nor from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor that the work or materials do not in fact conform to the contract. The Owner shall not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor or the Contractor's sureties, or both, such damages as it may sustain by reason of the Contractor's failure to comply with the terms of the contract. Neither the acceptance by the Contracting Agency, or any representative of the Contracting Agency, nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Contracting Agency, shall operate as a waiver of any portion of the contract or of any power herein reserved, or of any right to damages. A waiver of any breach of the contract shall not be held to be a waiver of any other or subsequent breach.

107.21 DUST CONTROL

A. Dust that originates from the Contractor's operations, either inside or outside the right-of-way, shall be controlled at all times by the Contractor in accordance with federal, state, and local laws, ordinances, and regulations at the sole expense of the Contractor.

B. A permit from the Clark County Air Pollution Officer shall be obtained by the Contractor prior to the start of construction operations.

C. Reference is made to ***Section 637, "Pollution Control."***

107.70 CONTRACTOR'S RESPONSIBILITY TO THE PUBLIC

A. The Contractor is responsible to answer and resolve any conflicts that may arise between a homeowner or business owner and himself during the construction process.

107.71 ALLOWABLE WORK HOURS

A. No work between the hours of 6 p.m. and 7 a.m. will be allowed in residential areas unless approved by the Engineer or otherwise stated in the Special Provisions. If work after the aforementioned hours is approved, then the Contractor shall provide each affected resident at least forty-eight (48) hours written notice explaining the reason for the work after hours and providing an approximate duration of the activity.

107.72 NATURAL DRAINAGE AND STORM WATER RUNOFF

A. The Contractor shall be responsible for protecting and preserving public and private property from damage directly or indirectly caused by drainage or storm water runoff leaving the project during construction of all improvements, including downstream properties if damage is a result of the Contractor's actions in diverting or redirecting existing natural runoff patterns.

END OF SECTION 107

SECTION 109 – MEASUREMENT AND PAYMENT

109.01 MEASUREMENT OF QUANTITIES

A. The measurements and determination of the number of units of each pay item will be made in general as prescribed hereinafter and specifically as set out under "Method of Measurement" and "Basis of Payment" in the specification of each pay item.

B. After the items of work are completed and before final payment is made, the Engineer will determine the quantities of the various items of work performed as the basis for final settlement for all other than lump sum contracts. In the case of unit price items, the Contractor will be paid for the actual amount of work performed and materials used in accordance with these specifications, as shown by the final measurements, unless otherwise specified.

C. Actual authorized quantities of work satisfactorily completed under the contract, shall be measured by the Engineer in accordance with United States Standard Measures, and well recognized engineering practices. Unauthorized wastings of material will be deducted and only such quantities as are actually incorporated in the completed work will be included in the final estimate. The planimeter shall be considered an instrument of precision adapted to the measurement of areas, but other acceptable methods may be used.

D. Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures having an area of 9 square feet or less. Unless otherwise specified, transverse measurements for area computation will be the neat dimensions shown on the plans or ordered in writing by the Engineer.

E. In computing volumes of excavation, embankment, and borrow, the average end area method will be used unless otherwise specified.

F. All items that are measured by the linear foot such as pipe culverts, underdrains, guardrails, etc., shall be measured parallel to the base or foundation upon which such structures are placed, unless otherwise shown on the plans.

G. Items may be measured by surface area, either square foot or square yard. The term "gage" when used in connection with the measurement of plates, shall mean the U.S. Standard Gage. When reference is made, however, to the measurements of galvanized sheets used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing, the term "gage" shall mean that specified in the respective test designation for the material as described in the "Materials" section of these specifications.

H. When the term "gage" refers to the measurement of wire, it shall mean the wire gage specified in the AASHTO M 32 for cold drawn steel wire for concrete reinforcement.

I. Unless otherwise specified, water meters shall be accurate to within 2 percent of the indicated amount. The frequency of checking water meters will be determined by the Engineer.

J. The term ton shall mean the short ton consisting of 2,000 pounds avoirdupois. All materials that are specified for measurement by ton shall be weighed on accurate, approved scales set at locations designated by the Engineer. All materials shall be weighed on platform scales with the following exception: In lieu of platform scales, the

Contractor may provide an automatic printer system that will print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching control system. Such a system shall issue a weigh ticket for each load. The Contractor shall have on hand not less than ten 50-pound standard weights for testing the scales.

K. Scales:

1. All scales shall be furnished by and at the expense of the Contractor and shall have a certificate of inspection by the Bureau of Weights and Measures. The scales shall be tested and inspected by the Bureau of Weights and Measures and a new inspection certificate required as often as the Engineer may deem necessary, and after each scale move, in order to ensure the accuracy of the scales. The cost of inspecting the scales shall be borne by the Contracting Agency.

2. Platform scales shall be of sufficient size and capacity to weigh, in one operation, the entire loaded vehicle. Combination vehicles may be weighed as separate units, provided the connecting device between vehicles is so constructed that no weight other than that of the device itself is transmitted to either vehicle. When combination vehicles are used, approaches to and from the scale platform shall be level for sufficient distance to accommodate that portion of the combination vehicle that is off the scale platform. In instances where combination vehicles are weighed, the approaches to and from the scale platform shall be level with the scale platform for a minimum distance of 50 feet from each end of the scale platform.

3. If combination vehicles are utilized, provisions shall be made to ensure that all braking devices are disengaged during weighing operations as insurance against stresses being transmitted between either vehicle.

4. The scale pit shall be of sufficient width to permit access to all scale components for purposes of inspection, repair, cleaning, and adjusting.

5. Support members for platform scales shall consist of 12-inch by 12-inch or 6-inch by 16-inch (minimum) timbers placed on a firm gravel foundation. Scales consisting of more than one section shall be supported with 12-inch by 12-inch or 6-inch by 16-inch (minimum) timbers at each end of each section to avoid settlement of the scale platform. Concrete support members conforming to the minimum timber size requirements may be utilized in lieu of timber at the Contractor's option.

6. Platform scales shall be equipped with weatherproof housing so constructed as to protect the recording device and permit the weighmaster convenient access to all beams and dials. The housing shall not be less than 6 feet wide, 8 feet long, and 7 feet high; shall have 2 windows, adjustable for ventilation with one facing the scales; and shall be equipped with an adequate shelf suitable to the Engineer. The Contractor shall provide heat and electric lights when requested by the Engineer.

7. Conveyor scales of an approved type may be used. The conveyor scales shall be furnished with 1 master counter to run continuously and 1 remote counter which will print the weight in individual loads, then reset to zero automatically. The remote unit shall be placed in a weatherproof house with 2 windows. One window shall face the point of loading and the conveyor scales. This window shall also be equipped with a shelf 2 feet wide and 6 feet long. A controlled method of heating shall be supplied for cold weather operations.

8. A locked door shall be provided on the access to the conveyor balances (where fine adjustment must be made). The key shall be in the hands of the Engineer and the door shall be opened only for maintenance and adjustment of conveyor scales to meet the accuracy of the platform scales. This door shall be locked at all times during the operation of the conveyor scales. If conveyor weighing equipment is used, the following procedures shall be followed:

    a. The conveyor scales shall be calibrated against the platform scales, which shall have a certificate of inspection.

    b. At the beginning and middle of each shift, or as requested by the Engineer, 2 consecutive loads of material weighed over the conveyor scales shall be reweighed on the platform scales. The total weight indicated by the conveyor scales on the 2 loads shall check with the platform scale weight within 0.5 percent. If the conveyor scales weigh out of this tolerance, all loads shall be weighed on the platform scales until the condition is rectified.

    c. Consecutively numbered, individual weigh tickets shall be used with conveyor scale weights stamped by the remote counter.

L. Unless otherwise specified, materials shipped by rail shall be weighed over the authorized project scales before incorporation into the work.

M. Cement will be measured by the barrel or ton. The term "barrel" will mean 376 pounds of cement.

N. Timber will be measured by the thousand feet board measure (Mfbm) actually incorporated in the structure with no allowance for any waste except beveled ends. Measurement will be based on nominal widths and thicknesses, and the extreme length of each piece.

O. When a complete structure or structural unit (in effect, "lump sum" work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

P. All materials for which measurements are obtained by the cubic yard "loose measurement" or "measured in the vehicle" shall be hauled in approved vehicles and measured therein at the point of delivery. No allowance will be made for the settlement of material in transit. Vehicles for this purpose may be of any size or type acceptable to the Engineer, provided that the body is of such shape that the actual delivered contents may be readily and accurately determined and will remain constant. Unless all approved vehicles on the work are of uniform capacity, each vehicle shall bear a plainly legible identification mark, indicating its specified approved capacity. All vehicles shall be loaded to at least waterlevel capacity. Loads not hauled in approved vehicles or of a quantity less than the specified approved quantity for the hauling vehicle will be subject to rejection and no compensation will be allowed for the hauling of the material.

Q. Liquid Asphalts, Asphalt Cement, and Asphaltic Emulsions:

1. The unit of measurement for liquid asphalts, asphaltic emulsions, and paving asphalts shall be a ton or gallon at 60 degrees F.

2. Quantities of bituminous binders wasted or disposed of in a manner not called for under these specifications, or remaining on hand after completion of the work, will not be paid for.

3. When permitted by the Engineer, pay quantities of bituminous binder may be determined from volumetric measurements of the bituminous binder, in which case the bituminous binder shall be delivered in calibrated tanks and each tank shall be accompanied by its proper measuring stick and a calibration card signed by a sealer of weight and measures, and pay quantities shall be determined in accordance with the following procedure.

4. Volumetric measurements at any temperature shall be reduced to the volume the material would occupy at 60 degrees F, before converting the volumetric measurements to weight.

5. The following tables shall be used to convert volumes from gallons to weight. All types, SC, MC, and RC of the same grade shall be considered to have equal weights and volume.

AVERAGE WEIGHTS AND VOLUMES OF LIQUID ASPHALT AT 60 DEGREES FAHRENHEIT

Grade of Liquid Asphalt	Gallons Per Ton	Pounds Per Gallon
70	253	7.90
250	249	8.03
800	245	8.16
3000	241	8.30

AVERAGE WEIGHTS AND VOLUMES OF ASPHALT CEMENT AT 60 DEGREES FAHRENHEIT

Grade	Gallon Per Ton	Pounds Per Gallon
AC-40	233	8.59
AC-30	235	8.51
AC-20	235	8.51
AC-10	237	8.43

AVERAGE WEIGHTS AND VOLUMES OF ASPHALTIC EMULSION AT 60 DEGREES FAHRENHEIT

Type of Emulsion	Gallon Per Ton	Pounds Per Gallon
All Grades	240	8.33

6. When converting the volume of liquid asphalt, asphalt cement, or asphaltic emulsion at any temperature to the volume of 60 degrees F, a conversion factor for correlation shall be used. Said conversion factors shall be those prescribed in The Asphalt Institute (Pacific Coast Division) publication "Asphalts -- Paving Liquids and Emulsions" (PCD-7).

R. Rental of equipment will be measured by time within 1/2 hour of actual working time and necessary traveling time of the equipment within the limits of the project. If equipment has been ordered on the job on a standby basis by the Engineer, half-time rates for the equipment will be paid.

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END OF SECTION 109

SECTION 201 – CLEARING AND GRUBBING

DESCRIPTION

201.01.01 GENERAL

A. This work shall consist of clearing, grubbing, removing, and disposing of all vegetation and debris within the limits of construction, except such objects as are designated to remain or be removed in accordance with other sections of these specifications. This work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.

CONSTRUCTION

201.03.01 GENERAL

A. The Engineer will establish clearing limits and designate all trees, shrubs, plants, and other things to remain. Areas to be cleared will be as set forth in ***Subsection 201.03.02, "Areas to be Cleared."*** The Contractor shall preserve all things designated to remain. Paint required for cut or scarred surfaces of trees or shrubs selected for retention shall be an approved asphaltum base paint prepared especially for tree surgery. ***Subsection 107.21, "Dust Control"*** shall be complied with.

201.03.02 AREAS TO BE CLEARED

A. Areas to be cleared shall be one or more of the following:

1. The entire area upon which the project construction is to be performed to the width of the excavation and embankment slope lines.
2. Ditch and dike areas to the width of the slope lines.
3. Areas on which service roads or ramps, streets, approaches, and all other accessory roads and connections are to be constructed, such areas to extend to the width of the excavation and embankment slope lines.
4. Designated material sites and designated borrow pits.
5. Areas designated in the plans or Special Provisions.

201.03.03 CLEARING AND GRUBBING

A. Surface objects and trees, stumps, roots, and other protruding obstructions, designated for removal, shall be cleared or grubbed or both. Unless otherwise specified, the Contractor may leave stumps and nonperishable solid objects provided they do not extend more than 6 inches above the ground line or low water level, and are a minimum of 3 feet below subgrade or embankment slope.

B. The Engineer may permit sound stumps to be cut off not more than 6 inches above the ground and to be left outside of the construction limits of cut and embankment areas, except in the area to be rounded at the top of backslopes where stumps are to be cut off flush with or below the surface of the final slope line.

C. Where feasible, trees shall be felled toward the center of the area to be cleared. Where trees cannot be felled without danger to traffic or injury to other trees, structures, or property, the trees shall be cut in sections from the top down.

D. There shall be no burning unless approval has been given in writing by the Clark County Air Pollution Control Officer and this approval concurred with by the Engineer. If perishable material is burned, it shall be burned under the constant care of competent watchmen at such times and in such a manner that anything designated to remain on the right-of-way, the surrounding forest cover, or other adjacent property will not be jeopardized. Burning shall be done in accordance with applicable laws, regulations, and ordinances.

E. When permitted by the Engineer, materials, debris, and perishable materials may be removed from the right-of-way and disposed of at locations off the project outside the limits of view from the project with the written permission of the property owner on whose property the materials and debris are placed. The Contractor shall make all necessary arrangements with property owners for obtaining suitable disposal locations and the cost involved shall be included in the unit price bid. Attention is directed to ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

F. Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable materials and compacted in accordance with ***Subsection 203.03.18, "Compaction, Dirt Embankment"*** or ***Subsection 203.03.19, "Compaction, Rock Embankment"*** if within the staked prism. Payment for backfilling and compacting will be considered subsidiary to other items of the work and no further compensation will be made therefor.

G. All merchantable timber in the clearing area shall become the property of the Contractor unless otherwise provided. Timber and debris may be stored or decked within the right-of-way only in areas approved by the Engineer and shall be removed prior to final acceptance of the project.

H. Low hanging branches and unsound or unsightly branches on trees or shrubs designated to remain shall be removed as directed. Branches of trees extending over the road shall be trimmed to give a clear height of 20 feet above the road surface. All trimming shall be done by skilled workmen and in accordance with good tree surgery practices.

I. Scalping shall include the removal of material such as brush, roots, sod, grass, residue of agricultural crops, sawdust, and decayed vegetable matter from the surface of the ground.

J. Unless otherwise permitted by the Engineer, the Contractor shall scalp areas where excavation or embankment is to be made, except that mowed sod need not be removed where the embankment to be constructed is 4 feet or more in height to subgrade elevation.

END OF SECTION 201

SECTION 202 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

DESCRIPTION

202.01.01 GENERAL

A. This work shall consist of the removal, wholly or in part, and satisfactory disposal of all buildings, fences, guardrails, structures, old pavement, abandoned pipelines, and any other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed of under other items in the contract. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes, and pits.

CONSTRUCTION

202.03.01 GENERAL

A. The Contractor shall raze, remove, and dispose of all buildings and foundations, structures, guardrail, culvert markers and guide posts, fences, and other obstructions, any portions of which are on the right-of-way, except utilities and those for which other provisions have been made for removal. All designated salvable material shall be removed, without unnecessary damage, in sections or pieces which may be readily transported, and shall be stored by the Contractor at specified places within the project limits. Unusable material shall be disposed of in accordance with ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."*** Basements or cavities left by structure removal shall be filled to the level of the surrounding ground and, if within the prism of construction, shall be compacted in accordance with ***Subsection 203.03.18, "Compaction, Dirt Embankment"*** or ***Subsection 203.03.19, "Compaction, Rock Embankment."***

202.03.02 REMOVAL

A. Bridges, culverts, and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic.

B. All operations necessary for the removal of any existing structure which might endanger the new construction shall be completed prior to the construction of the new work. No equipment or devices shall be used which might damage structures, facilities, or properties which are to be preserved and retained.

C. Unless otherwise directed, the substructures of existing structures shall be removed down to the natural stream bottom and those parts outside of the stream shall be removed down one foot below natural ground surface. Where such portions of existing structures lie wholly or in part within the limits for a new structure, they shall be removed as necessary to accommodate the construction of the proposed structure.

D. Operations necessary for the removal of an existing structure or obstruction, which may damage new construction, shall be completed prior to placing the new work.

E. Bituminous pavement shall be removed to clean straight lines. Saw cutting of edges to be joined is required. Where only the surface of existing bituminous pavement is to be removed by heater-planing, or by other approved methods, a minimum laying depth of

1 inch of new pavement material shall be provided at the joint line. Where bituminous pavement adjoins a trench, the edges adjacent to the trench shall be saw cut to neat straight lines before resurfacing.

F. Concrete pavement shall be removed to neatly sawed edges. Saw cuts shall be made to a minimum depth of 1-1/2 inches. If a saw cut in concrete pavement falls within 3 feet of a construction joint, cold joint, expansion joint, or edge, the concrete shall be removed to the joint or edge. The edges of existing concrete pavement adjacent to trenches, where damaged subsequent to saw cutting of the pavement, shall again be saw cut to neat straight lines for the purpose of removing the damaged pavement areas. Such saw cuts shall be either parallel to the original saw cuts or shall be cut on an angle which departs from the original saw cut not more than 1 inch in each 6 inches.

G. Concrete curb, walk, gutters, cross gutters, driveways, and alley intersections shall be removed to nearest score line or joint.

H. In removing manholes, catch basins, and inlets, any live sewers connected to item shall be rebuilt and properly reconnected and a satisfactory bypass service shall be maintained during such construction operations. When abandoning manholes, catch basins, and inlets, they shall be thoroughly cleaned and existing pipe connections shall be plugged with concrete of the class and grade specified for structures. The portions of the structures shall then be removed to the required elevations and any necessary backfill shall be placed and compacted to specifications.

202.03.03 EXTENSIONS

A. Where existing culverts and bridges are to be extended or otherwise incorporated in the new work, only such part or parts of the existing structure shall be removed as is necessary to provide a proper connection to the new work. The connecting edges shall be cut, shaped, and trimmed to the required lines and grades without weakening or damaging the part of the structure to be retained. Reinforcing bars which are to be left in place, so as to project into the new work as dowels or ties, shall not be injured during removal of concrete.

202.03.04 CLOSING CULVERTS

A. Existing culverts within construction limits, the top of which are 5 feet or more below finished roadway grade, shall be abandoned and closed unless otherwise noted on the plans. The headwalls of such culverts, or any part of the structure that is within 3 feet of the finished grade line shall be removed. The ends of the culvert shall be completely filled with satisfactory soil for a distance of at least 2 feet, plus the height of the opening of the structure.

202.03.05 SALVAGE

A. When specified, gravel, roadmix, or plantmix surface suitable for reuse shall be removed to the depth required and surfacing so removed shall be carefully salvaged and placed in compact stockpiles at locations approved by the Engineer. Care shall be exercised to prevent contamination of stockpiled material. Any remaining unsuitable material shall be scarified and incorporated in embankment as set forth in ***Section 203, "Excavation and Embankment."***

B. Fences and gates designated for reuse shall be removed in such a manner that all material can be salvaged. Wire shall be carefully removed from the posts and rolled in rolls of a size that can be conveniently handled. Posts shall be removed by methods that will keep breakage to a minimum.

C. Guardrail, culvert markers, and guide posts designated for reuse shall be removed in such a manner that all material can be salvaged. Bolts, supports, and other hardware shall be removed from all rails, plates, and posts and all parts shall be sorted and stored at the locations specified. Rail, plates, and posts shall be properly stacked and miscellaneous hardware shall be stacked or boxed and reasonable care exercised in handling, storage, and preservation of materials as will ensure the maximum salvage value for the entire operation. Attention is directed to ***Section 619, "Object Markers and Guide Posts."***

D. When specified for salvage, structural steel removed from old structures shall be stored in a neat and presentable manner on blocking and at locations suitable for loading. Structures or portions thereof which are specified for re-erection shall be stored in separate piles.

E. When re-lay culvert pipe is required, the Contractor shall remove the pipe in such a manner as not to damage the material in any way. If no particular pipe is noted for re-lay, the Contractor shall salvage and clean sufficient amount of the best available pipe to satisfy the re-lay pipe item.

F. Timber or piling from all structures designated to be salvaged shall have all nails and bolts removed therefrom and shall be stored in neat piles at locations suitable for loading.

202.03.06 DISPOSING OF MATERIALS

A. Unless otherwise provided, excavated material shall be used in backfilling excavations made in removing the structure, in constructing embankment, or otherwise disposed of in a manner satisfactory to the Engineer.

B. When the placement of riprap and similar structures is included in the proposal, suitable broken concrete or masonry removed from old structures may be used in such construction. Any concrete or masonry which cannot be placed in backfills or embankments or used as riprap, shall be disposed of in accordance with ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."*** The material shall not be placed where it will obstruct any drainage course.

C. When concrete or masonry is placed in embankments, it shall be placed in accordance with ***Subsection 203.03.16, "Embankment Materials."***

END OF SECTION 202

SECTION 203 – EXCAVATION AND EMBANKMENT

DESCRIPTION

203.01.01 GENERAL

A. This work shall consist of grading and excavating the roadway, excavating borrow pits, removing slide material, and excavating ditches and stream channels and satisfactorily disposing of all excavated material and all work necessary for the construction and completion of cuts, embankments, slopes, ditches, dikes, stream channels, approaches, parking areas, intersecting driveways and highways, and subsidiary work. Exceptions are slope rounding, structure excavation, or other separately designated pay items of work, which are made a part of the contract. All work shall be in conformity with the alignment, grades, and cross sections shown on the plans or established by the Engineer.

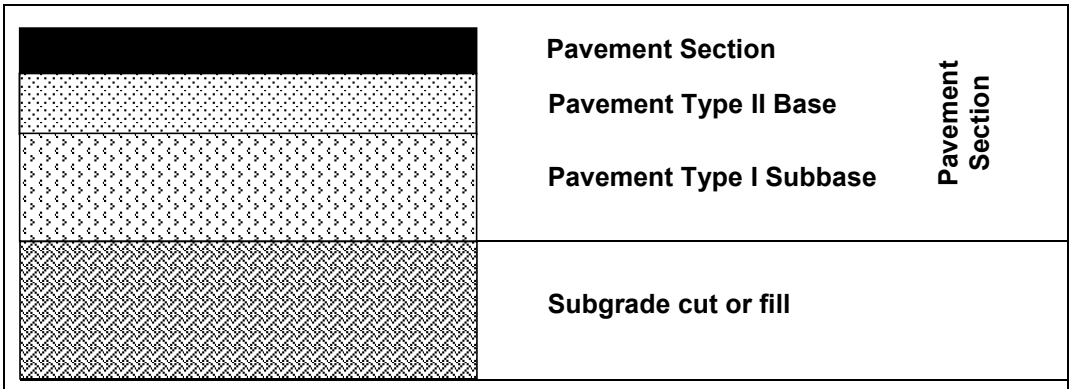


Figure 1- Definition of Terms

B. The compacted subgrade shall be maintained at optimum moisture content until placement of an aggregate base course.

MATERIALS

203.02.01 ROADWAY EXCAVATION

A. Roadway excavation shall consist of all excavation involved in grading and constructing the roadway and appurtenances, irrespective of the nature or type of material encountered; except excavation designated as structure excavation, drainage excavation, channel excavation, and borrow excavation when these items are provided as items of work under the contract. Dividing the project into construction stages shall not be construed as separate material classifications.

B. When cementitious material is encountered within the excavation limits, the treatment, removal, trimming, and working of that material shall be considered as incidental to the excavation work.

203.02.02 DRAINAGE EXCAVATION

A. Drainage excavation shall include all excavation in the construction of open ditches less than 12 feet in bottom width, excepting ditches that are part of the roadway prism as shown in the plans. The nature or type of material encountered shall have no bearing on the classification of material.

B. When cementitious material is encountered within the excavation limits, the treatment, removal, trimming, and working of that material shall be considered as incidental to the excavation work.

203.02.03 CHANNEL EXCAVATION

A. Channel excavation shall include all excavation in the construction of open ditches or stream channels with a bottom width of 12 feet or more with the exception of ditches that are part of the roadway prism as shown in the plans. The nature or type of material encountered shall have no bearing on the classification of material.

B. When cementitious material is encountered within the excavation limits, the treatment, removal, trimming, and working of that material shall be considered as incidental to the excavation work.

203.02.04 BORROW

A. Borrow shall consist of approved material excavated and used in the construction of fills, or for other construction purposes. Borrow shall be material that is excavated from sources specified in the Special Provisions or designated by the Engineer. The source of material to be excavated shall be approved in advance by the Engineer. Borrow shall be excavated to the lines and grades established by the Engineer.

B. The Contractor shall notify the Engineer, sufficiently in advance, of opening any borrow site so that adequate time will be allowed for testing the material and establishing cross section elevations and measurements of the ground surface. The widening of roadway cuts shall be considered as roadway excavation and not as borrow, unless otherwise specified. Borrow excavation will not be classified according to type or character of material encountered in the borrow area unless otherwise required in the Special Provisions.

203.02.05 SELECTED BORROW

A. Selected borrow shall consist of approved material required for the construction of embankments within the required limits shown on the plans or directed by the Engineer, and shall be obtained from approved sources.

B. Selected borrow shall conform to the requirements set forth in the Special Provisions.

CONSTRUCTION

203.03.01 ROADWAY EXCAVATION

A. All excavation shall be made true to lines and grades staked by parties under the supervision of a Nevada licensed professional land surveyor working for the Engineer or Contractor and shall be so conducted as to avoid removing or loosening any material outside the required slopes. If any material is so disturbed, it shall be replaced and thoroughly compacted to the required cross section, unless such replacement is impractical as determined by the Engineer.

B. The work done under this section shall begin at some definite point or points on the project subject to the approval of the Engineer, and the work shall progress toward completion in an orderly manner. The roadway shall be graded to full cross section width before placing base or surfacing of any type, unless otherwise specified.

C. Intersecting roads, service highways, ramps, approaches, and driveways shall be graded as shown on the plans or established by the Engineer.

D. All suitable material removed from the excavation shall be used as far as practicable in the formation of embankments, subgrade, shoulders, slopes, dikes, and backfill for structures, unless otherwise indicated on the plans or specifications herein or disposed of in a manner satisfactory to the Engineer. Excavated material shall not be wasted without permission.

203.03.02 GRADE TOLERANCE

A. Immediately prior to placing subsequent layers of material thereon, the grading layer shall conform to one of the following:

1. The subgrade shall not vary more than 0.10 foot above or below the grade established by the Engineer or Contractor.

2. The final subgrade layer prior to application of the structural base shall not vary more than zero foot above or 0.10 foot below the grade.

203.03.03 UNSUITABLE MATERIAL

A. Unsuitable material as defined in Section 101 “Definitions”, and that is unsuitable for planned use, including material below the natural ground surface in embankment areas, shall be excavated and disposed of in a manner approved by the Engineer or as specified in the contract documents.

B. When unsuitable material is removed and disposed of, the resulting space shall be filled with material suitable for the planned use. Such suitable material shall be placed and compacted in layers as specified below under embankment.

C. Disposal of material outside the right-of-way shall be in accordance with ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

203.03.04 BLASTING

A. Any material outside the authorized cross section on the backslopes which may be shattered or loosened because of blasting shall be removed by the Contractor at no additional cost to the Contracting Agency. Shattered or loosened material below the bottom limits of required excavation shall be uniformly distributed and compacted or otherwise disposed of in a manner satisfactory to the Engineer. The Contractor shall discontinue any method of blasting which leads to overshooting or is dangerous to the public or destructive to property or to natural features.

B. The use of coyote holes in blasting is prohibited. Attention is directed to ***Subsection 107.10, "Explosives."***

203.03.05 ROCK CUTS

A. In excavating side hill rock cuts and rock cliffs, the Contractor shall exercise care and use precautionary methods so as not to break down, loosen, or otherwise damage supporting rock below the bottom limits of required excavation. In general, such cuts shall be worked from the top of lifts of such height that will not damage the bench of rock below the bottom limits of required excavation. The Contractor shall be responsible for the methods used and for any damage to the roadbed resulting from Contractor's operations.

B. The slope of all rock cuts shall be scaled and dressed to a safe, stable condition by removing all loose spalls and rock not firmly keyed to the rock slope. Overhanging rock shall be removed when, in the opinion of the Engineer, it may be a hazard to public use of the roadway.

C. In solid rock excavation, slopes shall be constructed to the approximate neat lines staked by the Engineer. No rock shall project or overhang more than 12 inches from the true slope.

203.03.06 OVERBREAK

A. Overbreak is that portion of material excavated, displaced or loosened outside and beyond the slopes or grade as staked or re-established, regardless of whether any such overbreak is due to blasting, the inherent character of any formation encountered, or to any other cause. Slides and slipouts as defined in ***Subsection 203.03.11, "Slides and Slipouts,"*** and that portion of rock subgrade as set forth below shall not be considered overbreak. All side slope overbreak as so defined shall be removed by the Contractor and shall be disposed of in the same manner as provided for the surplus under the heading of "Surplus Material," but at no additional cost to the Contracting Agency and without any allowance for overhaul.

B. Rock removed to a maximum depth of 6 inches below subgrade will be measured for payment as described in ***Subsection 203.04.01.C.2, "Overbreak."***

203.03.07 SLOPES

A. All excavation and embankment slopes, except in solid rock, shall be trimmed to the lines staked by the Engineer. The degree of smoothness shall be that normally obtained by hand shovel operations or blade grader operations.

203.03.08 WIDENING CUTS

A. If the Engineer directs the Contractor to excavate beyond the limits of the typical cross section originally proposed and within the limits of the right-of-way, the Contractor shall do so and compensation therefor will be as set forth in ***Subsection 203.04.01.C.3, "Widening Cuts."***

203.03.09 SURPLUS MATERIAL

A. Unless otherwise specified in the contract documents, surplus excavated material shall be used to widen embankments uniformly, or to flatten slopes, or at other locations, all in a manner satisfactory to the Engineer. No surplus material shall be disposed of above the grade of the adjacent roadbed nor shall the Contractor waste any material unless approved in writing by the Engineer.

B. If the quantity of surplus material is specified in the contract documents, such quantity shall be considered approximate only. The Contractor shall verify that there is sufficient material available for the completion of the embankments within the areas involved before disposing of any indicated surplus material inside or outside the right-of-way. Any shortage of material caused by premature disposal of the indicated surplus material by the Contractor shall be replaced by the Contractor and no compensation will be allowed the Contractor for such replacement.

203.03.10 SELECTED MATERIAL

A. When specified in the contract documents, or when selected by the Engineer, suitable selected material encountered in excavating or widening the roadway prism or any other excavation within the right-of-way, or in the excavation or borrow, shall be used for finishing the top portion of the subgrade. The top portion of the subgrade shall be 2 feet in depth, or as determined by the Engineer.

B. Selected material shall be defined as material that is excavated from one or more of the above sources and is used for selective purposes.

C. When practical, selected material shall be hauled directly from excavation to its final position and compacted in place and such work shall be paid for at the contract unit price for the excavation item involved. Attention is directed to ***Subsection 104.05, "Rights In and Use of Materials Found on the Project."***

D. When the transporting of selected material directly from excavation to its final position is impractical, the selected material shall be left in place until it can be placed in final position and no additional compensation will be made because of the delayed excavation. If, however, the conditions are such that the undisturbed selected material will hamper

ordinary grading operations or cause unnecessary movements of equipment, the Engineer may order, in writing, the removal of sufficient selected materials and the stockpiling thereof to enable practical hauling operations. If the excavation and stockpiling of selected material is specified in the contract documents or is ordered by the Engineer, the excavation and stockpiling locations shall be designated by the Engineer. The selected material shall be removed from the stockpile and placed in final position when approved by the Engineer.

E. Measurement for payment of selected material will be in accordance with ***Subsection 203.04.01.C.4, "Selected Material."***

203.03.11 SLIDES AND SLIPOUTS

A. Material outside the planned roadway or ditch slopes that is unstable and constitutes potential slides in the opinion of the Engineer, material from slides that has come into the roadway or ditch, and material that has slipped out of new or old embankments shall be excavated and removed. The material shall be excavated to designated lines or slopes either by benching or in a manner approved by the Engineer. Such material shall be used in the construction of the embankments or disposed of as approved by the Engineer.

B. The above provisions shall not be so construed as to relieve the Contractor from the duty of maintaining all slopes true and smooth. Erosion, regardless of amount or extent, caused by the action of the elements which results in damage to work or materials, shall in no case be considered a slide or slipout. Measurement for payment will be in accordance with ***Subsection 203.04.01.C.6, "Slides and Slipouts."***

203.03.12 DRAINAGE

A. During construction of the roadway, the roadbed shall be maintained in such condition that it will be well drained at all times.

B. V-type ditches shall be formed to the cross section and dimensions on the plans by means of suitable equipment, which will deposit all loose material on the downhill side. The bottom of the finished ditches shall not be less than 2 feet 6 inches below the crest of the loose material piled on the downhill side.

C. In going from cut-to-fill, the roadway ditches shall be so cut as to avoid damage to embankments by erosion.

D. The flat-bottom ditches indicated on the plans, or staked by the Engineer, shall be excavated to the required cross section and grade. Materials so obtained shall be used to construct roadway embankments or dikes or both, to form a continuous diversion channel as staked by the Engineer.

203.03.13 CHANNELS

A. To avoid destruction of natural growth during construction of ditches, channels, or dikes, travel of equipment shall be confined to the construction limits. Where ditches, channels, and dikes are nearly parallel to the roadway, turn-around shall not be located closer than

200 feet apart. Attention is directed to ***Subsection 107.12, "Protection and Restoration of Property and Landscape."***

B. Fine grading of channel bottoms will not be required unless paving is specified.

203.03.14 BORROW

A. A possible source of borrow material may be indicated in the contract documents. If the Contractor desires to use borrow materials from sources other than those described in the contract documents, the Contractor shall, at no additional cost to the Contracting Agency, acquire the necessary right to take materials and pay all costs involved. All costs of exploring such alternate sources shall be borne by the Contractor. Use of material from these sources will not be permitted until approved in writing by the Engineer.

B. The Contractor shall, at the time of execution of the contract, execute an "Agreement" for all borrow deposits obtained under an "Option and Agreement for Sale of Materials" when said "Option" is contained in the Special Provisions. This agreement shall be executed whether the material is to be used or not.

C. In case designated borrow deposits fail to contain the necessary quantity of acceptable material, the Contractor shall immediately notify the Engineer in writing. The Engineer shall thereupon investigate, and if the Engineer's investigation shows that there is not sufficient quantity of acceptable material, the Engineer shall designate an alternate deposit from which to obtain the deficit.

D. In all borrow pits having undesirable material, including overburden, refuse, organic and deleterious substances, the material shall be removed and wasted or redistributed, in a manner satisfactory to the Engineer. All costs incurred therefor shall be considered as incidental and subsidiary to the borrow material.

E. Borrow shall not be obtained until all other excavation items are complete to the extent necessary to determine the need for borrow.

F. The Contractor shall notify the Engineer 30 days in advance of opening any borrow areas so that cross section elevations and measurements of the ground surface after stripping may be taken, and the borrow materials can be tested before being used. Sufficient time for testing of the borrow material shall be allowed.

G. Borrow deposits shall be excavated to regular lines as staked to permit accurate measurement. The dimensions of the borrow deposit will be designated and the Contractor shall not excavate below the depth or outside limits given, except with prior approval. The depth of excavation throughout the area of the borrow pits shall be as uniform as practicable and the side slopes shall conform to the requirements of ***Section 626, "Final Cleanup."*** Unless otherwise permitted, borrow pits shall be excavated so that the pits will drain to the nearest natural outlet.

H. All materials that are not satisfactory for use for the purposes intended shall be rejected at the pit and disposed of in a manner satisfactory to the Engineer.

I. If the Contractor excavates more material than is required, the excess will not be measured for payment.

J. All work and materials required to build and maintain borrow haul roads and obliteration of haul roads in accordance with ***Section 626, "Final Cleanup"*** shall be considered subsidiary to the "borrow" item and no further compensation will be allowed.

203.03.15 FOUNDATION

A. When embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is to be built one half width at a time, the slopes that are steeper than 5:1, when measured at right angles to the roadway, shall be continuously benched as the work is brought up in layers. Benching shall be of sufficient width to permit operations of placing and compacting equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus cut out shall be recompacted along with the new embankment material at no additional cost to the Contracting Agency.

B. All foundations for embankment shall be cleared and grubbed in accordance with ***Section 201, "Clearing and Grubbing."***

C. In designated areas, unsuitable material shall be removed and disposed of as prescribed in ***Subsection 203.03.03, "Unsuitable Material."***

D. Where 12 inches or less of embankment is placed over existing bituminous surface, such surface shall be removed and incorporated in the embankment or otherwise disposed of as approved by the Engineer. Where more than 12 inches of embankment is placed over existing bituminous surface, such surface shall be left undisturbed. Measurement for removal of existing bituminous material will be measured and paid for as roadway excavation unless the contract documents specifically call for payment under ***Section 202, "Removal of Structures and Obstructions."***

203.03.16 EMBANKMENT MATERIALS

A. Embankments shall be constructed with suitable materials, excavated as prescribed and with any excess materials from other operations which are acceptable and suitable for use.

B. All materials used in embankment shall be free from objectionable material such as leaves, grass, roots, logs, stumps, brush, or other perishable material.

C. When there is a choice of material, the excavation shall be made so the best material will be placed on top of the embankment for at least 1 foot in depth. This paragraph shall not be interpreted as to require the Contractor to stockpile and subsequently rehandle embankment materials except as provided in ***Subsection 203.03.10, "Selected Material."***

D. Material shall not be placed in the embankment when either the material, foundation, or the embankment on which it would be placed is frozen.

E. Where embankments are to be made of material from rock cuts or other material that is unsuitable for finishing the roadbed, the upper 6 inches of the roadbed shall be formed of approved material.

F. Embankment material for the detention basin berm shall be granular backfill in accordance with ***Subsection 207.02.02 "Granular Backfill."***

203.03.17 PLACING EMBANKMENT

A. For embankment or backfill deposited against structures, attention is directed to Subsection 207.03.02, "Placing and Compacting at Abutments, Piers, Wingwalls and Retaining Walls."

B. Where structure abutments are placed on embankment, the embankment shall be constructed to subgrade elevation prior to excavating for the construction of the abutment. Where the abutment is supported on piles, the embankment shall be constructed to the elevation of the bottom of the footing.

C. Where a structure is to be covered by a rockfill, it shall be covered with not less than 2 feet of satisfactory soil or granular materials before the rock embankment is placed over the structure.

D. Embankments shall, except as specified herein, be constructed in layers. The construction of embankments shall begin at the lowest point of the fill below the grade or the bottom of ravines. Individual layers shall be spread evenly to uniform thickness throughout and parallel with the finished grade for the full width of the embankment, unless otherwise permitted. The thickness of the layer shall be as necessary to secure the required compaction with 12 inch maximum thickness after compaction. Excepted provisions for placing in marsh and placement of rock are outlined below. Hauling equipment shall be routed to obtain uniform compaction and channelization of haul routes and rutting of the fill shall be avoided.

E. When embankments are constructed across wet or swampy ground that will not support the weight of heavy hauling and spreading equipment, the Contractor will be expected to choose such methods of embankment construction and to use such hauling and spreading equipment as will least disturb the soft foundation. When soft foundations are encountered, and when approved by the Engineer, the lower part of the fill may be constructed by dumping and spreading successive vehicle loads. This shall be in a uniformly distributed layer of a thickness not greater than that necessary to support the vehicle while placing subsequent layers, after which the remainder of the embankment shall be constructed in layers and compacted as specified.

F. It is not the policy of the Contracting Agency to allow an increase in the planned depth of embankment material over soft, wet, or swampy ground for the sole purpose of providing support for heavy hauling and spreading equipment, unless the Contractor proves to the satisfaction of the Engineer that the planned depth is inadequate to support light hauling vehicles. If it proves necessary for the Contractor to use smaller hauling vehicles or different methods of embankment construction than the Contractor had originally

contemplated in order to comply with the foregoing, such shall not be the basis for a claim for extra compensation against the Contracting Agency. The unit contract price for the various pay items involved shall be full compensation for all labor, materials, and equipment necessary to perform the work as outlined herein.

G. Embankment which, in the opinion of the Engineer, contains enough rock larger than 9 inches to make it impractical to place and compact in 12-inch lifts shall be considered as "Rock Embankment." The materials shall be spread in a uniform horizontal layer over the full width of the embankment. The layer thickness shall not exceed 1-1/3 times the vertical dimension of maximum size material larger than 9 inches. The largest size rock allowed in the embankment will be 3 feet measured in vertical direction and rocks larger than this shall be broken up before being placed in the embankment. Rock to be wasted may exceed 3 feet and be disposed of in an inconspicuous manner approved by the Engineer.

H. In rock fills where end dumping is employed, direct end dumping upon the previously constructed layer of embankment will not be permitted. Rock shall be dumped on the layer of embankment being constructed and dozed ahead into place. Care shall be exercised to work the fines and smaller rock into the spaces between the larger rock. Compaction will be required as provided in Subsection 203.03.19, "Compaction, Rock Embankment."

I. To the extent of project requirements for embankments, all rock from excavation shall be used for embankment. The Contractor shall plan the grading operation to use rock that may be encountered in excavation in accordance with the following provisions:

J. Rock, in general, shall be placed to form the base of embankment for the full width of the cross section under the following condition:

1. on the side slope or slopes of a new embankment being placed; or

2. on the side slope or slopes of an embankment already in place requiring widening; or where excess rock may be wasted; or

3. on the side slopes and top of rolled embankment made of embankment materials other than rock.

K. The Contractor shall not place large rock in embankments where piles will be driven. The Contractor shall be responsible for penetrating the embankment with specified piles.

L. When rock and other embankment materials are excavated at approximately the same time, the rock shall be distributed throughout the fill and not nested in one location.

M. When there is insufficient material other than rock in the excavation to permit properly compacted layers, the rock shall be placed for the full cross section width with the larger rocks well distributed and the void spaces filled with the smaller rocks and fragments.

N. When shown on the plans or considered necessary by the Engineer, embankments shall be built to such elevation above required grade to allow for settlement, or sufficient surcharge shall be placed above the required elevation of earth grade over deposits of

unstable material to secure displacement or settlement. Surcharge shall be removed only after the fill has reached stability or the required settlement time has been reached.

203.03.18 COMPACT, DIRT EMBANKMENT

A. Optimum moisture content and material density of the various soils will be determined by a Geotechnical Engineer and acceptable ranges for optimum moisture and material density shall be approved by the Engineer. At the time of compaction, the moisture content of the various soils shall be within the approved ranges.

B. The compacted subgrade shall be maintained at a minimum of optimum moisture content until placement of an aggregate base course or cement treated base.

C. When necessary, each layer before being compacted shall be processed as required in order to bring its moisture content within the prescribed limits. The material shall be wetted by the application of water or dried as necessary and either process may be carried out either on the embankment or at the source of the material or otherwise as approved by the Engineer. Full compensation of any work involved in wetting or drying embankment material to obtain the required moisture content shall be considered as included in the contract unit price bid for excavating or furnishing the material and no additional compensation will be allowed therefor.

D. Hauling and leveling equipment shall be routed over each layer of the fill in such a manner as to uniformly distribute the compaction afforded by the wheel load. In addition to hauling and leveling equipment, the Contractor shall provide compaction equipment that is specifically designed and manufactured for compacting dirt embankments. The compaction equipment shall work continuously with the grading equipment.

E. The top 8 inches of the base of cuts and natural ground having less than 5 feet of embankment, measured from the subgrade, and all embankment material, shall be compacted to not less than 90 percent relative compaction unless otherwise specified. When natural ground material is encountered that cannot be compacted to the required density, compaction requirements shall be determined by the Engineer.

F. All selected borrow and structure backfill placed within the limits of embankment shown on the plans for approaches to bridges shall be compacted to not less than 95 percent relative compaction unless otherwise specified.

G. It is to be expected that a loss of density in the upper portion of earth subgrade may occur due to the elements, or for lapse of time, or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed.

203.03.19 COMPACTION, ROCK EMBANKMENT

A. Field density tests will not be required on rock embankments. In lieu thereof, the required compaction shall be tested by proof rolling. Unless otherwise specified, compaction shall be attained and tested by using construction methods and equipment as follows:

1. Methods:

    a. The material for the embankment shall be deposited, spread, and leveled the full width of the embankment, and the layer of thickness may be 1-1/3 times the vertical dimension of maximum size material. The maximum size rock shall not exceed 3 feet.

    b. Hauling and leveling equipment shall be routed and distributed over each layer of the fill in such a manner as to make use of the compaction afforded thereby. Rollers, vibrators, or compactors shall compact the embankment full width with a minimum of 3 complete passes for each layer of embankment. The compacting equipment shall not exceed a speed of 5 miles per hour and shall work continuously with the grading equipment.

    c. Rolling shall be done in a longitudinal direction along the embankment and shall begin at the outer edges and progress toward the center. The travel paths of traffic and construction equipment shall be kept dispersed over the entire width of the embankment to aid in obtaining uniform compaction. Weights of equipment used in making embankments over soil having an excessive moisture content may be limited, if, in the judgment of the Engineer, such limitations are necessary in order to maintain the fill in a satisfactory condition.

    d. Water shall be applied to the embankment in the amount necessary to obtain the required compaction.

2. Equipment:

    a. Compaction equipment shall be adequately designed to obtain compaction requirements without adverse shoving, rutting, displacement, or loosening and shall meet the requirements specified herein. Rollers shall have displayed thereon in permanent legible characters, the manufacturer's guaranteed net operating weights as distributed on each axle.

    b. The proof roller shall be a pneumatic-tired roller or pneumatic-tired compactor weighing not less than 50 tons, and capable of applying to the ground loads of not less than 25,000 pounds per wheel. All tires shall be of equal size and diameter and shall be capable of operating at an air pressure of at least 90 psi. The tires shall be kept uniformly inflated so that the difference in pressure in any 2 tires shall never exceed 5 psi and means shall be provided by the Contractor for checking the tire pressure on the job at any time.

3. Tests:

    a. Subsequent layers shall not be placed until the previous layer of the embankment is compacted to the degree that no further appreciable deflection is evidenced under the action of proof rolling equipment, as determined by the Contractor with approval of the Engineer.

b. Rolling and proof rolling may be deleted on any layer or portion thereof when, in the judgment of the Engineer, accomplishment is physically impractical.

c. Payment for rolling and proof rolling or for the correction of any subgrade weakness or deficiencies disclosed by the proof rolling operation shall be considered subsidiary to the price bid for the "Excavation" item.

4. The Contractor shall submit an inspection report to the Engineer that has been reviewed and stamped by a Nevada professional engineer.

203.03.20 MAINTENANCE

A. Embankment material that may be lost or displaced as a result of natural settlement of the ground or foundation upon which the embankment is constructed shall be replaced by the Contractor with acceptable material from excavation or borrow, etc. The quantity of material required will be paid for at the regular contract price for the type of material used.

B. The Contractor shall, at no additional cost to the Contracting Agency, remove and replace with acceptable material any embankment or portion thereof which has been constructed with unapproved material as well as remove and replace portions of the embankment which may become unstable or displaced as the result of carelessness or negligence on the Contractor's part.

203.03.21 SUBGRADE TOLERANCE

A. Subgrade shall comply with ***Subsection 203.03.02, "Grade Tolerance."***

203.03.70 OVEREXCAVATION AND BACKFILL

A. Where overexcavation below the depths as shown on the plans or required by the specifications is necessary to remove unsuitable material, the Engineer may require the Contractor to remove the unsuitable materials and backfill to the finished graded section with Type I aggregate base, conforming to 3-inch size per subsection 704.03.03, compacted to a minimum of 90% of ASTM D1557 Modified Proctor and in accordance with the methods in the USS.

B. Unless otherwise provided in the Special Provisions, overexcavation and backfill below the limits shown on the plans will be paid for as "Extra Work".

203.03.71 HAZARDOUS MATERIAL

A. Hazardous material shall be defined as material or water contaminated with volatile organic compounds, inorganic non-metals, petroleum hydrocarbons or other contaminates as specified by the Nevada Division of Environmental Protection Agency (NDEP).

B. The Contractor shall retain a Certified Environmental Manager (CEM) for making periodic inspection of the project for potential hazardous materials. In addition, the CEM will be available for inspection of the project as directed by the Engineer and/or NDEP should material be uncovered that may be potential hazardous material.

C. When potential hazardous material is encountered with the project, the Contractor shall:

1. Immediately contact the CEM, Engineer and City of Las Vegas Environmental Officer.

2. Have the CEM perform the inspection of the potential hazardous material and if required perform the inspection for the removal and disposal of the hazardous material.

3. Retain a certified geotechnical firm to perform the required tests for hazardous materials and/or contaminants.

4. If required, perform the removal and disposal of the hazardous materials as directed by the CEM, Engineer and/or City of Las Vegas Environmental Officer in coordination with NDEP.

203.03.72 EXCAVATION

A. It is expected excavation for storm drain and detention basin items will require removal of various types of material, including cemented soils and rock (i.e. caliche).

B. Prior to construction, baseline distress evaluation by a qualified professional shall be conducted by the Contractor. The evaluations shall document existing distress to the structures and other improvements in the area of work.

C. Vibration monitoring by a qualified professional shall be conducted by the Contractor during excavation of cemented soils. The Contractor shall be required to conduct impact assessment tests of the equipment excavating cemented soils prior to construction. The Contractor shall submit an Impact Assessment Test Plan and Impact Assessment Test Results. The frequency and amplitude of the vibratory equipment shall be calibrated and used to measure ground velocity for conformance to the current regulatory limit of 0.3 inch per second peak ground velocity at the nearest affected structure. The measurements shall comply with the recommendations of the “Office of Surface Mining, Blasting Guidance Manual, 1987.”

D. The Contractor shall submit to the Owner a plan detailing his proposed excavation techniques. This excavation plan shall include the results of a seismic survey performed by a certified seismic survey firm. The plan must show all proposed locations of excavation operations utilizing methods involving headache balling, hoe ram, or other techniques. The excavation plan shall include recommendations from certified seismic survey firm for limiting ball weights, height of drop, etc. for all areas headache balls and/or hoe rams techniques are proposed. In addition, the plan must include the results of a pre-excavation survey and a seismic monitoring plan. The excavation plan shall also include as a minimum; detailed examination of adjacent structures, including videotaping and

installation of crack monitoring tape along existing structural cracks. The excavation plan must be approved by the Owner prior to construction.

E. If damage to structures becomes evident, the Contractor shall immediately cease his excavation operations and submit a new excavation plan detailing new or modified methods to end the adverse effects. The Contractor shall make no claims for any delay caused by the re-submittal nor any additional expense resulting from changing his proposed excavation methods.

F. The excavation plan shall be updated and resubmitted to the Owner any time the Contractor proposes altering his methods. The plan(s) will be considered shop drawings and will be handled as such. The Contractor shall make no claim for any losses resulting from delays during the review of these submittals in accordance with the limitations detailed for shop drawings in these specifications.

G. The Contractor's methods for excavation are solely his responsibility. Approval of the excavation plan by the Owner will in no way limit the Contractor's liability regarding property damaged and subsurface damage beyond the excavation limits by his operations, nor will it alter the Contractor's sole responsibility for the safety of his operations. The Contractor shall be responsible for all damage caused by his excavation operations and be responsible for answering all complaints. Provide the Owner with advance warning of the use of excavation techniques which may lead to property damage, to review the proposed techniques, to confirm general compliance with these specifications, and to allow monitoring of the excavation methods.

H. Excavations near mapped alluvial faults shall be inspected by a qualified professional prior to RCP/RCB installation. If a fault is encountered, appropriate remedial action shall be taken by the Contractor per geotechnical recommendations.

203.03.73 COMPACTED FILL

A. Compacted fill will consist of native material excavated, hauled, screened, placed, and compacted within the neat lines shown on the Drawings and as specified in Subsection 203.03.16.

B. All fill materials shall be placed in continuous horizontal layers in maximum 12-inch lifts. Each layer shall be moisture conditioned to at least minus 2 percent of optimum moisture content and compacted by rolling with compaction equipment methods to at least 95 percent of the maximum dry density as determined by ASTM D1557.

C. The existing soil in areas to receive fill along the dam embankment shall be scarified to a minimum of 8 inches, reworked, moisture conditioned, and recompacted to at least 95 percent of the maximum density as determined by ASTM D1557. Moisture content at time of compaction should be at least optimum. The depth of excavation, replacement, and compaction may be reduced or increased by the Owner's representative depending on the representative's visual inspection of uncovered soils. Hard cemented soils may result in a decrease in required excavation depth while partially cemented soils or soft spongy or deleterious soils may result in an increase in required excavation depth. Any increase in depth shall comply with Subsection 203.03.70, Over-Excavation and Backfill.

203.03.74 EMBANKMENT PROTECTION

A. Completed excavation and embankment grading planes and other disturbed areas within the limits of construction shall be protected by soil stabilizer placed on all exposed soil surfaces. Soil stabilizer shall be applied to all disturbed soil areas not specified to be covered with riprap, decomposed granite, aggregate base, asphalt pavement or other surfacing. Unless otherwise specified in these Special Provisions, herbicide shall not be placed on any surfaces within the detention basin.

B. Apply soil stabilizer within 14 days of when no further disturbance of the surface will be made. Protect all structures, walls, landscaping, etc. from overspray. Store and handle soil stabilizer in accordance with the manufacturer's recommendations. Do not spray when weather conditions are windy. Windy conditions are defined as a sustained wind of 8 mph or more, or any condition that may cause dispersal of material to be difficult or inaccurate. Soil stabilizer shall form a crust like barrier within 4 to 8 hours. The use of accelerators is recommended.

C. Soil stabilizer shall be PLAS-TEX, Enviro-Shield Bonded Fiber Matrix, or approved equal and shall be applied at the manufacturer's recommended application and dilution rates.

D. Add a color pigment to the soil stabilizer at the time of application. Apply a suitable pigmentation to the soil stabilizer slurry such that is used for pigmenting concrete at an application rate of 50 pounds per acre. The color of the pigmentation shall be approved by the Engineer.

203.03.75 QUALITY CONTROL TESTING

A. Quality control testing will be performed for Dam Safety Permit compliance in accordance with the State Engineers Office. The testing will be performed by an independent testing laboratory.

B. The Contractor shall schedule his operations so as to allow and facilitate quality control testing by the independent laboratory.

C. The following standard tests will be used as a basis for classifying soil materials and for control testing:

Test Designation	Test
ASTM C136 AASHTO T27	Test for Sieve or Screen Analysis of Fine and Course Aggregates
ASTM D1556	Density of Soils In-Place by the Sand-Cone Method
ASTM D1557 AASHTO T180	Moisture-Density Relations of Soils and Soil Aggregate Mixing Using 10 Pound Rammer and 18-Inch Drop
AASHTO T310	In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

ASTM D4318 AASHTO T89/T90	Plasticity Index of Soils
AWWA 4500E	Maximum Sulfate Content
AWWA 4500CL	Maximum Chloride Content
Southern Nevada Amendments to the Building Code	Maximum Expansive Potential 60 psf
ASTM C117	Test for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
ASTM D422	Particle-Size Analysis of Soils
ASTM D6938	Nuclear Methods
ASTM D5084	Permeability
ASTM D3080	Direct Shear Testing

D. Two representative soil samples of imported fill will be performed at the beginning of construction. Additional tests will be conducted to classify and establish the moisture density relationship for each type of soil encountered in areas that may yield excavated materials suitable for placement in embankment. Whenever the material encountered is different from previously tested material, a new set of classification and moisture-density tests will be performed.

E. The number of locations of in-place density tests for embankment and compacted fill construction shall be sufficient to determine that each layer of material placed in embankment has been compacted adequately to obtain the density specified therefore. The minimum number of in-place density tests by ASTM D1556 and AASHTO T310 procedures will be one for each 5,000 square feet per 8-inch lift of fill.

F. The following standard tests will be used for concrete material quality control testing:

Test Designation	Test
ASTM C1064	Temperature of Freshly Mixed Portland Cement Concrete
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C173/C231	Air Content of Freshly Mixed Concrete
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens

G. The concrete will be tested a minimum of once per day and per every 100 cubic yards placed.

H. The above frequency of tests is approximate and is provided for the Contractor's information in planning Contractor's work and interruptions during testing. The actual number of tests will depend on the variability of materials being placed and uniformity of the Contractor's placement operations.

I. Quality control test data will be reviewed and submitted monthly. All quality control test data will be compiled in a final report and submitted at the completion of work for Dam Safety Permit compliance. All reports submitted to the City shall be stamped by a Nevada Registered Professional Engineer.

203.03.76 CALICHE EXCAVATION

A. Caliche is anticipated to be encountered on this project and is defined as a rock-like material that occurs in soil deposits erratically in thickness, hardness, and lateral extent and it is therefore difficult to predict in terms of interference with below-grade construction. Contractor shall take adequate precautions to reduce the potential for vibrational damage to adjacent or nearby structures when using heavy impact equipment during removal of caliche. In the event structures are damaged, Contractor shall be responsible for all repairs.

B. Generation of oversized material (rocks or hard chunks greater than 6 inches nominal diameter) shall be anticipated by Contractor when excavating caliche. Oversize material shall be crushed prior to being used as structural fill, backfill, and compacted fill, or disposed of in a suitable manner.

TESTING

203.05.02 TESTING

SECTION	DESCRIPTION	TEST	REFERENCE SPECIFICATION AND/OR TEST PROCEDURE	RECOMMENDED FREQUENCY
203.02.01	Roadway Excavation (Subgrade)	Field Density	AASHTO T 310	1/5000 SF
203.02.02	Drainage Excavation (Subgrade)	Field Density	AASHTO T 310	1/5000 SF
203.02.03	Channel Excavation (Subgrade)	Field Density	AASHTO T 310	1/5000 SF
203.02.04	Borrow	Sieve Analysis	AASHTO T 11 & T 27	1/Type
		Plasticity Index	AASHTO T 89 & T 90	1/Type[1]
203.02.05	Selected Borrow	R-Value	AASHTO T 190	1/Type
		Proctor	AASHTO T 180	1/Project or Change
203.03.01	Roadway At Grade or Fill (Subgrade)	Field Density	AASHTO T 310	Residential = 1/5000 SF/Lift/Day
				Arterial and Collector = 1/5000 SF/Lift/Day
203.03.10	Selected Material	Sieve Analysis	AASHTO T 11 & T 27	1/1000 LF
		Plasticity Index	AASHTO T 89 & T 90	1/1000 LF
		R-Value	AASHTO T 190	1/Type
		Field Density	AASHTO T 310	1/5000 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change
203.03.15	Foundation[2] (Subgrade)	Field Density	AASHTO T 310	1/500 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change
203.03.18	Embankment	Field Density Fill	AASHTO T 310	1/5000 SF/Lift/Day
		Field Density Native Below Embankment Fill Operations	AASHTO T 310	1/5000 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change
203.03.19	Rock Embankment	Visual	Issue Inspection Report	Full Time

END OF SECTION 203

[1] A maximum testable lift is defined as a 12-inch layer of compacted material.
[2] This is in reference to benched slope construction of embankment only.

SECTION 206 – STRUCTURE EXCAVATION

DESCRIPTION

206.01.01 GENERAL

A. This work shall consist of the removal of all material of whatever nature encountered in the construction of foundations for bridges, retaining walls, headwalls for culverts and other structures; the excavation of trenches for pipe culverts, box culverts, cut-off walls for slope paving and concrete aprons, footings for riprap and other excavation specifically designated on the plans, in these specifications or in the Special Provisions as structure excavation, which shall include the work of disposing of surplus material and cleaning up the sites. Structure excavation shall include dewatering and the furnishing of all equipment and the construction or installation of all cofferdams, cribs, and other facilities, which may be necessary to perform the excavations and the subsequent removal of such facilities except where they are required or permitted by the plans or specifications to remain in place. It shall also include all the necessary clearing and grubbing within the proposed structure area and removing old structures or parts thereof as required if the proposal does not include separate bid items for such work.

B. For separate requirements pertaining to the excavation involved in the installation of pipe culverts and underground piping, attention is directed to those sections of these specifications governing such work.

C. Where structure over-excavation below the depths as shown on the plans or required by the specifications is necessary to remove unsuitable material, the Engineer may require the Contractor to remove the unsuitable materials and backfill to the required grade with material conforming to ***Subsection 704.03.02, "Drain Backfill,"*** compacted to a minimum of 90% of ASTM D1557 Modified Proctor and in accordance with the methods in the USS.

D. If groundwater is encountered within the excavated area, dewatering shall be performed as specified in ***Section 270, "Dewatering."***

CONSTRUCTION

206.03.01 GENERAL

A. The Contractor shall notify the Engineer in sufficient time in advance of the beginning of excavation for structures so that elevations and measurements may be taken of the existing ground before it is disturbed and of existing substructure units within the limits of excavation for structures before they are removed. Any material excavated or removed before these measurements have been taken will not be paid for.

B. The excavated area shall conform to the outlines of the footings, as shown on the plans, and shall be of sufficient size to permit placing of the full width and length of the footings shown. The elevation of the bottoms of footings as shown on the plans shall be considered as approximate only, and the Engineer may order, in writing, such changes in dimensions or elevation of footings as may be necessary to secure a satisfactory foundation.

C. Unless otherwise permitted by the Engineer, foundations shall be compacted to not less than 95 percent relative compaction for culvert pipe and structures. For fine-grained soils, which are classified by having 50 percent or more passing the No. 200 sieve, the relative compaction may not be less than 90 percent if approved by the Engineer.

D. All rock or other hard foundation material shall be freed from all loose material, cleaned and cut to a firm surface, either level, stepped or serrated, as may be permitted by the Engineer. All seams and crevices shall be cleaned out and filled with concrete mortar or grout.

E. Where masonry is to rest on material other than rock or boulders, special care shall be given not to destroy its bearing value.

F. Should the Contractor remove structure excavation below grade, the Contractor shall backfill to the required elevation at no additional cost to the Contracting Agency with backfill in a manner satisfactory to the Engineer.

G. Wet pits shall be dewatered for inspection and for construction of foundations unless otherwise provided.

H. Excavated material, which is suitable for backfilling, shall be so utilized or used in embankments, in a manner satisfactory to the Engineer. Surplus or unsuitable material shall be disposed of to cause no obstruction to flow of streams or otherwise impair the efficiency or appearance of the structure. It shall be disposed of in such a manner as to prevent damage to property or the creation of unsightly conditions, and shall not be placed where it will interfere with the operation of drains or impair the roadway ditches, etc.

I. After each excavation is completed, the Contractor shall notify the Engineer, and no masonry shall be placed until the Engineer has approved the depth of excavation and the character of the foundation material.

206.03.02 SAFETY REQUIREMENTS AND REGULATIONS

A. The Contractor shall follow OSHA safety regulations (29 CFR, Part 1926, Subpart P, Excavations) for sloping the sides of excavations, using shoring and bracing, and for using other safety features. When the sides of excavations are sloped for safety considerations, the Contractor shall provide, for informational purposes, one copy of the design that demonstrates conformity with OSHA regulations to the Engineer. Where support systems, shield systems, or other protective systems are to be used, the Contractor shall be responsible for their design and shall submit design calculations along with detailed drawings that demonstrate conformity with OSHA regulations to the Engineer. These calculations and detailed drawings shall be stamped and signed by a professional engineer licensed to practice in the state of Nevada. The design calculations and detailed drawings are considered working drawings and shall be submitted in accordance with ***Subsection 105.02, "Plans and Working Drawings."***

END OF SECTION 206

SECTION 207 – STRUCTURE BACKFILL

DESCRIPTION

207.01.01 GENERAL

A. This work shall consist of placing and compacting, to the lines designated on the plans or as established by the Engineer, backfill material in excavations for bridges, retaining walls, headwalls for culverts, and other structures; placing and compacting backfill material for box culverts and other non-pipe culverts; and other backfill specifically designated in the contract documents as structure backfill. This item does not include backfilling pipes within a trench or minor miscellaneous structure excavations outside the limits of the roadway.

MATERIALS

207.02.01 SELECTED BACKFILL

A. Selected backfill shall be of a quality acceptable to the Engineer and shall consist of suitable material from the excavation complying to Table 1 and Table 2. It shall be free from sod, frozen earth, organic materials, rubbish, or debris. If the material does not comply with Table 1, it may be used only if approved by the Engineer.

Table 1 – Select Backfill Gradation

Sieve Sizes	Percentage of Weight Passing
6-inch	100
3-inch	80-100
No. 4	35-100

Table 2 – Select Backfill Maximum Plastic Index Requirement

Percentage by Weight Passing No. 200 Sieve	Plasticity Index Maximum
10-10.0	15
10.1-20.0	12
20.1-50.0	10
50.1-80.0	8
80.1-100.0	6

B. When the completed select backfill test results from the sample indicate a Plasticity Index of 12 or greater, a swell potential test may be required. Contact the Contracting Agency for further procedure requirements or comply with the contract Special Provisions.

C. The liquid limit of the material shall not exceed 50 percent maximum.

D. Stones or lumps exceeding 3 inches shall not be used within the zones 12 inches or less from the structure, 12 inches or less from the finish subgrade in unpaved areas, or 16 inches or less below the finish subgrade in paved areas.

E. Acceptable material from excavation "Selected Backfill" may be used for structure backfilling unless "Granular Backfill" is specified.

207.02.02 GRANULAR BACKFILL

A. Granular backfill shall consist of natural sand or a mixture of sand with gravel. Broken Portland cement concrete and bituminous type pavement will be permitted, subject to the gradation limits specified herein. The granular backfill material shall have a sufficient amount of fine material to fill the voids between the coarser aggregate.

B. In addition, the material shall conform to the following requirements:

Table 3 – Granular Gradation

Sieve Sizes	Percentage of Weight Passing
3-inch	100
No. 4	35-100
No. 16	25-100
No. 200	5-15

C. The plasticity index of the material shall be as specified in ***Subsection 704.03.01, "Plastic Limits."***

D. The total available water soluble sulfate content of the material shall not exceed 0.3 percent by dry soil weight.

CONSTRUCTION

207.03.01 GENERAL

A. Compaction of backfill or embankment around all structures shall be in accordance with the requirements of AASHTO LFRD Bridge Construction Specifications with exceptions as described in this section. The compaction shall be performed with mechanical tamping units and the material shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used subject to approval by the Engineer.

B. Unless otherwise specified or approved by the Engineer, the compaction requirement shall be a minimum of 95 percent.

C. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used. Backfill material shall be placed in uniform horizontal layers with a maximum compacted depth of 12 inches and shall be brought up uniformly on all sides of the structure or improvement.

D. Backfill material to be used around buried structures where water is present or anticipated to be present shall be carefully selected so that it will protect the surrounding soil from infiltrating into the backfill as determined by the Engineer. This select material shall serve as a filter material. If the drain material is to remove an appreciable quantity of water, graded filter drains using separate fine-grained layers for filters and coarse-grained layers

to conduct the water may be required. As an alternate to using a filter material, a filter fabric may be placed between the backfill material and surrounding soil.

E. Material resulting from structure excavation and not used, shall be deposited in roadway embankments in accordance with the requirements specified elsewhere or otherwise disposed of in a manner approved by the Engineer and no additional compensation will be allowed for such work.

F. Structure backfill shall not be placed until the structure or facilities have been inspected by the Engineer and approved for backfilling. Backfill material shall not be deposited against the back of concrete abutments, concrete retaining walls, or the outside walls of concrete box culverts until the concrete has reached 80 percent of the required compressive strength and approved by the Engineer.

G. Backfill operations placed against concrete walls that will support any deck shall not be performed until after the deck has been placed.

H. Where backfill is placed against waterproofed surfaces, care shall be taken that no damage is done to the waterproofing material.

207.03.02 PLACING AND COMPACTING AT ABUTMENTS, PIERS, WINGWALLS AND RETAINING WALLS

A. With the approval of the Engineer, all spaces excavated and not occupied by abutments, piers, or other permanent work shall be refilled with earth up to the surface of the surrounding ground or to the limits designated on the plans or as described herein. All backfill shall be thoroughly compacted in accordance with the provisions set forth in ***Subsection 207.03.01, "General."***

B. Where backfill is to be placed on one side of an abutment, wingwall, pier, or headwall, care shall be exercised to prevent displacement of line, or batter, or both.

C. Existing slopes that are shaped to cause wedge action in the backfill shall be step-cut or benched before backfilling.

207.03.03 PLACING AND COMPACTING AT CULVERTS

A. After the bedding has been prepared and the culverts installed or constructed as required by the pertinent specifications, "Selected Backfill" or "Granular Backfill" shall be placed along both sides of the culvert equally in uniform layers such that the elevation of the top of the backfill on either side of the culvert does not exceed the elevation of the top of the backfill on the other side of the culvert by more than 6 inches. The thickness of each layer shall be compatible with the characteristics of the backfill and the type of equipment being used, but shall not exceed 12 inches in depth after compaction nor a loose lift of 16 inches. Each layer shall be wetted as required and thoroughly compacted to the density requirements as set forth in ***Subsection 207.03.01, "General."***

B. Special care shall be taken in placing and thoroughly compacting the material under the haunches of all pipe culverts.

C. Unless otherwise directed, the backfilling shall continue as directed to the level of the ground or to an elevation 6 inches above the structure in the case of a pipe culvert in projection, or even with the top of the structure in the case of reinforced concrete box culvert in projection.

D. No construction equipment or other traffic shall be permitted to cross any culvert until a safe minimum depth of fill above the culvert has been placed and compacted in accordance with these specifications. The Contractor shall be solely responsible for protecting the structure from superimposed loading by construction equipment and shall repair any damage to the structure or replace the structure as ordered without extra compensation.

E. Special care shall be taken in backfilling arches, particularly half-circle arches. The arch shall be covered in layers, each layer conforming to the shape of the arch and tamped thoroughly.

207.03.04 PLACING AND COMPACTING OF BIN-TYPE RETAINING WALLS

A. Placing and compacting backfill material for bin-type retaining walls shall progress concurrently with the assembly of the bins, and backfilling around the outer sides thereof shall be kept approximately level with the inside fills. The materials shall be thoroughly tamped and meet the density requirements as set forth in ***Subsection 207.03.01, "General."*** Care shall be exercised to completely fill the depressions of stringers and spacers without displacing them from established line and batter.

TESTING

207.06.01 TESTING

Table 4 - Testing

Spec. Section	Description	Test	Reference Specification and/or Test Procedure	Recommended Frequency[1]
207.02.01	Selected Backfill	Sieve Analysis	AASHTO T11 & T27 ***USS 301*** & Special Provisions	1/1000 CY
		Plasticity Index	AASHTO T89 & T90 ***USS 301*** & Special Provisions	1/1000 CY
207.02.02	Granular Backfill	Sieve Analysis	AASHTO T11 & T27 ***USS 301*** & Special Provisions	1/1000 CY
		Soluble Sulfates	AWWA 4500E	1/Type
207.03.01	General	Field Density	AASHTO T310	If Riding Equipment Used: 1/5000 SF/Lift
				If Walk Behind Equipment Used: 1/1000 SF/Lift Per Structure Per Day

END OF SECTION 207

[1] A maximum testable lift is defined as a 12-inch layer of compacted material.

SECTION 208 – TRENCH EXCAVATION AND BACKFILL

DESCRIPTION

208.01.01 GENERAL

A. This work shall consist of the excavation and backfill of trenches for the accommodation of substructures including, but not limited to electrical conduits, telephone conduits, television cable, traffic signal conduits, gas lines, sewer lines, water lines, and storm drains except where governed by utility agency specifications. These other agencies are responsible for the trench to the top of subgrade (bottom of the pavement section).

B. When the terms "Backfill" or "Trench Backfill" are used herein, they shall be construed to mean one or more of the types of backfill specified below under "Materials."

C. The designing engineer shall comply with the intent of the pipe material as defined as either rigid or flexible in conformance with the AASHTO LRFD Bridge Design and Construction Specifications and this Section. Special attention shall be given to the sidewall material properties as this section assumes a minimum AASHTO A1 or A3 material. Other sidewall material type shall be given special consideration for minimum trench widths, the use of Controlled Low Strength Materials (CLSM), or other critical processes that would affect the pipe ability to withstand the load and shall also be noted on the plans and specifications for the project.

D. The type of pipe and applicable installation requirement (trench and embankment) to be used as demonstrated by the design and approved by the Agency Engineer shall be clearly noted on the drawings and specifications along with installation procedures that may differ from this section.

E. Quality control field inspection and testing requirements including frequency shall be in accordance with Contracting Agency requirements. Frequency of quality control field inspection and testing shall be in accordance with ***Subsection 203.05.02, "Testing."***

F. Ponding and jetting will not be allowed on City of Las Vegas projects.

208.01.02 DEFINITIONS

A. **Foundation:** Over-excavation and backfill of the foundation is required only when the native trench bottom does not provide a firm-working platform for placement of the pipe bedding material.

B. **Bedding:** In addition to bringing the trench bottom to required grade, the bedding levels out any irregularities and ensures uniform support along the length of the pipe.

C. **Haunch Zone:** The backfill under the lower half of the pipe (haunches) distributes the superimposed loadings.

D. **Initial Zone:** The backfill from the springline to the top of the pipe zone provides the primary support against lateral pipe deformation for flexible pipe.

E. **Final Zone:** Backfill above the pipe zone to the top of subgrade.

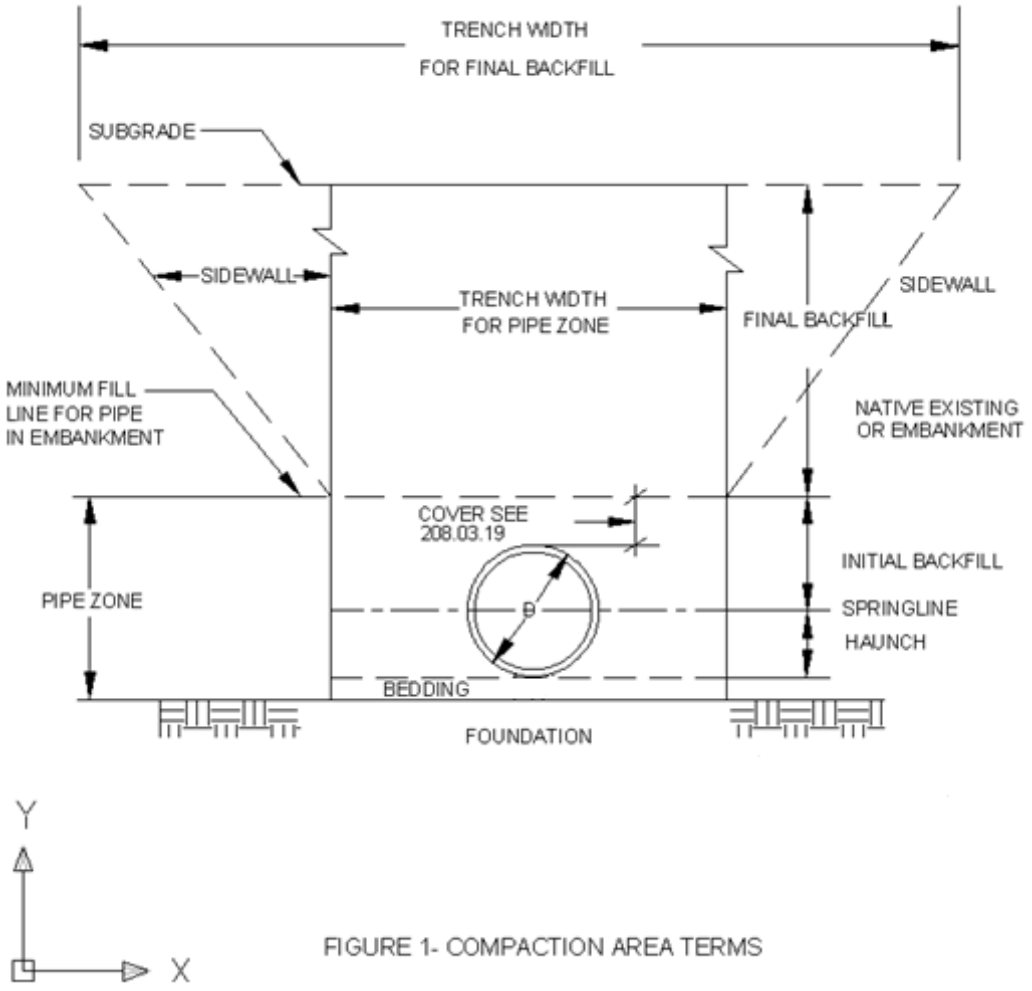


FIGURE 1- COMPACTION AREA TERMS

MATERIAL

208.02.01 GENERAL

A. The material placement in the pipe zone area shall first comply with Table 1, when applicable. Note that CLSM backfill is required for storm drain pipes within the detention basin embankment, see plans for specific limits.

Table 1 - Pipe Zone Maximum Particle Size for Backfill

Nominal Pipe Size (inches)	Maximum Particle Size (inches)
2 to 4	1/2
6 to 8	3/4
10 to 16	1
18 and larger	1-1/2

B. One of two methods of compaction of the trench pipe zone shall be used and shall be specified in the Construction Documents and approved by the Engineer prior to construction:

1. **Method A:** The use of CLSM as defined in this section. This method is required for storm drain pipe within the detention basin embankment, see plans for specific limits.

2. **Method B:** The use of aggregate materials as described in this section as associated with either Rigid or Flexible designed pipe shall be as specified in this subsection below.

C. Prior to construction, the materials and method type shall be submitted and approved by the Engineer.

208.02.02 SELECTED BACKFILL

A. This material shall be similar to that removed from the trench excavation or may be imported material as specified in ***Subsection 207.02.01, "Selected Backfill,"*** or as otherwise shown on the Drawings.

208.02.03 GRANULAR BACKFILL

A. Granular backfill shall be as specified in ***Subsection 207.02.02, "Granular Backfill."***

208.02.04 SAND BACKFILL

A. Sand backfill shall consist of natural sand or a mixture of sand with gravel or stone. In addition thereto, the material shall conform to the following gradation requirements:

Table 2 - Sand Backfill Gradation

Sieve Sizes	Percentage of Weight Passing
3/8 inch	100
No. 4	80-100
No. 200	5-20

B. The plasticity index of the material shall be as specified in ***Subsection 704.03.01, "Plastic Limits."*** The soluble sulfate content shall not exceed 0.3 percent by dry weight of soil.

208.02.05 TYPE II AGGREGATE BASE BACKFILL

A. Type II aggregate base backfill shall be as specified in ***Subsection 704.03.04, "Type II Aggregate Base."*** The total available water soluble sulfate content shall not exceed 0.3 percent by dry weight of soil.

208.02.06 DRAIN BACKFILL

A. Drain backfill shall be as specified in ***Subsection 704.03.02, "Drain Backfill."*** The type shall be as shown on the plans or approved by the Engineer.

208.02.07 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. Backfill shall be as specified in ***Subsection 704.03.07, "Controlled Low Strength Material."***

208.02.08 CRUSHED ROCK

A. The materials properties shall conform to ***Subsection 704.03.06, "Crushed Rock."***

208.02.09 TYPE III AGGREGATE

A. Aggregate properties and gradation shall conform to Type III as specified in ***Subsection 704.03.05, "Type III Aggregate,"*** or as approved by the Engineer.

208.02.70 STRUCTURAL BACKFILL

A. Structural backfill shall consist of material conforming to subsection 207.02.02 “Granular Backfill” or subsection 207.02.01 “Selected Backfill”. Additionally, the backfill material shall be non-gypsiferous (solubility less than 4%), have an expansion potential less than 4%, shall be free of vegetation and debris and contain no rocks larger than four inches nominal diameter.

CONSTRUCTION

208.03.01 TRENCH EXCAVATION, GENERAL

A. Excavation including the manner of supporting excavation and provisions for access to trenches, shall comply with the current regulations as determined by NOSHA. Excavation shall include, without classifications, the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grade shown. Excavation for pipe, wire, or conduits shall be by open trench unless otherwise specified or shown on the plans. However, should the Contractor elect to tunnel or jack any portion not so specified, he shall first submit a design by a Nevada Professional Engineer to and obtain an approval from the Engineer. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavation, and all pumping, ditching, or other approved measures for the removal or exclusion of water, including storm water and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. The Contractor shall be responsible for any damage to persons or property due to interruption or diversion of storm or wastewater because of his operations. If due to delays in delivery of materials or for other reasons, and the Contractor is not expected to fully complete the work within any excavated area in a reasonable length of time as determined by the Engineer, the Engineer may require the Contractor to backfill the excavation and

re-excavate when the work can be completed expeditiously, with no additional payment therefor.

B. Except as otherwise shown or provided herein, excavation shall be open cut trenches with vertical sides up to the top of the pipe zone.

C. Trenching and shoring operations shall be conducted in accordance with 29 CFR (Code of Federal Regulations) Part 1926, Occupational Safety and Health Standards (OSHA) – Subpart P – Excavations (July 1, 1990).

208.03.02 MINIMUM TRENCH WIDTH

A. Excavation of pipe trench for flexible and rigid pipe is as required in Table 3 and this width is only applicable for trenches that have trench sidewall of native material"" which meets the classification class A1 or A3 installation as defined in AASHTO M145 table. In all cases, the trench width shall be wide enough to allow for the compaction equipment.

Table 3 - Minimum Trench Widths

Flexible Pipe	Minimum shall be not less than 1.5 times the pipe outside diameter plus 12 inches
Rigid Pipe	Minimum shall be not less than the outside diameter plus the outside diameter times 0.33

B. For pipe backfill using CLSM, the minimum trench width may be reduced to the pipe diameter plus 12 inches and enough room needed to allow for the proper placement of the CLSM using tools to "spade" the material under the pipe haunches. This condition applies only for trench sidewalls meeting the minimum AASHTO material class A1 or A3.

C. If the sidewall trench soil is classified other than AASHTO Class A1 or A3, a recommendation by a Nevada Professional Engineer shall be submitted and approved by the Engineer prior to construction. However, minimum trench width shall not be less than the minimum stated in this section.

208.03.03 MAXIMUM TRENCH WIDTH

A. The maximum width of the trench shall be determined by the Contractor based on the method and means for the installation. However, trench width shall not exceed the width of a ride-along compactor plus 2 feet when working alongside the pipe or culvert. If for any reason this maximum trench width is exceeded, a higher strength of pipe may be required as determined by the Engineer with no additional cost to the Contracting Agency.

B. Except when otherwise specified or ordered by the Engineer, the bottom of the trench shall be excavated uniformly to the grade or depth indicated on the drawings. The maximum amount of open trench permitted in any one location shall be per Section 624 of these Special Provisions. Trench shall be considered open until backfilled to the top of subgrade. Trenches crossing streets shall be completely backfilled immediately after pipe, wire, or conduit installation.

C. Substantial bridging, properly anchored, capable of carrying the design loading, in addition to adequate trench bracing, shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular working hours. Safe and convenient passage for pedestrians and access to all properties shall be provided.

208.03.04 TRENCH OVER-EXCAVATION

A. Wherever the excavation is made below the grade shown on the drawings, or below the grade ordered by the Engineer, it shall be refilled to the required grade with suitable backfill and bedding material ""at no additional cost to the Contracting Agency.

B. Trench over-excavation below the specified level of bedding material, and additional backfill material, ordered by the Engineer where unsuitable materials are encountered, shall be paid by the appropriate contract item.

C. Trench over-excavation and backfill to control groundwater shall be at the option and expense of the Contractor; however, the backfill material shall comply with this specification and the approved design of the pipe.

208.03.05 DISPOSAL OF UNSTABLE AND EXCESS EXCAVATED MATERIALS

A. Excess material and excavated material unsuitable for backfill shall be removed from the site of the work by the end of each working day unless otherwise approved by the Engineer and disposed of by the Contractor as specified in ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

208.03.06 CHANGES IN ALIGNMENT OR GRADE

A. In the event that changes in elevation of the trench of less than 6 inches are ordered by the Engineer, no changes in the contract amount will be allowed.

208.03.07 PORTABLE TRENCH SHEILD

A. Portable trench shields or boxes that provide a moveable safe working area for installing pipe may be used for the installation of pipe. After placing the pipe in the trench, backfill material shall be placed in lifts and the shield shall be lifted to allow for the backfill material to be placed for each lift, trench wall to trench wall.

208.03.08 MINIMUM PIPE SPACING

A. If the pipe space between parallel pipes in a single trench is not conducive to mechanical backfill, then CLSM shall be used.

208.03.09 TRENCH BACKFILL

A. The backfilling of the trench differs in each zone due to the complexity of providing a secure support for the pipe as well as ensuring that all voids are filled to prevent nuisance

water flow under the pipe. The zones are foundation, bedding, haunch, initial, and final as illustrated in Figure 1.

208.03.10 USE OF CLSM

A. CLSM Class II is required for storm drain pipe within the detention basin embankment, see plans for specific limits. CLSM Class I and Class II may be placed in other installations. However, for flexible pipe, in the pipe zone region, either full CLSM or full aggregate backfill is required. There can not be applied a mixing of CLSM and aggregate fill layers due to the different stresses that can occur on the pipe at the interface of both types of products.

B. CLSM shall be placed directly into the space to be filled. The placement of CLSM shall include "spading" under the pipe haunches and into the corrugations or other difficult areas around a structure. Care shall be taken to prevent flotation or misalignment of the pipe by means of straps, soil anchors or other designed and approved means of restraint as per the manufacturer's recommendation. Material may be placed in stages equally on both sides of the pipe to prevent movement or flotation of pipe.

C. If CLSM Class III - Bonded Aggregate Fill (BAF) is to be used, it shall be as specified in ***Subsection 704.03.07, "Controlled Low Strength Material (CLSM)."*** When used as backfill, CLSM Class III shall comply with ***Subsection 704.03.02, "Drain Backfill."***

208.03.11 FOUNDATION

A. Trench foundation shall be stable prior to placing bedding material. If the Engineer determines that unsuitable materials exist at the trench foundation, the Contractor shall remove and replace the material as directed by the Engineer and as specified in ***Subsection 208.03.04, "Trench Over-Excavation."***

208.03.12 PIPE BEDDING

A. **Dry Utilities:** Dry utilities shall be defined as facilities for fiber optics, electrical, telephone, television cable, traffic signals, and natural gas lines. Pipe bedding for dry utilities only may consist of sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a bedding material, the sand shall be moisture conditioned and mechanically compacted.

B. **Wet Utilities:** Wet utilities shall be defined as facilities for sewer lines, water lines, and storm drains. Except as otherwise provided herein, or in the Special Provisions, or as otherwise shown on the plans, the trench shall be excavated to a depth of at least 4 inches to 6 inches below the bottom of the pipe barrel and to a depth that will be sufficient to provide at least 2 inches of clearance under the pipe bell (where applicable).

C. Uniform and stable bedding shall be provided for the pipe and any protruding features of its joints and/or fittings with the exception that the middle of the bedding equal to 1/3 the pipe outside diameter shall be loosely placed (see Figure 1). The compaction shall be:

1. Compaction density minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

D. The material for use as bedding shall be Type II Aggregate Base or CLSM complying with this section.

E. Bedding shall be backfilled to the required grade of the bottom of the pipe. When Crushed Rock is used for foundation stabilization, the Contractor shall follow the same procedures described below in ***Subsection 208.03.16, "Drain Backfill."***

F. All pipes shall be placed directly on the bedding material unless otherwise required or approved by the Engineer. If groundwater is present or anticipated to be present, the need for a filter material as specified in ***Subsection 207.03.01, "General,"*** shall be reviewed and approval may be required by the Engineer.

208.03.13 HAUNCH ZONE BACKFILL

A. **Dry Utilities:** After pipe or conduit is laid, the haunch areas shall be backfilled with sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a backfill material, the sand shall be moisture conditioned and mechanically compacted.

B. **Wet Utilities:** After the pipe or conduit is laid, the haunch areas shall be backfilled with Type II, Type III, Aggregate Base Backfill, or CLSM. Crushed Rock or drain backfill may be used for the haunch zone only if material use has been specifically approved by the governing agency. If crushed rock or drain backfill is used, comply with ***Subsection 208.03.16, "Drain Backfill."***

C. Compaction of the haunching material can best be accomplished by hand with tampers or suitable power compactors for maximum compacted lift thickness of 6 inches. The Contractor shall take care to not disturb the pipe from its line and grade and shall compact to:

1. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

D. While compacting the embedment near the pipe with impact-type tampers, caution shall be taken to not allow direct contact of the equipment with the pipe.

208.03.14 INITIAL ZONE BACKFILL

A. **Dry Utilities:** Initial zone backfill for dry utilities may consist of sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a backfill material, the sand shall be moisture conditioned and mechanically compacted.

B. **Wet Utilities:** After the pipe or conduit is laid, the initial backfill areas shall use Type II, Type III, Aggregate Base, or CLSM. Avoid usage of impact tampers directly above the pipe until the full loose layer backfill depth above the pipe is obtained. Crushed Rock or drain backfill may be used for the initial zone only if material use has been specifically

approved by the governing agency. If crushed rock or drain backfill is used, comply with ***Subsection 208.03.16, "Drain Backfill."*** The depth of initial backfill above the pipe shall comply with Table 4:

Table 4 - Initial Zone Material Depths

Pipe or Conduit	Initial Zone
2-inch or less diameter	6 inches above the top of pipe
Greater than 2-inch diameter	12 inches above top of the pipe

208.03.15 FINAL ZONE BACKFILL

A. The remaining backfill shall consist of one of the following types as determined by the Engineer.

B. Selected Backfill or CLSM Backfill. Backfill material from the initial backfill zone to finished grade, shall be "Selected Backfill," or CLSM.

1. The material shall be compacted to:

   a. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

   b. If "Selected Backfill" is used in trenches 2 feet or less in width, no stones or lumps greater than 3 inches will be permitted.

2. **CLSM:** When used, CLSM backfill shall be placed from the top of the initial backfill zone to the finished grade.

208.03.16 DRAIN BACKFILL

A. In the event that Drain Backfill is used to control groundwater, the Contractor shall, at no additional cost to the Contracting Agency, construct dams conforming to the requirements of ***Section 501, "Portland Cement Concrete,"*** Class II CLSM, or compacted Type II Aggregate Base. Construct the dams within the drain rock bedding material at each manhole or at intervals of 600 feet, whichever is less. Dams shall extend the width of the trench, a minimum of 18 inches in length, for the height of the drain backfill, and where Type II is used, the compaction shall be:

1. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

B. The Contractor shall install nonwoven geotextile filter fabric between the bedding and backfill material in such a manner to prevent migration of the backfill material into the bedding whenever Drain Rock or Crushed Rock is used as bedding.

C. Geotextile filter fabric shall conform to the requirements specified in AASHTO M288, "Subsurface Drainage Geotextile."

208.03.17 COMPACTION

A. Compaction shall be performed by mechanical means. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used and shall have a maximum lift thickness as indicated in Table 5 - Compaction Lift Thickness. The lifts shall be placed on both sides of the pipe at the same time to reduce pipe movement.

Table 5 - Compaction Lift Thickness

Location	Maximum Compacted Lift Thickness (inches)	Maximum Loose Lift Thickness (inches)
Bedding, Haunch, and Initial Zones	6	8
Final Zone Backfill	12	16

B. Each layer shall be evenly spread, moistened, and tamped or rolled until the specified relative compaction has been attained.

C. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.

208.03.18 TRANSITION INSTALLATIONS

A. When differential conditions of pipe support might occur, such as in transitions from manholes to trench, a transition support region shall be provided to ensure uniform pipe support and preclude the development of shear, or other concentrated loading on the pipe.

208.03.19 MINIMUM DEPTH OF COVER

A. The minimum cover shall be as stated on the plans and/or contract Special Provisions. For flexible pipe, the minimum cover for compaction process using wheel or hydro hammer loads is 24 inches. Equipment used for the initial zone shall allow compaction to the lift requirements of this specification without damage to the pipe.

208.03.20 TESTING

A. Where tests reveal non-compliance with the requirements of the Contract, the Contractor shall bear the costs of subsequent rework and retesting until the required specification compliance is obtained to the satisfaction of the Engineer.

208.03.21 CUTTING AND RESTORING STREET SURFACING

A. Prior to beginning work within any public right-of-way, or cutting any street surfacing therein, an encroachment permit and barricade plan approval shall be obtained from the governmental entity or agency having jurisdiction over that right-of-way.

B. Permit fees and construction restrictions shall be in accordance with the rules, regulations, and ordinances of the entity or agency having jurisdiction.

C. While undergoing improvements, all streets upon or within which any work is being done shall be kept open to all traffic by the Contractor, as specified in ***Subsection 104.04, "Maintenance of Traffic,"*** unless otherwise approved by the Engineer, or as provided in the Special Provisions.

D. Prior to beginning the work, barricading and traffic control devices conforming to the latest editions of the Traffic Control Plans for Highway Work Zones for the Clark County Area and the Manual on Uniform Traffic Control Devices shall be in place, and shall be in compliance with the governmental agency approved traffic control and barricade plan.

E. Pavement in the area of the trench excavation may be wheel cut or spade cut.

F. Temporary Steel Plate Bridging: When approved by the Engineer or Contracting Agency, the Contractor may use steel plates to bridge excavated trenches in areas where the roadway surface is to be opened to traffic. Steel plates shall extend at least 12 inches beyond the edges of the trench. Trenches shall be adequately reinforced to support the bridging and traffic loads. Trench plate thickness shall be at least 3/4 inches for a 1 foot wide trench and shall increase 1/8 inch for every foot of trench width up to a thickness of 1-1/4 inch for a 5 foot wide trench. Steel plates for trench widths greater than 5 feet shall require a special structural design. Trench plates shall be coated with an Antiskid type surface meeting current Caltrans standards of a nominal Coefficient of friction of 0.35 in accordance with California test method 342 (Appendix H). Trench plates shall not be overlapped or stacked on top of another plate. At no time shall the length of any configuration of steel plates exceed three hundred feet or be left in place for longer than 14 days without prior written approval from the Engineer. The Contractor shall ensure that anchoring, strength and side supports are adequate to prevent collapse or movement of the plates. The placement and installation method for temporary steel plate bridging shall be as follows:

1. **Method 1: Roadways with posted speeds of 45 mph and greater, or when required by the Engineer** – The pavement shall be cold-planed to a depth equal to the thickness of the plate and to a width and length equal to the dimensions of the plate(s). Any voids shall be filled with cold mix and compacted to ensure that the roadway has a smooth drivable surface and the plate is flush with the top of the roadway surface (recessed into the asphalt.) The Contractor shall ensure that the approach and ending plates are securely attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement, subsequent plates shall be butted to each other. Steel Plate Ahead (W8-24) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes.

2. **Method 2: Roadways with posted speeds less than 45 mph** – Approach and ending plates shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement. Subsequent plates shall be butted to each other. Fine graded asphalt concrete shall be compacted to form ramps with a maximum slope of 8.5% and a minimum 18 inch

taper to cover all edges of the steel plates. Steel Plate Ahead (W8-24) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry, or equivalent slurry approved by the Engineer.

G. Whenever permanent pavement patches are not constructed immediately following trench backfilling operations, temporary pavement patches consisting of a minimum of 2 inches of hot or cold plantmix or plates shall be utilized to provide the required number of paved travel lanes. Bump Ahead (W8-1) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes. Temporary pavement patches may be left in place for a maximum of 30 working days following completion of backfilling operations unless otherwise approved by the Engineer.

H. The following surface tolerance for temporary patches shall be observed. When a 12-foot straight edge is laid across the temporary patch parallel to the centerline of the street and in a direction transverse to the centerline, a rut, hump, or depression of more than 1/2 inch shall not be evident. Deteriorated temporary patches exhibiting ruts, humps, or depressions shall be repaired or replaced immediately upon notification of the Engineer. If the existing street exceeds the above tolerances, then the temporary patch shall be equal to or better than the condition of the surrounding pavements.

I. Unless otherwise specified and approved, prior to placing the permanent patch, the existing pavement shall be saw cut to a neat line and to a minimum width as shown on the Standard Drawings for Pavement Restoration.

J. Existing aggregate base, shall be scarified and recompacted to meet the requirements of ***Section 302, "Aggregate Base Courses."*** Compaction by rolling with vehicle tires will not be permitted. Aggregate base courses that were constructed with geosynthetics shall be repaired in conformance with the manufacturer's recommendations.

K. BLANK

L. Completion of the permanent patch in areas where an open graded surface course exists, which is less than 10 years in age, shall include placement of a surface course to match the existing surface texture and material mix design, including original bituminous cement type.

M. In areas where lime treated sub-base, cement modified sub-base, soil cement, or similar materials have been used, the Contractor may substitute a lean concrete mix or asphalt concrete equivalent, subject to approval of the Engineer.

N. Upon completion of the permanent patch, including the surface treatment, the surface shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities. The Contractor shall inspect with a straightedge 12 feet long that is laid across the permanent patch parallel to the centerline of the street and in a direction transverse to the centerline. The surface shall not vary more than 1/4 inch from the lower edge of the straightedge. Patches exhibiting deviations greater than 1/4) inch shall be replaced or use mechanical grinding prior to acceptance of the patch. If the existing street

exceeds the above tolerances, then the patch shall be equal to or better than the condition of the surrounding pavement. The Contractor shall submit a report of the tolerance testing to the Engineer for approval prior to the acceptance of the patch.

O. Any concrete improvements disturbed or damaged during construction shall be replaced prior to placement of the permanent pavement patch.

P. All traffic control devices removed or disturbed during construction shall be replaced upon completion of the permanent patch including but not limited to delineation, paint, thermoplastic pavement markings, and traffic signal detector loops. Temporary lane lines and other markings used during construction shall be permanently removed, to the satisfaction of the Engineer, prior to placing the new traffic stripes or markings.

Q. Pavement in the area of the trench excavation shall be sawcut.

R. Cold mix patches will not be allowed.

END OF SECTION 208

SECTION 209 – DRAIN BACKFILL

DESCRIPTION

209.01.01 GENERAL

A. This work shall consist of furnishing, hauling, placing, and compacting drain backfill material around structures, pipes or perforated underdrains to the lines designated on the plans or established by the Engineer.

MATERIALS

209.02.01 GENERAL

B. Material shall conform to the requirements of ***Subsection 704.03.02, "Drain Backfill."***

CONSTRUCTION

209.03.01 GENERAL

C. The trench shall be excavated and drain backfill placed in accordance with provisions of ***Section 607, "Underdrains."***

D. Where drain backfill is part of the structural section, it shall be compacted to not less than 90 percent maximum density. Test method to be determined by the Engineer.

E. Compacting by ponding or jetting will not be permitted.

SECTION 210 – WATERING

DESCRIPTION

210.01.01 GENERAL

A. This work shall consist of, but is not limited to furnishing, hauling, and applying all water required for compaction of embankment foundation areas, embankments, subgrade, mineral aggregate base and surfacing materials, structure backfill, processing lime treated base or subgrade material, or cement treated base, and for controlling dust caused by grading operations, traffic, and natural conditions.

MATERIALS

210.02.01 GENERAL

A. All materials shall conform to the requirements set forth in ***Section 722, "Water."***

CONSTRUCTION

210.03.01 EQUIPMENT

A. Equipment used for applying water required for compacting embankment materials, subgrade, base and surfacing materials, and for controlling dust shall be pressure type distributors equipped with a spray system that will ensure uniform application of water. All the watering equipment used for the application of water shall be equipped with a positive means of shutoff and the use of equipment not so equipped will not be permitted. An approved pump, pipe, hose, and nozzle equipment may be used in embankment construction. Where the head is sufficient to provide enough pressure, the pump requirement may be eliminated.

B. The Contracting Agency does not require that watering equipment be provided with measuring or metering devices.

210.03.02 GENERAL

A. Water for dust control shall be applied in the amounts and on the areas designated by the Engineer.

B. The Contractor shall apply water in the amount necessary to attain the compaction in those materials requiring a specified density. In certain areas of the base courses, water may be introduced into the aggregate at the plant and when necessary to attain the specified compaction, shall be supplemented by additional wetting as specified above.

C. Excavation areas and borrow pits may be watered prior to excavating the material.

D. When water is applied directly to the roadbed, the material shall be processed by suitable equipment until the layer is uniformly wet. Care shall be taken to avoid disturbing layers which have been previously placed and compacted.

E. The Contractor shall make all arrangements for providing an adequate water supply. The Contractor shall negotiate with owners of supply and sign an agreement with each owner prior to removing the water. A copy of said agreement shall be furnished to the Engineer.

The Contractor shall pay all royalties occurring under such agreements and shall also obtain any necessary right-of-way.

END OF SECTION 210

SECTION 211 – EROSION CONTROL

DESCRIPTION

211.01.01 GENERAL

A. This work shall consist of preparing slopes, placing and compacting top soil, seeding, fertilizing, jute matting, and mulching graded and disturbed areas in accordance with these specifications and the details shown in the contract documents.

MATERIALS

211.02.01 GENERAL

A. The materials used shall be those prescribed for the several items which constitute the finished work and shall conform to the applicable requirements of ***Section 726, "Roadside Materials."***

211.02.02 PLANTING SOIL

A. Unless designated in the contract documents, the Contractor shall make the Contractor's own arrangements for obtaining soil at no additional cost to the Contracting Agency. Soil shall be transported directly from the source to final position unless otherwise permitted. Soil shall not be obtained from an area known to have noxious weeds growing in it.

B. Prior to removal of planting soil from the source, the Contractor shall contact the County Weed Control Agency or the State Quarantine Officer for the inspection and destruction of injurious and noxious weeds. Soil that has been treated with herbicides or sterilizers shall be tested by the Nevada State Department of Agriculture to determine the residual in the soil.

211.02.03 SEED

A. All seeds shall conform with all laws and regulations pertaining to the sale and shipment of seed required by the Nevada State Department of Agriculture and the Federal Seed Act. All shipments of seed shall be reported to the Nevada State Department of Agriculture for inspection. Seed shall be of the varieties and proportions specified in the contract documents.

211.02.04 FERTILIZER AND AGRICULTURAL MINERALS

A. All fertilizer and agricultural minerals shall conform with all "Rules and regulations governing the registration, and collection of license tonnage fees for commercial fertilizer in the State of Nevada" as required by the Nevada State Department of Agriculture. Commercial fertilizer formulation and rate of application shall be as specified in the contract documents and subject to sampling for verification of analysis.

211.02.05 MULCH

A. **Hay or Straw:** Hay or straw shall be acceptable to the Engineer. All shipments of hay or straw shall be free of noxious weeds as defined by Nevada State Department of Agriculture. Rate of application shall be as specified in the contract documents.

B. **Wood Cellulose Fiber:** Wood cellulose fiber shall be manufactured in such a manner that after addition and agitation in slurry tanks with fertilizers, seeds, water, and other approved

additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry. When hydraulically sprayed on the ground, the material shall be uniformly impregnated with seed. Rate of application shall be as specified in the contract documents.

C. **Wood Chips:** Wood chips shall be as specified in ***Subsection 726.03.04.D, "Wood Chips and Shavings."***

D. **Bark:** Bark shall be as specified in ***Subsection 726.03.04.E, "Bark."***

211.02.06 ASPHALT EMULSION

A. Asphalt emulsion used as a tie-down for mulch shall be as described in the contract documents.

CONSTRUCTION

211.03.01 PREPARATION

A. Excavation slopes shall be thoroughly cultivated to the depth shown in the contract documents, after which planting soil, if required by the contract, shall be uniformly spread to an approximate thickness of 4 inches, the exact thickness will be determined by the Engineer.

B. Cultivation of embankment slopes shall be required before placing planting soil unless otherwise specified in the contract documents or ordered by the Engineer. Such cultivation shall be considered subsidiary to other portions of the work and no direct payment will be made for such work.

C. Cultivation shall not be performed until all equipment is through working in the area, except equipment required to cultivate the area and spread planting soil.

D. After cultivation and prior to seeding, all rocks 1 inch in smallest dimension and larger shall be removed from all slopes to be seeded and shall be disposed of as approved by the Engineer.

211.03.02 PLACEMENT OF PLANTING SOIL

A. Planting soil shall be evenly spread over the specified areas to the depth shown on the plans unless otherwise approved by the Engineer. After the planting soil has been spread, all large clods, hard lumps, rocks, and litter shall be raked up, removed, and disposed of by the Contractor.

B. Planting soil shall not be placed when the ground is frozen, excessively wet, or, in the opinion of the Engineer, in a condition detrimental to the work.

C. All damage occurring to existing roadbeds, shoulders, walks, curbs, or other existing adjacent structures or areas due to the Contractor's operation in hauling and placing the planting soil shall be repaired by the Contractor at no additional cost to the Contracting Agency.

211.03.03 FIRMING OF PLANTING SOIL

A. Planting soil shall be made firm by use of a heavy or weighted disk set at an acute angle. The entire planting area shall be firmed by a minimum of three passes of the disk. The planting soil surface shall be brought to finished grade by one pass of a toothed harrow with teeth set at a 45-degree angle or by one pass of a steel-wire mat. Soil firming

operations shall be performed by traveling at right angle to the slope, except slopes greater than 30 percent shall be firmed by equipment conveyed up and down the slope by means devised by the Contractor. After firming operations, the planting soil shall be 2 inches below the top of all structures.

211.03.04 SEEDING AND FERTILIZING

A. The Contractor shall notify the Engineer not less than 24 hours in advance of any seeding operation and the Contractor shall not begin the work until areas prepared or designated for seeding have been approved. Following the Engineer's approval, seeding and fertilizing of the approved slopes shall begin immediately.

B. Seeding shall not be done during windy weather or when the ground is frozen. Seed and fertilizer shall be uniformly spread over the area at the rate and mix specified in the contract documents. Seed and fertilizer may be sown by one of the following methods:

1. An approved type hydro-seeder which utilizes water as the carrying agent and maintains a continuous agitator action that will keep seed and fertilizer mixed in uniform distribution until pumped from the tank. Pump pressure shall be such as to maintain a continuous, nonfluctuating stream of solution.

2. Approved blower equipment with an adjustable disseminating device capable of maintaining a constant, measured rate of material discharge that will ensure an even distribution of seed and fertilizer at the rate herein specified.

3. Helicopters properly equipped for aerial seeding and fertilizing. Helicopters so equipped shall have the following:

   a. Two hoppers or seed compartments each capable of containing a minimum of 100 pounds of grass seed or granular fertilizer.

   b. Power driven, readily adjustable disseminating mechanisms capable of maintaining a constant, measured rate of distribution of grass seed or granular fertilizer.

   c. Where liquid fertilizer is furnished in lieu of dry granular fertilizer, the helicopter shall be equipped with two barrels or containers capable of containing a minimum of 15 gallons each. Distribution shall be a spray boom of sufficient size and length, fitted with proper nozzles to distribute uniformly, liquid fertilizer as herein specified.

4. Approved power-drawn drills, with double-disc front delivery openers, and depth bands for positive depth control. Depth control shall be set at a depth of 3/4 inch for consistent furrow bottom placement.

   a. An approved deep furrow drill may be used where it is determined the seedbed is firm and there is little danger of soil blowing. An approved spreader may be used for fertilizer placement. Drills and spreaders shall be calibrated before use on the project.

   b. Areas inaccessible to above methods of application shall be seeded and fertilized by approved hand methods. Distribution of the material shall be uniform and at the rates specified.

c. The Contractor shall provide qualified personnel experienced in all phases of the seeding and fertilizing operation, equipment, and methods as herein specified.

211.03.05 SPREADING MULCH:

A. **Hay or Straw:** Hay or straw mulch shall be furnished, hauled, and evenly applied at the rates indicated, and shall be spread by means of an approved type mulch spreader. The spreader shall produce a uniform distribution of the hay, without cutting or breaking it into short stalks. Areas beyond the range of the mulch spreader shall be mulched by approved hand methods. Distribution of the material shall be uniform and at the rate specified in the contract documents.

1. Unless otherwise specified, straw or hay shall be anchored into the soil by use of a heavy disc with flat serrated discs approximately 1/4 inch thick, having dull edges and spaced no more than 9 inches apart.

2. Anchoring shall be to a depth of 2 inches across the slope, and with no more than one pass of the equipment on the same surface.

B. **Wood Cellulose Fiber:** Wood cellulose fiber utilized as a mulch may be applied with seed and fertilizer in one operation by approved hydraulic equipment. The equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed, and water. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic discharge spray nozzles which will provide a uniform distribution of the slurry.

C. **Wood Chips:** Wood chips utilized as a mulch may be applied by available mechanical chip spreaders or by approved hand methods. The wood chips shall be spread to an average depth of 3 inches.

D. **Bark:** Bark utilized as a mulch may be applied by available mechanical spreaders or by approved hand methods. The bark shall be spread on open slope areas to an average depth of 3 inches. Bark applied as a mulch for tree and shrub rings shall be spread to an average depth of 4 inches.

211.03.06 APPLYING ASPHALT EMULSION

A. When called for in the contract documents, mulch material shall be anchored in place with asphalt emulsion as herein specified. Asphalt emulsion shall be sprayed into the mulch as it leaves the blower pipe and shall be uniformly mixed with the mulch. Asphalt emulsion as specified shall be applied at the rate of 250 gallons per acre. Any mulch disturbed or displaced following application shall be removed, reseeded, and remulched as specified.

211.03.07 PLACING JUTE MATTING

A. Jute matting shall be unrolled and placed parallel to the flow of water immediately following the bringing to finished grade the area specified in the plans or the placing of seed and fertilizer. Where more than one strip is required to cover the given areas, the strips shall overlap a minimum of 4 inches. Ends shall overlap at least 6 inches with the up-grade section on top. The up-slope end of each strip of matting shall be buried in

6-inch slots with the soil firmly tamped against it. The Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be buried in a similar manner. Check slots shall be placed between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as up-slope ends. Check slots shall be spaced so that one check slot or one end occurs within each 50 feet of slope.

B. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting shall be spread evenly and smoothly and in contact with the soil at all points.

C. Jute matting shall be held in place by approved wire staples, pins, spikes, or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in 3 rows for each strip of matting, with 1 row along each edge and 1 row alternately spaced in the middle. All ends of the matting and checks slots shall be fastened at 6-inch intervals across their width. Fastening devices shall anchor the matting against the soil and be driven flush with the finished grade.

END OF SECTION 211

SECTION 270 – DEWATERING

DESCRIPTION

270.01.01 GENERAL

A. This work shall consist of furnishing all materials, labor, equipment and supervision to design, install, operate, remove dewatering systems and to lower the water table sufficient to prevent ground water from entering excavations.

B. The work shall also consist of, but is not necessarily limited to, the proper disposal of groundwater removed by a dewatering system **in accordance with local, state, and federal regulations**. Prior to discharging groundwater into the storm drain system, the Contractor shall be responsible for obtaining the groundwater discharge permit from the Nevada Division of Environmental Protection, comply with the conditions of the permit and pay all costs associated with the permit requirements such as permit fees, laboratory analysis and treatment of the discharge water, if required. The permit application can be downloaded at: ndep.nv.gov/BWPC. Sampling and laboratory analysis shall be completed by Nevada Certified Environmental Manager and Certified Laboratory.

C. Dewatering shall conform to the requirements of ***Section 208, "Trench Excavation and Backfill"*** and ***Section 502, "Concrete Structures"*** unless otherwise specified herein.

MATERIALS

270.02.01 GENERAL

A. At or prior to the preconstruction conference, the Contractor shall submit the dewatering plan showing method of dewatering, piping locations, discharge points, sewer and storm drainage facilities utilized and estimated discharge quantities.

CONSTRUCTION

270.03.01 GENERAL

A. Dewatering for structures and pipelines shall commence when groundwater is first encountered and shall be continuous until such times as water can be allowed to rise in accordance with the following provisions. Dewatering shall be conducted such that no concrete footings or floors or pipelines are placed in water nor shall water be allowed to rise over them until the concrete or mortar has set at least eight (8) hours. Water will not be allowed to rise in pipeline trenches or drained excavations until pipelines or facilities are backfilled or restrained to prevent flotation.

B. The Contractor shall remove all dewatering equipment and materials at the completion of the work or as otherwise directed by the Engineer.

C. The dewatering system shall be kept in operation until all work in the excavation is backfilled and properly compacted to a point three (3) feet above the existing water table elevation.

D. The Contractor shall arrange for and provide all necessary utilities to operate the dewatering system.

270.03.02 POINT OF DISCHARGE

A. The Contractor shall dispose of groundwater removed by the dewatering system into the storm drain system in accordance with local, state and federal regulations.

END OF SECTION 270

SECTION 301 – SELECTED MATERIAL SUBBASE

DESCRIPTION

301.01.01 GENERAL

A. This work shall consist of excavating and placing selected granular materials in one or more courses for subbase in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer. This material is designated to be placed below the Type II aggregate structural layer for pavements and is a part of the pavement structure.

301.01.02 REFERENCE CODES AND STANDARDS

A. Related Interagency Quality Assurance Committee (IQAC) procedures at:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

MATERIALS

301.02.01 GENERAL

A. Material shall be as set forth in the Special Provisions.

B. When Type I Aggregate Base is specified, the gradation acceptance limits and testing methods shall be as set forth in ***Subsection 704.03.03, "Type I Aggregate Base."***

CONSTRUCTION

301.03.01 SUBGRADE PREPARATION

A. The surface of the subgrade upon which the selected material is to be placed shall conform to the established lines and grade, shall be smooth and uniform, and shall be compacted to the required density. The tolerance to the plan elevation grade shall be +0 inches and -1/2 inch.

301.03.02 PLACING

A. In producing, handling, and placing selected materials, care shall be taken to prevent segregation of the fine particles from the coarse. When the required compacted thickness is more than 6 inches, the material shall be placed in layers, none of which shall exceed 6 inches in depth after compaction, except as provided in ***Subsection 301.03.04, "Compaction."***

B. After the material has been uniformly deposited, it shall be thoroughly blade-mixed to the full depth of the layer by alternately blading the entire layer to the center and back to the edges of the roadbed.

1. The material shall then be spread and finished to the required cross section.

2. At the option of the Contractor, selected material may be spread with equipment meeting the requirements of ***Subsection 303.03.03, "Surface Tolerances."***

C. Binder material, if required, shall be incorporated either in the surfacing aggregate at the plant where the aggregate is produced or uniformly on the roadbed in amounts designated by the Engineer.

301.03.03 WATERING

A. Water shall be applied prior to and during all blading operations to moisten the material sufficiently to prevent segregation of the fine and coarse particles.

B. Water shall also be applied during the compaction and maintenance stages in sufficient amounts to attain compaction and prevent raveling.

301.03.04 COMPACTION

A. Compaction shall immediately follow the spreading operation.

1. Where the required thickness is 6 inches or less, the base course may be spread and compacted in one layer.

2. However, if vibratory compaction equipment approved by the Engineer is used, and the requirement for density is complied with, the compacted thickness of any one layer may be increased to 8 inches.

B. Aggregate bases placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations that are inaccessible to the spreading equipment may be spread in one or more layers by any means to obtain the specified results.

C. Each layer of material shall be compacted to not less than 95 percent relative compaction, except under sidewalk areas. Under sidewalk areas, the material shall be compacted to not less than 90 percent compaction.

D. A loss of density in the upper portions of the material may occur due to the elements or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed for such recompaction.

END OF SECTION 301

SECTION 302 – AGGREGATE BASE COURSES

DESCRIPTION

302.01.01 GENERAL

A. This work shall consist of furnishing, placing, and compacting aggregate base courses constructed as specified below and in conformity with the lines, grades, thicknesses, and cross sections shown on the plans or established by the Engineer.

302.01.02 REFERENCE CODES AND STANDARDS

A. Related Interagency Quality Assurance Committee (IQAC) procedures at:
http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

MATERIALS

302.02.01 GENERAL

A. Materials shall meet the requirements of the following subsections:

Materials	Subsection
Type I Aggregate Base	***704.03.03***
Type II Aggregate Base	***704.03.04***

CONSTRUCTION

302.03.01 SUBGRADE PREPARATION

A. Any ruts, holes, defects, or soft yielding places which occur in the subgrade or subbase for any cause whatsoever shall be corrected and compacted to required density and stability before an aggregate base course is placed thereon.

1. The above mentioned repairs shall be made at no additional cost to Contracting Agency, except as provided for in ***Subsection 203.03.03, "Unsuitable Material."***

2. The tolerance to the plan elevation grade shall be +0 foot and -0.1 foot.

B. Unless otherwise specified, the top 6 inches of subgrade shall be compacted to not less than 90 percent compaction.

302.03.02 SPREADING AGGREGATES

A. The aggregate shall be uniformly deposited on the approved subgrade by means of the hauling vehicle with or without spreading devices. Aggregate shall be distributed over the surface to the depth specified on the plans or established by the Engineer.

B. After base course material has been deposited, it shall be thoroughly blade-mixed to full depth of the layer by alternately blading the entire layer to the center and back to the edges of the road. The material shall then be spread and finished to the required cross section by means of a self-propelled pneumatic-tired motor grader.

C. At the option of the Contractor, the aggregate may be spread with an approved self-propelled spreader with the aggregate ready for compaction without further shaping. If

this option is exercised, however, the operation shall become subject to the requirements of ***Subsection 302.03.03, "Watering and Mixing Aggregates."***

D. Reference points will be established on one side of the roadway at intervals approved by the Engineer.

E. Furnish, place, maintain, remove, and dispose of all materials required to provide continuous line and grade control to the placing machine.

302.03.03 WATERING AND MIXING AGGREGATES

A. The base course material and water may be mixed at the plant in a mixer approved by the Engineer.

B. Water shall be added during the mixing operation by means of spray bars in the amount necessary to provide the optimum moisture content for compacting.

C. After mixing to the extent that the product has a uniform homogeneous appearance, the material shall be transported to the job while it contains the proper moisture content and may be placed on the roadbed by means of an approved self-propelled aggregate spreader.

D. If the material has dried appreciably prior to final compacting, additional water shall be added by means of a pressurized water truck to assist in compaction and to prevent raveling.

302.03.04 WATERING

A. Water may be applied prior to and during all blading and processing operations to moisten the material sufficiently to prevent segregation of the fine and coarse particles.

B. Water shall be applied during the compaction and maintenance stages in sufficient amounts to assist in compaction and prevent raveling.

C. Comply with ***Section 210, "Watering."***

302.03.05 COMPACTION

A. Compaction shall immediately follow the spreading operation.

1. Where the required thickness is 6 inches or less, the base course may be spread and compacted in 1 layer.

2. However, if vibratory compaction equipment of a type approved by the Engineer is used, and the requirement for density is complied with, the compacted thickness of any 1 layer may be increased to 8 inches.

B. Aggregate bases placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations that are inaccessible to the spreading equipment may be spread in one or more layers by any means to obtain the specified results.

C. Each layer of material shall be compacted to not less than 95 percent compaction, except for under sidewalk areas, where the material shall be compacted to not less than 90 percent compaction.

D. A loss of density in the upper portions of the material may occur due to the elements or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed for such recompaction.

302.03.06 TOLERANCE FOR FINISHED SURFACE

A. When a 10-foot straightedge is laid in any direction, the finished surface shall not deviate at any point more than 1/2 inch from the bottom thereof.

B. The tolerance to the plan elevation grade shall be +0 foot and -0.05 foot.

END OF SECTION 302

SECTION 310 – SOIL CEMENT SLOPE TREATMENT

DESCRIPTION

310.01.01 GENERAL

A. This section covers high compressive strength and low compressive strength soil cement concrete in addition to bedding mix, and also includes requirements for producing, transporting, placing, compacting, curing, and other work appurtenant to constructing soil cement concrete. In these Specifications, high strength and low strength soil cement concrete differ in aggregate, cement, water, and performance requirements. All other requirements contained herein including producing, transporting, placing, compacting, curing, performing quality control, etc. apply to all soil cement regardless of its strength classification.

B. Soil cement concrete shall be placed and compacted to the line, grades, and sections indicated on the drawings. Bedding mix to be used for special treatment of cold joints in soil cement structures shall consist of fine aggregate, cement, and water.

C. The Contractor shall have full responsibility for administration of a Quality Control Plan for soil cement concrete, which shall meet the same quality control requirements of ***Section 106, "Control of Materials."***

310.01.02 GOVERNING STANDARDS

A. Except as modified or supplemented herein, all materials and construction methods for soil cement work shall comply with the applicable provisions of the ACI and ASTM standards specified.

B. Mix design proportions will be determined by the Contractor and meet the specification requirements contained herein.

MATERIALS

310.02.01 MATERIALS

A. Materials used for soil cement concrete shall conform to the following requirements and no substitutions or alternate material sources shall be permitted without the advance approval of the Engineer:

(a) Portland Cement	ASTM C150, Type V, having a maximum tricalcium aluminate content of 5 percent.
(b) Pozzolan	ASTM C618, Class F.
(c) Water	ASTM C94.
(d) Admixtures (optional)	Retarder ASTM C494, Type D.

(e) Fine Aggregate	Natural onsite soil, or crushed rock, clean and free of organic contaminants (solid or chemical). Clay lumps or balls larger than 2-inch shall be pulverized to pass a No. 4 sieve prior to mixing.
(f) Coarse Aggregate	Natural onsite soil, or crushed rock. Sound crushed rock, in accordance with ASTM C33, free of potential alkali reactivity. Gradation shall be as required to achieve the blended aggregate requirements as specified herein.
(g) Bedding Mortar Aggregate	Neat cement slurry. Mixture of cement, fly ash if desired, and water without any aggregate. Artificial or manufactured sand will not be acceptable.

310.02.02 BLENDED AGGREGATE REQUIREMENTS

A. Contractor shall screen, blend, and otherwise process aggregates from onsite sources to produce a blended soil cement aggregate with a plasticity index of zero that meets the following requirements in accordance with ASTM C136:

LOW STRENGTH SOIL CEMENT BLENDED AGGREGATE REQUIREMENTS	
U.S. Standard Sieve	Percent Passing By Weight
1”	100
No. 4	30 - 80
No. 200	0 - 25

HIGH STRENGTH SOIL CEMENT BLENDED AGGREGATE REQUIREMENTS	
U.S. Standard Sieve	Percent Passing By Weight
1"	100
3/4"	80 - 100
No. 4	30 - 50
No. 30	10 - 25
No. 200	3 - 12

310.02.03 ONSITE AGGREGATE

A. Geotechnical analysis indicates that processed onsite aggregate is acceptable for the soil cement mix. Onsite material should be screened of material larger than 1 inch in diameter. Crushing of oversize material for use in soil cement mix is acceptable and is encouraged to increased fractured faces in the mix. Screening (e.g. at the number 4 sieve) of onsite aggregates and recombining stockpiles (e.g. 50-50 mix) may be required in order to meet

specified gradation. Processing methods for aggregate production, including any washing, shall be at the Contractor's discretion.

B. Contractor shall provide necessary aggregate to allow for overbuild, stockpile bases, trial placement, testing, waste, and materials used for Contractor's convenience.

C. Unless otherwise approved, Contractor shall maintain sufficient quantities of aggregate on-site for a minimum of three days of soil cement placement at the maximum anticipated production rate.

310.02.04 ADMIXTURES

A. If used, the admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations for minimum shrinkage and for compliance with these specifications. Retarding admixture may be used in all soil cement.

310.02.05 BEDDING MIX

A. Use bedding mix as shown in the drawings between the foundation and soil cement and wherever required between layers of soil cement. Retard bedding mix so that its initial set time exceeds 3 hours at 95° F. It may be re-tempered within this time period before it is spread on the foundation or lift surface. Spread bedding so that the maximum thickness over rock foundations does not exceed 2-Inches or 3/4-Inch on soil cement surfaces. Spread bedding mix to a minimum thickness of 1 inch on rock foundations and 3/8-Inch on soil cement lift surfaces. Spread soil cement over the bedding and begin compacting within 45 minutes from the time the bedding mix was discharged. Use mix proportions of fine aggregate, cement, and water developed by the Contractor, based on trial mix testing approved by the Engineer. Use materials of the same type and from the same source as those used for the trial-mix testing. Proportion the bedding mix within the following general guidelines:

Slump (placed on soil cement)	7 to 9 Inches
Maximum aggregate size	3/8-Inch
Minus 200 material (aggregate)	2% maximum
Water reducing admixture	may be required
Design strength (28 day)	2500 psi minimum
Retarder	as required to achieve the required delayed set time

B. Admixtures may be introduced into the mix to maintain its workability. Proportion the mix to be broomable and to minimize segregation. Batch bedding mix either on-site or offsite and transport to the lift surface by crane and bucket, transit truck mixer, pump, or other methods approved by the Engineer. Do not use conveyor delivery unless it can be demonstrated that the mix can be transported on the conveyor without any segregation. The mix design shall have 15% to 30% Pozzolan substituted for cement, by volume, provided that all other specification requirements are met.

310.02.06 SOIL CEMENT MIX DESIGNS

A. At least 90 days prior to construction of the soil cement test sections, Contractor, using the services of an independent testing laboratory acceptable to Owner, shall prepare soil cement mix designs and trial batches for the high strength and low strength mixes. The mix designs and testing shall be conducted under supervision of a Professional Engineer registered in the State of Nevada. Certified reports covering the materials, mix designs, and test results shall be submitted to the Engineer for review.

B. The mix designs will be determined by the Contractor's independent testing laboratory based on the following performance specifications:

Performance Specifications for Low Strength Soil Cement	
Minimum 28 day Compressive Strength of Test Cylinders	750 psi
Minimum 28 day Compressive Strength of Core Samples	750 psi

Performance Specifications for High Strength Soil Cement	
Minimum 28 day Compressive Strength of Test Cylinders	2,000 psi
Minimum 28 day Compressive Strength of Core Samples	2,000 psi

The Contractor is solely responsible for conforming to the performance specifications and may adjust proportions as needed to conform to them. Written approval of the Engineer is required for each mix design change, which must include new mix proportions and test results verifying it conforms to the performance specifications.

The mix design shall include the following information as a minimum:

1. Batch weights or proportions and specific gravities for each proposed aggregate size, water, cement, pozzolan and if required, filler.

2. AASHTO T-180 and ASTM D558 maximum density and optimum moisture.

3. Moisture content and dry density of compressive strength specimen.

4. Water/cement ratio of compressive strength specimen.

5. Compressive strength of soil cement at ages 7, 14, and 28 days and 2 specimens based on an average of at least 3 specimens at an age of 28 days and 2 specimens for other ages.
6. Recommended factor of safety used to determine the cement content that will reasonably assure compliance with the strength requirements.

CONSTRUCTION

310.03.01 SUBMITTALS

A. Placement Plan Submittal

Thirty (30) days prior to beginning soil cement placement, Contractor shall prepare and submit a Soil Cement Placement Plan. The plan shall include sketches and a written narrative containing the following information:

(1)	Working Hours	Tentative hours of work
(2)	Material Storage	Size and capacity of aggregate, cement, fly ash, Pozzolan, and water storage facilities.
(3)	Plant	Type, model and description of mixing plant proposed for use. Maximum hourly capacity and anticipated average hourly production rates. Calibration report.
(4)	Control of Mix Proportions	Location and type of measuring equipment used to control proportions of all mix ingredients.
(5)	Layout Diagram	Diagram showing location of plant, storage facilities, and stockpiles.
(6)	Equipment	General description of type and size of equipment to be used for transporting, conveying, placing, spreading, and compacting soil cement.
(7)	Form Systems	Description and sketches of forming systems.
(8)	Curing	General description of curing plan.

B. Material Submittals

(1)	Cement and Pozzolan:	Submit source(s) of cement and Pozzolan.
(2)	Aggregates:	Submit source(s) of all aggregates.
(3)	Delivery Schedule:	Submit delivery and production schedule for all materials.

C. Testing Laboratory Material Submittals

Contractor shall submit representative production samples of cement, Pozzolan, aggregates, and admixtures to the independent testing firm laboratory selected by the Contractor and approved by the Owner 90 days prior to soil cement placement. Contractor shall submit samples that are representative of those proposed for the project and include manufacturer's test reports indicating compliance with applicable specification requirements and showing all chemical and physical properties. Contractor shall identify all materials with labels and/or tags as appropriate, and provide minimum quantities of materials as shown in table below:

TESTING LABORATORY MATERIAL SUBMITTALS	
MATERIAL	**QUANTITY**
Fine Aggregate	2 tons
Coarse Aggregate	2 tons
Cement (in barrels or sealed bags)	0.3 ton
Pozzolan (in barrels or sealed bags)	0.15 ton
Water	Furnished by laboratory
Admixtures (if proposed by Contractor)	1 gallon each

D. Mix Design Submittals

(1) Bedding Mix Design: Submit mix design and test results for bedding mix showing that the selected mix meets the requirement of ***Subsection 310.03.05, "Batching and Mixing."*** Submit 28-day compressive strength test results no later than 90 days following Notice-to-Proceed.

(2) Soil Cement Mix Design: Submit mix design and test results for soil cement mix showing that the selected mix meets the requirement of ***Subsection 310.02.06, "Soil Cement Mix Designs."*** Submit 28-day compressive strength results no later than 90 days prior to the planned start of soil cement activities.

E. Soil Cement Aggregate Production, Delivery Plan, and Schedule Submittal

Prepare and submit to the Engineer for approval, a production and delivery schedule and a plan for stockpiling aggregate onsite. If onsite aggregate is not used for soil cement, submit a plan for transporting the soil cement aggregates from the aggregate plant(s) to the soil cement plant site. Include a map showing the proposed haul route(s); traffic control measures; the number, type, and weights (fully loaded) of haul vehicles to be employed; and height and weight restrictions for all bridges located along the proposed route(s).

F. Delivery Ticket Submittals

Submit delivery tickets for each delivery of cement, Pozzolan, and bedding mix. Include the source, date manufactured or produced, type or class, Contractor's name, project name, and a

certification that the material meets the specification requirements. Include the following information on each delivery ticket for each load or batch of bedding mix:

(1) Name and location of batch plant
(2) Ticket number
(3) Load and truck number
(4) Date
(5) Destination
(6) Concrete class
(7) Batch weights for all materials
(8) Amount of concrete
(9) Time mixer charged with concrete
(10) Recording of revolution counter (transit-mixed concrete)
(11) Space for initials of receiving party

G. Hot and Cold Weather Concreting Submittals

Submit proposed plan for placing soil cement during hot and cold weather conditions. Include planned procedures for heating and/or cooling materials, use admixtures, and protection of completed work.

H. Quality Assurance Plan Submittal

At least 30 days prior to soil cement placement, Contractor shall submit a Quality Assurance Plan to the Engineer. The Quality Assurance Plan shall include the names and qualifications of personnel involved in the Contractor's quality assurance program, a description of the procedures and frequency of testing, and a tentative format for the daily plant reports as specified in ***Subsection 310.03.10, "Curing and Protection."***

310.03.02 ENGINEER REVIEW

A. Owner will review the Soil Cement Placement Plan and Quality Assurance Plan for general conformance with the project requirements and for the purpose of planning its own quality control testing and inspection activities. Contractor must obtain Engineer's approval of all submittals in this section prior to placing soil cement.

310.03.03 SOIL CEMENT TEST SECTION

A. Prior to beginning placement of the permanent soil cement, the Contractor shall place low strength and high strength soil cement test sections using the mix designs prepared by the independent laboratory. The Contractor shall demonstrate the quality, efficiency, and workability of all the materials and equipment necessary for uninterrupted production and placement of the soil cement, expect that conveyor placement will not be required. Tasks are to include lift surface cleaning, compaction, density testing, cold joints, bedding mix placement, and forming and/or shaping of steps and training walls. Trial placement shall not be initiated until the plant and all equipment required for delivery and placement of the soil cement are operational and fully calibrated. Contractor shall demonstrate various spreading and compaction procedures including, but not limited to, various equipment types and number of passes. The Contractor shall use personnel on the test sections who will be working

directly on the low strength and high strength sections of the project in order to familiarize them with the process and products.

B. The test section for high strength soil cement and low strength soil cement will be constructed at a location determined by the Engineer and agreeable to Contractor. The test section shall consist of three twelve inch thick lifts of soil cement approximately 100 feet long at the base. The lift width shall be 8 feet. The total volume of high strength soil cement test section will be approximately 30 cubic yards.

C. The Contractor shall construct the first two lifts, and discontinue work for 24 hours. At that time, the Contractor shall prepare the surface for a cold joint in accordance with ***Subsection 310.03.07, "Joints Lift and Construction Joints,"*** and proceed with placing the remaining lift.

D. The trial section is to be placed 28 days prior to production of the remaining soil cement work. Acceptance of the trial section is predicated upon achieving the required strengths.

Subgrade Preparation

The foundation soil for the test section shall be cleared, graded, and compacted in accordance with ***Section 203, "Excavation and Embankment."*** The soil cement and bedding mortar shall be placed with the methods and in the sequence that will occur during the actual construction.

Mixing

Soil cement for test sections constructed shall be batched and mixed in accordance with the same requirements specified in ***Subsection 310.03.06, "Soil Cement Transporting, Placing, Spreading, and Compacting."***

Placement

Soil cement placement for test section construction shall be placed, spread, and compacted in accordance with the requirements specified in ***Subsection 310.03.06, "Soil Cement Transporting, Placing, Spreading, and Compacting."*** Equipment used for hauling and placing soil cement shall be clean and free of deleterious substances.

Testing and Quality Control

Prior to initiating the trial placement, Contractor shall perform testing of the aggregates in accordance with the requirements of ***Subsection 310.03.11, "Quality Control and Testing"*** to demonstrate that specification requirements are met. Contractor shall also perform all other tests and quality control measures Identified in ***Subsection 310.03.11, "Quality Control and Testing"*** during the trial placement. In addition, the Engineer will perform his own tests and inspections and the Contractor should anticipate interruptions. Contractor shall allow 3 days from the completion of his work to accommodate such tests and inspections of the trial section until production can begin so the Engineer can perform his evaluation of the test section.

Review Meeting

After completing construction of the test sections but prior to beginning soil cement construction, Contractor, Engineer, and Owner will assemble at a time and location determined by Owner to discuss the results of test section construction and the suitability of the soil cement mixtures. Soil cement mix proportions may be adjusted based on results obtained from test section construction.

310.03.04 JOB CONDITIONS

A. Cement and Pozzolan Delivery, Storage, and Handling

Cement and pozzolan for soil cement shall be stored in separate bins. Storage bins in which built cement and pozzolan are stored shall be weather tight and protected from exposure to moisture. Interior surfaces of storage bins shall be clean and free of deleterious substances to the satisfaction of the Engineer prior to storage. Each shipment of cement and pozzolan shall be stored in chronological order based on delivery date at the job site and shall be used in the same chronological order to prevent undue aging.

B. Temperature of Cement

Deliver cement to the job site at a temperature not exceeding 160° F. The temperature of the air used to transport cement into storage containers or silos must be less than 180°F. The temperature of the air will be determined by measuring the temperature on the outside of the transport pipe with a surface thermometer.

C. Storage

Immediately upon receipt at the soil cement mixing plant, store bulk cement, and pozzolan in a dry, weather-tight silos. All storage facilities are subject to approval and must permit easy access for inspection and identification. Store sufficient cement, and pozzolan to complete at least 5 hours of placement at the typical production rate being experienced.

D. Admixtures

Deliver admixtures (if proposed by Contractor) to the site in the original manufacturer's containers. Store and handle in accordance with manufacturer's printed instructions.

E. Aggregate Production, Delivery, Storage, and Handling

The Contractor’s responsibility includes producing aggregates onsite or providing and delivering aggregates to the site, monitoring delivered quantities, and stockpiling in a manner preventing segregation, intermixing, and contamination.

(1) General: The requirements of Subsection 310.03.04E (2) through (3) also apply when soil cement is produced off-site and hauled to the project site.

(2) Aggregate Production: Contractor shall operate the aggregate production plant in an efficient manner to achieve and maintain an adequate level of productivity and ensure that the final aggregate product is consistent and free from contamination by organic material, overburden, or other foreign materials.

(3) Environmental Controls:

a. Stormwater Control: Implement work to conform to Best Management Practices for control of site runoff and stormwater pollution for the work area that encompasses the aggregate production plant, stockpiles, and related construction site areas.

b. Pollutant Control: Contractor shall maintain aggregate plant areas in a clean orderly condition, free from spilled fuel, lubricant, coolant, or other potential pollutants. Contractor shall maintain material handling areas to reduce potential for pollutants to enter stormwater runoff and institute special precautions to prevent and to clean up spills of any material that might contaminate stormwater runoff.

(4) Delivery:

a. Compliance with Regulations: The Contractor's responsibility includes ascertaining and compliance with all state laws and regulations regarding haul vehicle weight limits and other restrictions as they relate to haul vehicles on public roads. Where the point of ingress or egress is connected to a paved public road, provide a stabilized construction entrance adjacent to the paved area to minimize the amount of mud transported onto the paved area. Contractor shall maintain the entrance pad and top dress with aggregate as required.

b. Delivery Route: Contractor shall deliver aggregates using route(s) identified in the approved delivery plan.

c. Maintenance of Roads: Contractor shall promptly remove, to the satisfaction of the Engineer and the haul route's jurisdictional authorities, any soil, aggregate, or other debris deposited on roads or adjacent areas as a result of the Contractor's activities associated with the work to be performed under this contract. If the Contractor fails to clean a road surface and adjacent areas in a timely manner, or fails to clean the road surface and adjacent areas to the satisfaction of the Owner of the road, the Owner of the road or the Owner has the right to perform the defective work and charge the Contractor for the cost incurred.

Contractor shall notify the Engineer as soon as any damage or deterioration to the road(s) occur that is likely to require remedial work.

(5) Stockpiling Procedures: Contractor shall maintain aggregate stockpiles in good condition to prevent segregation and inclusion of foreign materials. Stockpiles shall be located on level ground free of brush, roots, debris, and other deleterious substances. Stockpiles shall be constructed in uniform layers not exceeding 3 feet in thickness. The maximum height of any stockpile shall not exceed 15 feet. Ramps formed for stockpile construction shall be of the same material as that being stockpiled, and shall be considered a part of the stockpile. Prior to steepening or widening stockpile ramps, contaminated surface materials shall be removed. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

(6) Moisture Conditioning: If aggregate evaporative cooling is utilized, or if the aggregate is sufficiently dry to require moisture conditioning, continuously mist aggregates during stockpiling until a saturated surface-dry (SSD) condition is achieved. Use sprinklers or fog

spray type nozzles and do not apply pressurized water directly into stockpile. Exercise caution during aggregate stockpile misting to prevent washing of fine material.

(7) Stockpile Withdrawal: Withdraw aggregates from the stockpiles using conveyors, face loading with front-end loaders, or a combination of conveyors and face loading. Regardless of the method employed, withdraw materials that are representative of the entire stockpile, both in terms of gradation and moisture content. Blend any obviously segregated material with other material in a manner that will result in a gradation that meets the specifications. If the material cannot be suitably blended, separate it from the stockpile and use for other non-critical purposes, or waste the material.

F. Material Certification

With each shipment of cement and Pozzolan delivered to the project site, Contractor shall provide Engineer with one copy of the material supplier's certification as to the source quality, and weight of the material delivered to the project site.

G. Plant Calibration

After mobilizing and erecting plant equipment at the project site and prior to beginning soil cement production, Contractor shall perform, at his expense, all necessary shakedown and trial runs of his proportioning, mixing, hauling, handling, and conveying equipment so that when put into production operation for construction of the Work, the equipment shall consistently and accurately produce a uniform soil cement mixture of the quality specified.

Contractor shall calibrate the plant scales and other mixture proportion control devices and shall submit a calibration report prior to initiating soil cement placement. The accuracy of all scales and control devices shall be certified in accordance with State of Nevada standards for weights and measurement of concrete batching and mixing equipment. Contractor shall recalibrate the plant following each 30 shifts or 5,000 cubic yards of placement, whichever is less, or when quality control testing indicates a potential problem.

H. Flood Protection

The plant and all related equipment shall be built so that if the plant areas are temporarily inundated by flood waters, damage to the equipment or stockpiles shall not result in a delay caused by rebuilding of the plant or replacing stockpiles.

310.03.05 BATCHING AND MIXING

A. General

The Contractor shall select the type of concrete mixing plant to be used and shall determine the plant layout. The plant shall include all necessary mixers, volumetric or weight controls, storage bins, feed systems, and discharge mechanisms. A description of the plant shall be submitted to the Engineer for review and acceptance as described in ***Subsection 310.03.01, "Submittals."*** The plant may be a continuous pugmill or a batch type pugmill. The Contractor shall perform, at his expense, all necessary shakedown and trial runs of his mixing and proportioning equipment so that when put into production operation for construction, the equipment shall consistently and

accurately provide mixtures of the quality specified. The minimum sustainable capacity of the plant(s) must be at least 300 tons per hour using the specified mixes. Material not meeting the specified requirements will be rejected and not allowed in the construction. The Owner will require the Contractor to remove rejected material at the Contractor's expense.

B. Batching or Proportioning Tolerances

Batching or proportioning of soil cement materials shall conform to the mixture proportions directed, within the following tolerances:

BATCHING OR PROPORTIONING TOLERANCES	
MATERIAL	PERCENT*
Cement	± 2.0
Water	± 2.0
Blended Aggregate	± 3.0
Admixtures	± 3.0
Pozzolan	± 3.0

* For continuous mixing plants, the variation is in percent by weight of the total weight of each material for the specified mix in the total sample obtained for a given duration of time. The minimum sample collected shall be one to three cubic feet.

C. Continuous-Mixing Plant Requirements

(1) General

Continuous mix plants shall be capable of producing concrete of the same quality and uniformity as would be produced in a conventional batch-type plant. In general, the plants shall conform to the requirements of ASTM C685, except that proportioning tolerances shall be as specified herein and adaptation to accommodate aggregate size shall be made as needed.

The plant may be a central-type plant and shall have a stationary twin-shaft pugmill mixer and shall be a continuous-mixing type. The plant shall be equipped with positive means for controlling the mixing time maintaining constant mixing time, and maintaining a constant rotation speed of the pugmill shafts.

Mixers shall not be charged in excess of the capacity recommended by the manufacturer and shall be capable of combining the materials into a uniform mixture and shall be capable of discharging the mixture without segregation. The plant's transfer systems must be capable of charging and discharging the constituents and mixed product without bridging or choking.

Mixers shall be maintained on satisfactory operating condition and mixer paddles shall be kept free of hardened concrete. Mixer paddles shall be replaced when their face area has been reduced to less than 80% of their original area. The minimum mixing time for continuous mixing pugmills or batch type pugmills is 15 seconds. The minimum mix retention time for batch type pugmills is 90 seconds.

The intent is to operate continuous pugmills in a continuous manner at one set of feed rates with a minimum number of shutdowns and startups during soil cement production placing. Contractor shall calibrate and operate the plant so that all materials simultaneously begin feeding into the mixer at the specified rates when the mixer is started, and all materials simultaneously stop feeding into the mixer when it is stopped. No lag or lead-time between materials will be allowed at the point where they enter the mixer. After material feeds are shut down, discharge all remaining material in the mixer. The initial soil cement produced after a plant re-start may not conform to the specification requirements. If the plant can be stopped and re-started at the same mix proportions, no material has to be wasted. The need to waste material after a re-start will be evaluated for consistency and uniformity on a case-by-case basis by the Engineer. When the plant is shut down for over 30 minutes, waste the first one-half cubic yard of material.

(2) Aggregate Feed

Separate bins or compartments with steep side slopes, large gate openings, and the capability of handling aggregate in a damp condition shall be used for each aggregate group used in the soil cement mix. Each bin shall be of sufficient capacity to supply the mixer continuously while operating at full capacity. The bins shall be arranged to ensure separate and adequate storage of appropriate fractions of aggregate. Each compartment shall be provided with some means of preventing backing up of material into other bins. Unless the aggregate in the bin is readily visible to operating personnel, each aggregate bin shall be equipped with mechanical or electrical sensors to indicate when aggregate in the bin is below the level to permit accurate proportioning to the mixing unit. Each bin shall be constructed or equipped in such a manner that a representative sample may be taken readily and safely from each bin discharge during plant operations.

Feed cement and aggregates uniformly, continuously, and simultaneously, at the appropriate ratios for the mix design specified, into the mixer by belt or other acceptable method. Feed controls may be by volume or weight. Aggregate feed may be accomplished by a single belt from each stockpile or from feed bins of the various size groups through openings at the bottom of the feed bins. Provide each opening in aggregate feeders with a gate that can be locked at the necessary opening size to provide the correct feed rate. Keep return side of all belts clean. Keep bins sufficiently full to allow a uniform flow of aggregate at an essentially constant rate. Particular attention may be needed to guarantee a continuous flow of the fine aggregate if it is very damp and is graded towards the fine side of the specified gradation band. Feed cement (and Pozzolan) continuously in a manner that can be controlled by adjusting the belt speed or feed rate. Provide special attention to the cement (and Pozzolan) feed equipment so that it consistently and uniformly delivers materials even at low (100 lb./yd^3 or less) dosage rates.

Use feeds capable of gradual adjustment while in operation. Use continuously correcting automated gate openings and/or belt-feed rates by electronic feedback of weight sensor units on the belts if operation without them cannot provide the accuracy, consistency, and quality required by these specifications.
Provide individual silos for bulk cement and Pozzolan with ample size and so constructed that the various materials will remain separate under all working conditions. Separate all compartments containing cement and Pozzolan from each other by a free draining air space. Clearly mark cement and Pozzolan silos with signs to indicate the material contained in each silo.

(3) Cement and Pozzolan Feed

Feed cement and Pozzolan continuously in a manner that can be controlled by adjusting the belt speed or feed rate. Provide special attention to the cement (and Pozzolan) feed equipment so that it consistently and uniformly delivers materials even at low (100 lb./yd^3 or less) dosage rates. Metering and feed shall be designed and controlled so that cement is uniformly fed into the mixer or into the stream of aggregate on the feeder belt, all with necessary controls to prevent loss of cement as dust or in any other form. Control of the quantity of cement shall be linked either electronically or mechanically to the other feed systems. An electronic belt-weighing device shall be provided to meter and monitor the individual amount of cement delivered into the mixture.

(4) Water Control Units

Contractor shall provide a water dispenser that is capable of dispensing the mix water within the specified requirements. Contractor shall also provide piping, valves, and other components that are free from leakage for delivering water to the mixer. Water may be weighed or metered by an in-line volumetrically activated flow meter. The metering valve must be capable of gradual adjustment during the mixing process to compensate for varying moisture contents in the aggregates. Contractor shall use valves that are automatically controlled and will close if the cement, Pozzolan, or aggregate stops entering the mixer at the required rate. This control may be bypassed for cleaning operation. When the quantity of water is controlled by metering, provisions shall be made where the quantity of water delivered through the meter can be checked readily by weight. A water storage tank shall be provided to prevent surge drawdown effects.

(5) Mixer

The mixer unit shall be a stationary mixer of the twin-shaft pugmill type capable of producing a uniform homogenous mixture of the required soil cement materials within tolerances specified. Blades shall be adjustable for angular position on shafts and reversible to retard flow of mix. The mixer shall bear a manufacturer's plate indicating net volumetric contents of mixer at several heights inscribed on a permanent gate and the rate of feed of aggregate per minute at plant-operating speed.

(6) Discharge Hopper

A discharge hopper with a minimum capacity of five cubic yards shall be provided wherever the mixed soil cement temporarily accumulated before loading into trucks or conveyors for transport. The hopper shall be equipped with vibrators and dump gates that will permit rapid and complete discharge of soil cement without segregation. Hopper shall be constructed with side slopes, baffles, and gates as necessary to prevent segregation of the soil cement mixture. When discharging soil cement from conveyors into the hopper, the drop height shall not exceed 5 feet. When loading soil cement into trucks, scrapers, or other transport equipment, the maximum drop from the bottom of the discharge hopper to the bed of the transport equipment shall not exceed 5 feet. Telephone or radio communication between the discharge hoppers, the mixing plant, and the placement site shall be provided.

(7) Chutes and Drop Tubes

Unless specifically authorized in writing, chutes or uncontrolled drops exceeding 5 feet will not be permitted.

(8) Conveyors

Contractor shall design and/or provide conveyors and transfer components for low maintenance, continuous operation with clean return belt surfaces and without segregation or excessive loss of material. Fit all belts with covers or shields to prevent drying by the wind and sun, and over-wetting from rain. The maximum free fall drop from conveyors is 5 feet.

(9) Sampling Facilities

Suitable facilities and labor shall be provided for obtaining representative samples of materials as they enter the mixer, are discharged from the mixer, are discharged from the discharge hopper and from the placement after spreading. Contractor shall furnish all necessary platforms and equipment for obtaining samples, which will be used for quality control and quality assurance testing.

(10) Equipment Substitutions

After equipment is demonstrated as suitable for production and placement, as indicated by Contractor submittals, calibration report(s), and the trial placement, no substitution of equipment will be permitted without prior written approval by the Engineer.

310.03.06 SOIL CEMENT TRANSPORTING, PLACING, SPREADING, AND COMPACTING

A. General

The soil cement mass shall be constructed in as nearly a continuous operation as is practical. The spillway face, cut-off wall, and open channel cross section shall rise at essentially the same level across the entire area. As placement of a lift progresses, the exposed edges shall be kept "live" by progressively placing out from them. Whenever a cold joint at any edge of any lift does occur, it shall be prepared as required in the ***Subsection 310.03.07, "Joints Lift and Construction Joints."*** The rate and schedule of placement shall minimize the occurrence of cold joints. All surfaces of the concrete outlet conduit against which soil cement is to be placed shall be clean, free of dirt, oil, and grease, and properly prepared prior to placement of soil cement. All dirt, mud, water, and debris shall be removed from the space to be occupied by soil cement; all surfaces encrusted with dried soil cement from previous placement operations shall be cleaned; and the entire installation shall be acceptable to the Engineer.

B. Time Requirements

The time from mixing the soil cement to depositing it shall not exceed 20 minutes and the time from depositing the soil cement to spreading it shall not exceed 10 minutes. The compaction operation shall be started within 45 minutes after the addition of water to the soil cement moisture at the plant, and within 20 minutes after completion of spreading. Final compaction of any volume of soil cement shall be completed within one hour of the time at which water was introduced into that volume of soil cement mixture at the mixing plant.

C. Subgrade Preparation

Before placing soil cement, the subgrade shall be prepared as described in ***Section 203, "Excavation and Embankment."*** Immediately prior to the placement of the bedding mix, the receiving surfaces shall be in a moist condition. Contractor shall not cover exposed slopes with bedding mix until the area has been approved by the Engineer.

D. Slope Preparation

Before placing soil cement, the embankment slope face shall be uniform, dense and free of loose ravels or otherwise unsuitable materials. Density of the slope face shall be equal to the density specified for embankment construction. Immediately prior to the placement of soil cement, the receiving surfaces shall be in a moist condition.

E. Embedments

All embedments such as weep hole drain conduits shall be accurately positioned and securely anchored in place. Embedment surfaces shall be clean when installed.

F. Transporting

Soil Cement shall be transported from mixer to placement area as rapidly as practicable by methods which minimize segregation, contamination and drying. Trucks, conveyors, or other equipment acceptable to the Engineer may be used to transport soil cement to the placement area.

Soil cement may be hauled using trucks, large front-end loaders, or scrapers to various locations on the placement area. Tracked haul vehicles will not be permitted. Contractor shall use bottom-dump haul vehicles, end dump trucks with special tail gates or drop control methods that demonstrate an ability to handle dumping without excessive segregation, and/or front-end loaders. The haul vehicles must be free of deleterious materials including, but not limited to, oil, grease, loose, deteriorated, or dry soil cement and soil. The maximum free fall drop height from hauling vehicles is 5 feet.

Equipment will not be allowed to track mud or other contamination onto previously placed soil cement. This may require using clean crushed rock on haul roads, washing tires of vehicles prior to driving onto the soil cement prior to placing the next lift, or other special measures. Any segregated soil cement that results from using haul vehicles shall be removed by hand or re-blended. Haul vehicles shall be operated in a manner that precludes tight turns, sudden stops, or other procedures by vehicle operations (oil spills, etc.), it shall be cleaned or the damaged material shall be removed.

G. Conveying

Conveyor belt systems or mobile crane conveyors may be used for final deposition of the soil cement into place for spreading and compaction. The conveyor system and soil cement shall be designed and manufactured by personnel fully experienced with conveyor belt delivery of low slump mass concrete and shall be designed specifically for continuous operation at speeds that meet production requirements and do not segregate materials.

Conveyors shall be equipped with protection devices as necessary to prevent leakage of lubricants or other foreign materials onto the belts or onto the soil cement surfaces below. Conveying equipment shall be outfitted with suitable hoppers at all transfer points if soil cement is transported to the conveyor by truck or other vehicular equipment. If necessary Contractor shall provide baffles at the end of conveyors and within hoppers to limit free fall heights to 5-feet and at other locations that otherwise cause excessive segregation.

H. Placing and Spreading

(1) General

The Contractor is cautioned to understand and apply applicable fall protection requirements to all work on the site. The Contractor is responsible for all health and safety requirements at the site.

(2) Layout of the Placement Area

It is the intent of this specification to raise the soil cement at essentially the same level across its entire area. As nearly as is practical, expose no more than two lift surfaces at one time. One additional layer may be exposed under special circumstances such as crossing conduits or other features. Maintain lift grade control by using grade stakes and/or laser-guided equipment, or other surveying methods. Whenever a cold joint at any edge of any lift occurs, locate it at least 10 feet horizontally from the location of other cold joints that may have occurred previously. Prepare the joint as required by ***Subsection 310.03.07, "Joints Lift and Construction Joints"*** of these specifications for "cold joints" prior to resumption of soil cement placement.

(3) Depositing

Deposit soil cement at the location at which it is to be spread. Where haul vehicle delivery is used, depositing will generally be accomplished with a dump-spread action while the vehicle is moving. When stationary end dumping is necessary, deposit the material on top of the fresh soil cement layer being advanced, not on the previously compacted layer. Do not place material in piles higher than 3 feet. For belt delivery, limit pile heights to 3 feet and discharge from the belts in a manner that does not cause segregation. If trucks are used to deliver soil cement, do not discharge material directly against any formwork. At isolated or confined placement locations, the Engineer may permit pushing the soil cement up to 50 feet with spreading equipment, provided that segregation does not occur. Modify operations if the Engineer determines that excessive segregation is occurring.

(4) Spreading

Within 10 minutes after depositing, the mix shall be spread into an even layer that will, after compaction, be 12-inches thick, unless another lift thickness is satisfactorily demonstrated and approved during the trial placement. (Do not place soil cement in compacted lifts unless they are 4-inches thick.) Where soil cement is spread onto or into a bedding mortar, spreading shall be accomplished before the bedding has begun to set, but no more than 90 minutes from the time the bedding mix was batched and within 45 minutes of when the bedding mix was first deposited.

Spreading shall be accomplished with low contact pressure equipment, such as a track-type dozer and must be capable of placing the soil cement in uniform lifts and without segregation. The suitability and acceptance of any spreading equipment will be based on the results of the test section. Do not operate tracked spreading equipment on compacted soil cement unless tracks with flat rubber pads are used or rubber mats are placed between the compacted surface and the dozer tracks. Remove any loose material resulting from operation of equipment on compacted surfaces prior to placing the next lift. Have a front-end loader with operator available to assist with depositing and spreading of material in confined areas, at irregular foundation conditions, and at other locations as needed. Accomplish spreading in a manner that does not cause segregation. If large aggregate rolls or segregates to the outside edge of a spread layer of soil cement, reblend it into the soil cement or remove it. Maintain all equipment in good operating condition so that it does not leak or drip oil, grease, or other obvious visible contamination onto the soil cement. Do not place concrete on a previous layer which is suspect and is being considered for testing, retesting, or rejection, or has not been completely compacted.

Soil cement may be placed with an approved tamping paver. Adjust the paver and regulate the speed to prevent segregation. Do not exceed a paver speed of 10 feet per minute unless it can be demonstrated to the satisfaction of the Engineer that higher speeds do not cause problems. Operate the paver with a constant supply of soil cement in the hopper.

I. Compaction

(1) Compaction Procedures

At the start of compaction, the mixture shall be in a uniform, loose condition throughout the full depth, and at the specified optimum moisture content. The specified moisture content shall be maintained uniformly throughout the layer of material being compacted. Concrete lifts shall not be left undisturbed for longer than 30 minutes during compaction operations.

If necessary, moisture shall be added during the compaction operation to maintain the uncompacted mixture at its optimum moisture content.

(2) Compaction

Compact each 12-inch layer of soil cement with a minimum of 4 passes of a self-propelled double drum or 8 passes of a self-propelled, single-drum vibratory compactor. (A round trip is 2 passes). Use the largest size equipment specified below that is capable of physical and practical operation in the area to be compacted. Use small walk-behind vibratory rollers and/or hand-guided power tampers for compaction in any areas that cannot be reached with the drum of a large vibratory roller. Do not operate rollers in the vibratory mode until they are moving. Maintain all compaction equipment in good operating condition at all times and do not allow it to drip or spill oil or other obvious visible contamination onto the soil cement. Break down, trim, and compact the edge of all compacted layers against which adjacent soil cement is not placed within 30 minutes so that the edge is thoroughly compacted and does not contain loose segregated aggregate. Spread and roll so that a flat surface results with minimum roller marks from the edge of the drum, and so that the drum does not bridge over any of the surface beneath the roller drum after the last pass. Operate rollers at speeds not exceeding 160 feet per minute.

(3) Acceptance

Compacted soil cement shall be within 2 percent of optimum moisture content. No individual compaction density test shall be less than 95% of the optimum compaction density value. Determine the average wet density from the average of two readings taken with the gauge probe at a depth 2 inches from the bottom of the lift. If the two readings vary by more than 2%, repeat the density test. If it is demonstrated early in production that the two readings are consistently within 2%, the two readings can be reduced to one. Also measure densities with the gauge probe at 6 inches; however, this reading will not be used to compute the average density.

(4) Additional Compaction

If, after testing, the soil cement does not meet the required density, it may be compacted with additional roller passes, provided that the time limit in Subsection 310.03.06B has not been exceeded.

(5) Removal of Material

If the time limit specified in Subsection 310.03.06B has been exceeded and the soil cement has not achieved the required density, or if the mixture is wetted by rain so that the average moisture content exceeds the specified moisture requirements before achieving compaction, remove the soil cement full depth and replace it at no cost to the Owner. Clean the underlying surface and treat as a lift surface cold joint prior to replacing the removed soil cement with new material.

(6) Compaction Requirements

The Contractor will determine the optimum compaction density value during the trial placement. The optimum compaction density value is the highest density attainable using the specified soil cement mix proportions and the equipment approved for soil cement construction. Nuclear density readings are taken after two roller passes in the trial placement until there is no increase in density or the increase is less than 0.1 lb./pass. Final evaluation of density results for the determination of the optimum compaction density value will be made only after all major field adjustments have been made and the mix design is considered to represent soil cement that has suitable placement, spreading, and compaction characteristics, and provides the required strength and porosity values. Small field adjustments to the optimum compaction density value may be made throughout construction based upon the running average density value. Such changes may be made based on slight changes or long-term drift of density values resulting from field mix design adjustments.

(7) Compaction Equipment

Large-width, self-propelled vibratory rollers shall be used in open areas; small vibratory rollers shall be used within 3 feet of the cast-in-place concrete and at irregular areas; and hand-guided power tampers shall be used for compaction in any areas that cannot be reached with the drum of a vibratory roller. Rollers shall not be operated in the vibratory mode until they are moving. All compacting equipment shall be kept in good operating condition at all times and will not be allowed to drip or spill oil or other visible contamination onto the soil cement.

Self-Propelled Rollers: Contractor shall provide single or double drum, self-propelled vibratory rollers that transmit a dynamic impact to the surface through a smooth steel drum by means of

revolving weights, eccentric shafts, or other equivalent methods. Use compactors with gross weights of not less than 21,000 lb., minimum dynamic force of at least 475 lb. per inch of drum width at the operating frequency used during construction, vibrating frequency of at least 1500 cpm (cycles per minute), drum diameter between 4 and 6 feet, drum width of 5 to 8 feet, and engine horsepower of at least 125. The roller shall be operated at speeds not exceeding 1.5 miles per hour. Within the range of the operational capability of the equipment, the Engineer may direct or allow variations to the frequency and speed of operation which result in maximum density at the fastest production rate. Any other compaction equipment proposed must demonstrate that it is capable of compacting the soil cement full depth to the specified density prior to soil cement production. Provide at least one fully operable, self-propelled vibratory roller on the placement area at all times during production placement. Standby replacement equipment shall be available within an hour, if needed.

Power Tampers and Small Vibratory Rollers: Contractor shall use small vibratory rollers that can operate within a few inches of a vertical face to compact the soil cement adjacent to formwork, precast panels conventional concrete structures, abutment slopes, and at other areas where the large vibratory rollers specified above cannot maneuver. Contractor shall provide rollers with a dynamic force of at least 150 lb./in of drum width for each drum of a double drum unit and at least 300 lb./in of drum width for a single drum unit. Provide at least one fully operable, small roller at the site during soil cement placement.

Contractor shall provide tampers, plates, and rammers that develop a force per blow of at least 3500 lb. per square foot. Contractor shall maintain at least two tampers, plates, or rammers in good operating condition at the site during soil cement placement.

The amount of rolling and tamping required shall be whatever is necessary for the particular equipment to provide the specified degree of compaction. Contractor shall reduce the lift thickness as required to achieve the specified compaction in locations where power tampers and small vibratory rollers are used. Contractor shall conduct field tests with proposed equipment of rolling and tamping as required to comply with specifications. Standby replacement equipment shall be available as needed.

310.03.07 JOINTS LIFT AND CONSTRUCTION JOINTS

A. General

It is the intent of this specification to place the entire soil cement mass with sufficient continuity so that it hardens and acts as a monolithic block without discontinuous joints or potential planes of separation. The length of time between placement of successive layers of soil cement that can be tolerated is dependent upon temperature. Joint quality is also dependent upon cleanliness, surface moisture and whether a bedding mix is applied. When the limits between successive lifts of soil cement layers exceed those specified herein, a cold joint will be considered to have occurred, and the procedures described for cold joints in this section.

Routine Lift Surface Treatment: Keep joint surfaces in a clean, uncontaminated, and continuously moist condition until placement of the succeeding soil cement. At a minimum, the Contractor should anticipate blowing every lift surface with compressed air if loose material and contamination are present. Employ a system to continuously maintain lift surfaces in a moist, but not wet, condition. The system may consist of, or be supplemented as necessary by, mists and

light sprays from hand-held hoses to reach all areas of each lift. Heavy sprays from water trucks provide too much water and are not acceptable. Water trucks may be used if they can provide a fine spray or mist. Do not apply the mist or spray in a channeled or pressurized manner that may erode the fresh soil cement surface or at a rate that causes ponding on the surface. Have one person on duty during the soil cement placement operation with the sole responsibility of operating the water system to keep the entire surface moist but not over-watered. He may be allowed to perform routine maintenance of nozzles and move hoses only if these activities do not prevent him from keeping the entire exposed surface in a continuously damp condition. During non-placement hours the soil cement shall be maintained in a moist condition either by on-site personnel or by covering the lift with tarps or plastic.

B. Lift Surface Cold Joints

A cold joint on a lift surface will be considered to have occurred when a period of more than 4 hours has elapsed (from May to September), and a period of more than 8 hours has elapsed (from October to April) before placement of the successive lift. Prepare cold joints for the subsequent lift by removing all laitance, loose debris, and contaminants from the entire surface. Expose, but do not undercut the aggregate with the cleaning procedure. At this stage of maturity, use water jetting if air alone does not satisfactorily prepare the surface. After preparation, maintain the surface in a damp condition and place a layer of bedding mix with an average thickness as specified in ***Subsection 310.02.05, "Bedding Mix."***

C. Lift Edge Cold Joints

A cold joint on a lift edge will be considered to have occurred when more than 30 minutes has elapsed since placement of the material at the lift edge. Treat the cold joint prior to resuming soil cement placement by cutting back into the compacted cement providing a vertical full depth joint. The cold joint shall be transverse to the layer direction and located a minimum 6" inside the lift edge. Joints shall be staggered to inhibit cracking. Prior to subsequent lift, clean joint of laitance, loose debris and contaminates from the joint edge.

D. Lining Joints at Structures

The joints between the soil cement lining and concrete structures shall be 1-inch premolded elastomeric joint filler.

310.03.08 FINISH TREATMENTS AND TOLERANCES

The finish treatment and tolerances for soil cement shall be as specified herein.

A. Facing Finish Treatment

(1) Forming: Construct the exposed face of the soil cement as shown on the drawings and as specified herein. Select a forming system and demonstrate at the soil cement test section that it will provide soil cement surfaces within the specified tolerances and acceptable texture.

(2) Forms: Form the steps and any other exposed soil cement face to provide the finished surfaces shown on the drawings. Construct all formwork as specified. The Contractor is

responsible for the design of the formwork, as well as its construction in ***Section 502, "Concrete Structures."*** Provide and construct forms with sufficient strength to withstand the pressure resulting from placement and compaction of the soil cement and with sufficient rigidity to maintain specified tolerances. Forms need not be mortar tight if bedding mix is not used.

(3) Repairs: It is the intent of these specifications to require forms and soil cement workmanship be such that soil cement surfaces will require no repairs after form removal. The workability of the soil cement may need to be adjusted such that the concrete can be fully consolidated against the forms. It is anticipated that form work will have to be strengthened to resist lateral forces exerted by compaction equipment. As soon as the forms have been stripped and the formed surfaces exposed, the Engineer will inspect the formed surface to determine if there is adequate consolidation, excessive honeycomb, or other defects. The soil cement test section shall be used as a "Paint Chip" as to what texture and degree of honeycombing is acceptable and what is not. If the defects are excessive, clean the defective areas of loose or unconsolidated material and repair with conventional concrete at no cost to the Owner.

(4) Compaction: Compact the soil cement as specified in ***Subsection 310.03.06, "*Soil Cement Transporting, Placing, Spreading, and Compacting*."***

(5) Tolerances: See Subsection 310.03.08B.

B. Structural Tolerances

(1) General: Construct within the tolerances specified in ***Section 502, "Concrete Structures"*** except as supplemented or modified below.

(2) Specific Requirements:

a. Limit overbuild of the downstream face of the soil cement to 1 inches. Underbuild will not be allowed.

b. Do not vary the downstream edge of any soil cement lift by more than 1 inches in 100 feet.

c. Construct the thickness of individual compacted layers of soil cement within plus or minus 2 inches of that stipulated.

d. Keep the elevation of the surfaces of roller-compacted concrete layers upon which subsequent concrete is placed within 5 inches from the design elevation. Additionally, keep the elevation of the top three lifts within 2 inches of that shown on the drawings.

e. Do not vary the upstream and downstream edges of the finished top of structure by more than 2 inches in 10 feet. Do not exceed the plan width by more than 2 inches. Place the top lift such that the final elevation of the top soil cement layer is within 2 inches of that shown on the drawings and does not vary more than 1 inch in 10 feet. Underbuild will not be allowed.

f. Surface irregularities are solely the responsibility of the contractor.

310.03.09 REQUIREMENT AND LIMITATIONS

Contractor may be required to alter soil cement placement operations, or halt placement operations, to minimize the detrimental effects of adverse weather on the soil cement.

A. Hot Weather Soil Cement Placement

The Contractor shall protect the soil cement from moisture loss during hot weather. Soil cement placement shall be suspended if high ambient temperatures and/or wind dry the uncompacted soil cement mixture so that adequate compaction is not possible. The surface of soil cement upon which subsequent soil cement will be placed shall be kept continuously damp. During daylight hours the maximum temperature of the soil cement mixture immediately prior to compaction shall not exceed 85°F. If the Contractor places soil cement during the night between 8:00 p.m. to 8:00 a.m., the maximum temperature of the soil cement mixture immediately prior to compaction shall not exceed 90°F. The temperature will be measured at the point where the soil cement is delivered to the lift surface. Contractor shall take all precautions necessary to control the placement temperature of soil cement including, but not limited to, sprinkling stockpiles, use of chilled water or liquid nitrogen, use of sun screens, or nighttime placement.

B. Cold Weather Soil Cement Placement

Soil cement shall not be placed when ambient air temperatures drop below 32°F. In the event ambient temperatures drop below 32°F and the temperature of the soil cement mixture stays above 35°F, the Engineer may permit placing of soil cement for temporary periods provided the ambient temperature remains above 25°F. If the ambient temperature drops below 32°F or the surface of any soil cement less than 7 days old drops to 35°F, cover the surface with heavy tarps, blankets, straw, or other acceptable temporary protection until the ambient temperature rises above 35°F. Remove all soil cement that is less than 7 days old and is exposed to temperatures less than 32°F.

C. Rainfall

Soil Cement shall not be placed during heavy rain which is more than 0.20 inches per hour, or 0.03 inches in 6 minutes, as defined by the Weather Bureau Glossary of Meteorology. Contractor shall suspend production when free surface water begins to accumulate on the compacted soil cement when excessive pumping, tracking, or other unacceptable damage begins to develop, or when, in the opinion of the Engineer, rain is adversely affecting any aspect of quality. Contractor shall remove any uncompacted soil cement exposed to precipitation that, in the opinion of the Engineer, makes it unsuitable.

310.03.10 CURING AND PROTECTION

A. Cold Weather Protection

Keep the surface of all soil cement lift layers continuously damp and at a temperature above 35° F until it is covered with the next layer of soil cement. Comply with the temperature restrictions in ***Subsection 310.03.09B, "Cold Weather Soil Cement Placement."*** Measure the soil cement temperature with a digital thermometer equipped with a surface probe. Protect from erosion by

heavy rain and damage by water trucks all surfaces of soil cement layers upon which subsequent layers will be placed. Clean any surface damaged by erosion that undercuts coarse aggregates, and cover with bedding mix prior to placing next soil cement layer.

B. Moist Curing Requirements

Moist Curing Requirements: Keep the surface of all soil cement lift layers continuously damp until each is covered by the next layer or for a period of 14 days.

C. Use of Curing Compounds

Curing compounds will not be permitted on the soil cement.

310.03.11 QUALITY CONTROL AND TESTING

A. General

(1) Contractor shall establish and maintain an effective, on-site, quality control program in cooperation with the Owner and the Engineer for the soil cement concrete. The soil cement quality control program will be the means for ensuring compliance with contract requirements and for maintaining records of control, including all tests and inspections, their findings, and remedial actions taken when necessary. All testing and inspections described herein will be the responsibility of the Contractor. Density test results shall be made immediately available to the Owner and the Engineer. All lab test results will be provided to the Owner and the Engineer no more than 24 hours after test completion.

(2) Contractor shall establish and execute the quality control program under the supervision of a Soil Cement Quality Control Manager who will review and approve all activities concerning the production of materials, planning and scheduling of construction activities for placing soil cement, and the execution and evaluation of soil cement tests. Work closely with the Engineer and keep the Engineer advised of planned construction procedures, the placing schedule, the testing schedule, and results obtained from tests. Designate a Soil Cement Quality Control Manager for each shift. Several personnel may be required in the various areas of monitoring, testing, and reporting during the placement period. Make all information and test results available to the Engineer. Permit the Engineer full access to all construction and Contractor quality control activities.

(3) At a minimum, include the following processes in the soil cement Quality Control Program: Aggregate stockpiling and handling, aggregate testing, mixing requirements and mix proportions at the soil cement mixing plant, mix delivery, compaction, lift joints, material quality control, and all other tests and inspections required by these specifications. Establish the program as described in the following paragraphs.

B. Aggregate Gradation:

(1) Testing: At least once during each shift that soil cement is placed, and once during each shift that aggregates are delivered, test gradations and for the combined gradation of all aggregates mixed at the designated proportions. A retest sample is required for any gradation test out of specifications. The location where samples are taken will be selected

by the Engineer. Make provisions for accurate sampling of aggregates on feed belts to the soil cement mixing plant.

(2) Action Required: When a test result is outside of the specification limits, take a retest sample. If the retest sample is outside of the specification limits, suspend soil cement production until the problem is corrected. The Contractor will be responsible for all costs incurred as a result of soil cement placement suspension resulting from out-of specification materials.

C. Aggregate Moisture Determination

(1) Testing: At least once during each shift of soil cement placement for each aggregate size used, test the moisture in accordance with ASTM C566. The location where the sample is selected may be determined by the Contractor provided that it is typical of materials entering the mixer. The frequency of testing may be increased or decreased depending on moisture uniformity or variability as a project record is developed.

(2) Action Required: When moisture content determinations indicate a change in water entering the mix with the aggregates, contact the placement foreman to see if a corresponding adjustment in water added at the mixer is necessary to obtain adequate compaction and meet consistency requirements at the placement site.

D. Material Finer than the No. 200 Sieve

(1) Testing: During the first two weeks of aggregate stockpiling, perform tests every other day in accordance with ASTM C 117 to determine the amount of material passing the No. 200 sieve for the aggregate. After it has been established that a problem does not exist, and if production remains constant, continued testing will be required only once per week.

(2) Action: When test results for material finer that the No. 200 sieve are outside of the specification limits, take action to correct the deficiency. Suspend soil cement production until the problem is corrected. Materials produced "out of spec" may be blended with materials "in spec" so that the composite as used in soil cement meets specification requirements.

E. Aggregate Quantities

Accurately monitor and record the quantity of each aggregate produced, delivered, stockpiled, and used during each shift. Maintain a cumulative record of the amount of each aggregate produced or delivered, used in the permanent work, and wasted. Base quantities on saturated surface-dry (SSD) moisture conditions. Also record the moisture content.

F. Cement and Pozzolan Quantities

Accurately monitor and record the quantity of each material delivered and used during each shift and the quantities of materials stored onsite. Maintain a cumulative record of the amount of each material delivered, used in the permanent work, and wasted.

G. Soil Cement Mixing Plant Control

When the soil cement mixing plant is operating, continuously control the amount of all constituent materials including cement, Pozzolan, each size of aggregate, water and admixtures. Adjust the mixture proportions to compensate for free moisture in the aggregates as necessary. Prepare a daily report and submit to the Engineer before the start of the next shift indicating the type and source of cement used during that day, aggregate size groups and percentage used, required mix proportions per cubic yard for each mix design used, the amount of water as free moisture (above SSD) in each size of aggregate, and the aggregate weights per cubic yard of soil cement produced during plant operation. Also include in the report the total amount of each material used per shift. Include in the daily report the proportions for each batch, for batch plants, and for each one hour interval for a continuous plant.

H. Scales for Weight Batching

(1) Tests and Checking: Check the accuracy of scales with test weights prior to the startup of concreting operations. Retest the scales at least every month of operation thereafter. In addition, retest whenever there are variations in properties of the soil cement that could be the result of proportioning errors. When weight-batching procedures are used, frequently check the accuracy of each batching device during the startup of operations by noting and recording the required weight and the weight actually batched.

(2) Action Required: When either the weighing accuracy or batching accuracy is found not to comply with specification requirements, do not operate the plant until necessary adjustments or repairs have been made.

I. Volumetric Feed Calibrations

Check the accuracy of volumetric feeds by collecting all material delivered to the mixer during a unit of time. Provide suitable methods and equipment for obtaining and handling samples at the soil cement mixing plant. Determine the weight of material delivered to the mixer during a time interval between 5 to 15 minutes as determined by the Engineer, and calculate the resulting proportions of materials per cubic yard. Determine the accuracy of volumetric feeds at least three times during checkout of the soil cement mixing plant prior to production operations and soil cement placement. Recalibrate plant at least every 30 shifts or 5,000 cubic yards thereafter and whenever there are variations in the properties or control of the soil cement that could be the result of volumetric feed errors. Use samples of sufficient size to give accurate determinations. This may require sample weights in excess of 500 pounds per item checked.

J. Testing Soil Cement Mixers

(1) General: Sample and test fresh concrete for compliance with the specifications at the placing location. Provide a method of readily obtaining representative soil cement samples from the placement, the plant and gob hopper locations. Approximately 400 pounds of material will be required for each sample.

(2) Mixer Performance: A mixer performance test is required on a continuous pugmill plant only if the plant has not produced soil cement of similar proportions in the past. The tests may be required if the soil cement shows signs of nonuniformity or inconsistency in test results. In the event the test results show nonconformance with specifications, the Contractor shall

adjust mixer to meet specification, or replace with mixer that complies at Contractor's sole cost.

K. Temperature

(1) Testing: Measure and record the soil cement temperature on an hourly basis at the placement location. Perform additional tests when rapid set time or workability loss is reported by the placing foreman or Engineer, or during periods of hot weather. Record the temperature of the air and the soil cement during the period of cure and cold weather protection when those restrictions are applicable.

(2) Action Required: When soil cement temperature is outside the specification limits, suspend soil cement placement until the problem is corrected. Include temperatures as standard data in the quality control reports.

L. Moisture Content

(1) Tests and Checking: Determine the moisture content of the soil cement mix each time a density reading is taken with the nuclear gauge. Determine moisture content at the placement using a nuclear gauge in the backscatter mode immediately after compaction. Drive the probe to a depth of 2 inches above bottom of the lift for each reading. Calibrate the gauge against oven-dry samples of the mix design used. Verify the calibration to oven dry materials at least once per five shifts. Perform at least three tests in different areas of each layer of soil cement placed. Continuously monitor the apparent effectiveness of compaction equipment from a visual standpoint, and notify the mixing plant whenever the soil cement mix becomes too dry or too wet.

(2) Action Required: When moisture content tests indicate a significant change from what has been established as the optimum mixing and placing moisture, notify the placing foreman who will check the behavior of the mix under conditions at that time. When the placing foreman observes a condition of moisture that begins to consistently allow the vibratory rollers to sink excessively in the mix, cause excessive paste to develop at the surface, or leave an open, unconsolidated appearing surface, make an adjustment to the mix water added at the plant and record the adjustment.

M. Cement and Pozzolan

Visually monitor the cement and Pozzolan feed to the soil cement mix on a continuous basis throughout the operation of the soil cement mixing plant. In addition, directly measure and record the cement and Pozzolan contents of the soil cement, at 30-minute intervals and each time the silos are filled. Use a belt scale to measure the soil cement produced between mixing and loading. A load cell placed under the silos or volumetric measurement of the cement and Pozzolan used since the last silo filling will be acceptable methods of measuring the cement and Pozzolan usage. Report the cement and Pozzolan contents to the Engineer each time measurements are taken.

N. Soil Cement Specimens for Compression Tests

Forms for cylinders will be rigid reusable type with disposable liners. The Contractor shall prepare eight cylinders for testing per ASTM C39 for high strength soil cement and ASTM C42 for low

strength soil cement when requested by the Engineer (twice per shift). The Contractor will make, transport, cure, and test all samples (per ASTM C1435 and ASTM D558).

O. Density

(1) Nuclear gauge must be recently calibrated or during the trial placement, construct a soil cement block for nuclear gauge calibration. Make the block with a newly fabricated 30-inch diameter steel mold. Weigh the mold before, and after, filling with soil cement. Compute the density of the soil cement block and use this computed density to calibrate/check the nuclear density gauges.

(2) Tests and Checking: At least once every hour during placement, determine the density of the soil cement after compaction with a calibrated nuclear density gauge. Have at least one gauge on the placement area at all times. Test each layer of soil cement with the nuclear gauge every hour or 250 cubic yards, whichever is less, in at least 3 separate locations for wet density. Use the direct transmission mode. The Engineer may perform supplemental density testing with his own gauges.

(3) Action Required: When the nuclear gauge indicates a wet density less than required, perform a retest. If the retest indicates incomplete compaction, immediately provide additional rolling provided the time limits in ***Subsection 310.03.06B, "Time Requirements"*** are met, and determine whether the lower density resulted from insufficient passes of the roller, a change in the mix properties, or segregation at the bottom of the lift. If the mix properties have changed, suspend placement until the problem is corrected. If the problem persists and if the lower density is the result of inadequate rolling, notify the soil cement foreman. The Engineer may require full depth removal of the inadequately compacted material.

P. Compaction Equipment

(1) Tests and Checking: Before any compactor is used in soil cement construction, check it for correct dimensions, weight, vibratory frequency and amplitude; and cleanliness. At least once per 12 shifts of use, retest the frequency.

(2) Action Required: Remove compaction equipment not meeting the physical dimensions and weights required from the project. Correct any roller having improper frequency for soil cement compaction. Immediately notify roller operators running at speeds in excess of specification requirements or using improper compaction practices. Correct the problem or, if necessary, replace the operator.

Q. Dumping and Spreading

(1) Tests and Checking: Continually observe and monitor dumping and spreading operations to ensure that they are done in a manner that minimizes segregation. Routinely check each layer of soil cement in its spread condition for evenness and thickness, so that level, well-compacted layers within the specified thickness tolerance result after compaction. Determine the levelness, thickness, and elevation of each layer.

(2) Action Required: When thickness checks on uncompacted soil cement indicate an excess or shortage of material, immediately blade off or supplement the layer as needed. Whenever the thickness or elevation exceeds the allowable tolerances, notify the Engineer and he will determine what corrective action, if any, is necessary.

R. Preparation for Soil Cement Placement

Where applicable, inspect foundations, construction joints, forms, and embedded items in sufficient time prior to soil cement placement to assure that the area is ready to receive concrete. Check forms and facing panels for condition, support, alignment, and dimensions. The placing foreman will be the first level of supervision for all placing operations. The soil cement Quality Control Supervisor will determine if the specified mix is placed in the proper location, measure and record concrete temperatures, ambient temperatures, weather conditions, time of placement, yardage placed, and method of placement. Do not permit soil cement placement to begin until an adequate number of vibratory rollers and spreading equipment of the appropriate size, in working order, and with competent operators are available.

S. Curing and Surface Protection

(1) Continuous Moist Curing: At least every 2 hours, 7 days per week, inspect all areas subject to moist curing and lift surface protection. Record the surface moisture condition at that time. If any area has been allowed to dry, it will be considered as improperly cured.

(2) Action Required: Clean any area that has been allowed to dry more than 4 hours with a high-pressure water jet (3000 psi). Allow the surface to dry to a saturated surface dry condition and spread bedding mix prior to placing soil cement. If any area was allowed to dry less than 4 hours, clean it using a low-pressure water jet (500 psi) and prepare the surface as described above. The Engineer may require the Contractor to remove improperly cured soil cement.

(3) Protection: At least every 8 hours around the clock, 7 days per week, inspect all areas subject to cold-weather protection or protection against damage. Record any deficiencies. During removal of cold weather protection, measure concrete and ambient temperature at least every 2 hours. Record and provide temperature measurements to the Engineer on a daily basis.

T. Soil Cement Coring

The Contractor shall obtain 4-inch diameter cores at the locations directed by the Engineer. Obtain cores for the full depth of the soil cement placement and a minimum of 1-foot into the foundation rock (if placed on a rock foundation). Exercise special care to obtain cores in good condition from all holes. Place each core run in core boxes in the correct sequence. Separate the core runs with wooden blocks marked according to the measured depth at the end of each core run. If core loss occurs, place blocks with a similar diameter and a length equal to the core loss in the core box at the location of the core loss. Label the blocks with the amount of the core loss. If the loss area is not known, show the amount of loss on a wooden block with the letters D.O.R., "Distributed Over Run," marked on it and place the block just ahead of the "End of Run" block. Do not place cores from more than one hole in any box. Using a waterproof marker, label the inside of the lid and all four sides of the outside of the box with the hole number, box number, and depth

interval. Fasten the covers securely to the core box and deliver the box to the on-site core storage area. All testing of cores will be at the expense of the Contractor.

U. Thickness Testing

The engineer may request a thickness test text at any time to verity the placed thickness of soil cement. If a section of placed soil cement fails to meet the required thickness, additional tests will be done to determine the area that fails to meet these specifications. Areas that do not meet the required thickness as determined by the Engineer shall be subject to replacement:

V. Acceptance of Soil Cement – Acceptance and penalties for placed concrete shall be determined by the results of the 28 day compressive strength. Soil cement represented by the compressive strength tests which do not meet the minimum strength specified, will be subject to replacement. All soil cement represented by compressive strength test which do not provide at least 75 percent of the specified strength shall be removed and replaced unless allowed to remain in place by the Engineer.

The Contractor, at his own expense, can submit evidence that will indicate to the Engineer that the strength and quality of the soil cement is such that the concrete should be considered acceptable. The owner can perform its own individual testing to verify contractor testing.

If such evidence consists of concrete cores, the Contractor shall obtain three cores from the concrete represented by the failing strength test and deliver them to the Engineer in time to allow complete testing of such cores within 42 days after the placement of the concrete. All cores shall be obtained and tested in accordance with the requirements of AASHTO T-24. The concrete represented by the cores will be considered acceptable if the numerical average of three tests is 75 percent of the required 28-day compressive strength. If the average compressive strength does not meet this requirement, all concrete so represented shall be removed and replaced unless permitted to remain in place by the Engineer.

END OF SECTION 310

SECTION 409 – PORTLAND CEMENT CONCRETE PAVEMENT

DESCRIPTION

409.01.01 GENERAL

A. This work shall consist of a pavement composed of Portland cement concrete, with or without reinforcement as specified, constructed on a prepared subgrade or base course in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer.

B. At the option of the Contractor, concrete pavement may be constructed with equipment utilizing stationary side forms or by the use of slip-form paving equipment.

MATERIALS

409.02.01 MATERIALS

A. Materials shall conform to the requirements of the following sections and subsections:

Materials	Section/Subsection
Fine Aggregate	***706.03.03***
Coarse Aggregate	***706.03.01***
Hydraulic Cement	***701***
Water	***722***
Air-Entraining Admixtures	***702.03.02***
Joint Filler	***707.03.04***
Curing Materials	***702.03.01***
Reinforcement	***713***

B. An inadequate water supply shall be considered sufficient cause for delaying or stopping mixing operations. In case of a deficiency of water, the requirements for subgrade and curing concrete previously placed shall have priority over mixing.

409.02.02 GRADATION REQUIREMENTS

A. Gradation shall comply with ***Subsection 501.02.02, "Gradation Requirements."***

409.02.03 CONCRETE PROPERTIES AND TESTS

A. Portland cement concrete pavement shall be subject to the following requirements and test methods:

Test	Test Designation	Requirements
Flexural Strength of Concrete	ASTM C293	Minimum Modulus of Rupture: 450 psi

CONSTRUCTION

409.03.01 CLASSIFICATION AND PROPORTIONS

A. The Contractor shall notify the Engineer not less than 32 calendar days in advance of use of the proposed sources of materials and shall make arrangements for the Engineer to obtain samples as required for testing purposes.

1. When requested by the Contractor and allowed in writing by the Engineer, samples will not be required from aggregate sources previously tested within the past year.
2. Samples shall not exceed 500 pounds for each separate grading.
3. The Contractor shall furnish a written statement giving the cement factor in sacks per cubic yard; the proportions of cement, water, and each size of aggregate in saturated surface dry (SSD) condition; and the percentage of air in the concrete proposed for use in the work.
4. If the Contractor proposes to use an admixture other than an air-entraining agent, the Contractor shall state admixture's complete brand name and the quantity proposed to be used per sack of cement.
5. The Engineer, after making such tests as the Engineer deems advisable, will either accept the proposed materials and proportions or suggest modifications needed for acceptance.
6. After acceptance by the Engineer of batch proportions and materials, batch proportions and materials shall not be altered during the course of the work except as found necessary to maintain yield, cement factor, and unit weight within specification requirements.

B. Portland cement concrete shall be proportioned using the aggregates tested such that the requirements in Table 1 of this subsection will be satisfied without falling below the minimum or exceeding the maximum values given.

1. The cement factor of any individual batch placed in the work shall not be more than 0.15 sack per cubic yard less, nor more than 0.25 sack per cubic yard greater than the designated factor (sacks of cement per cubic yard).
2. Aggregates shall be batched and reported to the Engineer.
3. The weights used may be varied as necessary to comply with the above tolerances in cement factor and unit weight.
4. Coarse and fine aggregate in each batch of concrete shall be combined in proportions that will produce a mixture within the grading limits for combined aggregates specified as follows:

GRADING LIMITS OF COMBINED AGGREGATES

Sieve Sizes	Percentage Passing
2-inch	100
1-1/2-inch	90-100
1-inch	50-86
3/4-inch	45-75
3/8-inch	38-55
No. 4	30-45
No. 8	23-38
No. 16	15-33
No. 30	8-22
No. 50	4-13
No. 100	1-5
No. 200	0-3

TABLE 1 - CONCRETE PROPORTIONS

Class of Concrete	Sacks of Cement Per Cubic Yard		Coarse Aggregate Size No.	Maximum Water Gallons Per Sack Cement*	Slump Range Inches	Air Range %	Unit Weight Variation Pounds
	Min.	Max.					
P.C.A.	5.5	7	467	5.5	0-3**	4±1	±3
P.C.A.A.	6	7.5	467	5.5	0-3**	5±1	±3

*Based on aggregate in a saturated surface dry condition (SSD).

**The nominal slump in inches shall be 3 inches, the maximum slump shall be 3-1/2 inches. When the slump of concrete is found to exceed the nominal slump, the mixture shall be adjusted as directed by the Engineer to reduce slump to a value within the specified range. Four slump tests will be considered sufficient to determine nominal slump. The difference in slump, determined by comparing slump tests on 2 samples of mixed concrete for each individual batch tested, shall not exceed 1 inch. When the difference in slump does exceed 1 inch, procedure and equipment used in producing the concrete shall be adjusted to reduce the difference in slump to not more than 1 inch.

409.03.02 EQUIPMENT

A. **General:**

1. Equipment and tools necessary for handling materials and performing all parts of the work shall meet the approval of the Engineer as to design, capacity, and mechanical condition.
    a. This equipment shall be on the site and available for inspection, testing, and approval before paving operations are started.
    b. All equipment, tools, and machinery shall be maintained in a satisfactory working condition.
2. The Contractor shall provide equipment of such capacity that the paver will operate continuously or at a constant rate of production insofar as feasible. In the event that any piece of equipment does not have sufficient capacity to keep pace with the other operations, the Engineer may limit the size of the batch or otherwise limit the rate of production to prevent poor workmanship, overloading of equipment, or frequent delays.
3. Any equipment operating entirely or partially on the pavement, regardless of the age of the pavement, shall be equipped so that only rubber-tired wheels will come in contact with the pavement.
4. Aggregates and cement shall be proportioned by weight, except that when the amount of concrete required for any 1 contract is 10 cubic yards or less, the materials may be measured by volume. Materials that are proportioned by volume shall be measured in containers of known capacity.
5. Proportioning shall consist of combining the aggregates, each stored in a separate bin in the various gradations prescribed in ***Subsection 706.03.01, "Coarse Aggregate,"*** with cement and water.
    a. Weigh hoppers shall be charged from bins located directly over the hoppers or from conveyor belts.
    b. When conveyor belts are used, there shall be a separate belt for each size aggregate.
    c. There shall be an approved moisture meter installed to indicate the moisture in the sand.
6. Bulk cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge. The cement hopper shall be attached to a separate scale for individual weighing.
7. The amount of water to be added to the mixture shall be measured and discharged rapidly into the mixing drum through a valve with a positive cut-off. When water is measured by weight, the water shall be weighed on a separate scale.
8. All weighing or metering devices, except moisture meters used for proportioning materials, shall be accurate to within 1 percent.
    a. The devices shall be sealed and certified by the Nevada State Department of Weights and Measures.

b. These certifications shall be dated within the past 12 months and shall be renewed whenever required by the Engineer.

c. The moisture meter shall be accurate to within 1/2 of 1 percent.

d. Whenever portable bunkers are set up at a new location, the scale assemblies shall be inspected and certified regardless of the date the scales were last tested.

9. Scales used in proportioning shall be either springless dial or multiple beam type.

   a. Scale gradations shall be no greater than the following:

      1) Aggregate Scales: 25 pounds

      2) Cement Scales: 5 pounds

      3) Water Scales: 5 pounds

   b. All scales shall be of such size and so arranged that the scales may be read easily from the operator's platform.

   c. If a multiple beam type scale is used, the scale shall be provided with an indicator operated by the main beam that will give positive visible evidence of over or under weight.

   d. The indicator shall be designed to operate during the addition of the last 400 pounds of any weighing.

   e. The over travel of the indicator hand shall be at least 1/3 of the loading travel.

   f. Indicators shall be enclosed against moisture and dust.

10. Weighing equipment shall be insulated against vibration and movement of other operating equipment in the plant. When the entire plant is running, the scale reading at cut-off shall not vary from the weight designated by the Engineer by more than 1 percent for cement, 1 percent for water, 1-1/2 percent for any size of aggregate, or 1 percent for the total aggregate in any batch.

11. Machine mixing will be required in all cases other than those in which the mixing would obviously prove to be impractical, in which event hand mixing will be permitted. Mixing shall be commenced as soon as possible after the cement is placed in contact with the aggregates, but in no event shall the intervening period exceed 30 minutes.

12. All concrete mixers shall be of such design and construction and so operated as to provide a thoroughly and properly mixed concrete in which the ingredients are uniformly distributed.

    a. Mixers shall be maintained in proper and serviceable working condition and any part or portion thereof that is out of order, or becomes worn to such extent as to detrimentally affect the quality of mixing, shall be promptly repaired or replaced.

    b. Mixers shall not have any aluminum parts which will have direct contact with concrete.

B. **Concrete Consistency:**

1. The amount of water added at the mixer shall be regulated to take into account the free water in the aggregates. Free water is defined as the total water minus the water absorbed by the aggregate in a saturated surface dry condition.

2. The amount of water used in the mixture shall not exceed the minimum amount necessary to permit practical placement and consolidation of the concrete, and unless otherwise authorized by the Engineer, shall be that required to produce concrete with a slump within the range shown as nominal in the following table:

Type of Work	Nominal Slump Inches	Maximum Slump Inches
Concrete Pavement	0-3	3.5

3. The concrete used in the work shall not have a slump greater than that shown as maximum above, nor a free water content greater than 312 pounds per cubic yard of concrete.

4. The consistency of concrete shall be determined in accordance with ASTM C143.

5. If slump tests of individual samples taken at approximately the 1/4 and 3/4 points of the discharge differ by more than 2 inches, the mixer will not be acceptable for further use until the condition is corrected.

C. **Paving and Stationary Mixers:**

1. Paving and stationary mixers shall be equipped with an accurate automatic timing device so designed and constructed as to lock the discharge lever before aggregate and cement enter the drum, and release the lever only after the specified mixing time has elapsed. The regulation of the setting of the device shall be under the supervision of the Engineer. Water control equipment shall also be provided with each concrete mixer.

2. The proper proportions of aggregate, cement, and water for each batch of concrete shall be placed in the mixer, and shall be mixed for a period of not less than 1 minute after all materials are in the drum. The minimum mixing time, however, shall not be less than 1-1/2 minutes.

3. The rotating speed at which the mixer shall be operated shall conform to that recommended by the manufacturer.

4. The total volume of materials mixed in any 1 batch shall exceed neither the water level capacity of the mixer nor the manufacturer's guaranteed capacity of the mixer.

D. **Transit Mixers:**

1. The type, capacity, and manner of operation of the mixing and transporting equipment for ready-mix concrete shall conform to the current "Standards for Operation of Truck Mixers and Agitators of the National Ready-Mixed Concrete Association" and the "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau."

   a. Transit mix concrete trucks shall be equipped with an automatic device for recording the number of revolutions of the drum during the mixing period.

b. Each mixer and agitator shall have attached thereto, in a prominent place, a metal plate or plates installed by the manufacturer on which is plainly marked the capacity of the drum in terms of the volume of mixed concrete and the speed of rotation for the agitating and mixing speeds of the mixing drum or blades.

2. Each mixer shall have an identification number painted in a location on the truck that can be easily read from the batching platform.

3. The total volume of materials introduced into the mixer shall not exceed the manufacturer's guaranteed mixing capacity.

   a. If the concrete so mixed does not meet the uniformity requirements of this subsection, the amount of materials charged into the mixer shall be reduced.

   b. The drum of the mixer shall be completely emptied of previously mixed load.

   c. The proper proportions of aggregate, cement, and water for each load of concrete shall be placed in the mixer and shall be mixed therein for not less than 70 nor more than 100 revolutions of the drum or blades at the speed designated by the manufacturer of the equipment as mixing speed.

   d. Additional revolutions of the drum shall be at the speed designated by the manufacturer of the equipment as agitating speed.

   e. The revolving of the drum shall be continuous until the concrete is completely emptied from the drum.

4. When concrete is being placed for pavement structures, all wash water shall be emptied from the mixer before any portion of the succeeding load is placed therein. For all other work, the mixer shall be empty or may carry 10 gallons of water in the drum.

   a. Adequate control of ready-mixed concrete will normally require that additional water be added and mixed into the batch at the point of discharge.

   b. Water so added shall be mixed into the load for a minimum mixing time of 3 minutes.

   c. Water shall not be added to the load during transit.

   d. The total elapsed time between the addition of water at the batch plant and discharging the completed mix shall not exceed 60 minutes. Under conditions contributing to quick setting, the total elapsed time permitted may be reduced by the Engineer.

5. The Engineer shall be provided with a legible certified weighmaster's certificate at the job site for each load which shall contain the following information:

   a. Name of Vendor

   b. Name of Contractor

   c. Number of Cubic Yards in the Load

   d. Actual Weights of Cement and of Each Size of Aggregate

   e. Amount of Water Added at the Plant

   f. Amount of Water in the Aggregate

   g. Brand and Type of Cement

h. Brand and Amount of Admixture

i. Time and Date of Batching

6. When mix proportions have been designated for a project and are identified by number, the Engineer may waive the foregoing and accept a legible certified weighmaster's certificate which shall contain the following information:

a. Name of Vendor

b. Name of Contractor

c. Number of Cubic Yards in the Load

d. Mix Designation Number

e. Amount of Water Added at the Plant (including Water in Aggregate)

f. Time and Date of Batching

7. Space shall be provided on the certificate so that amount of water added on the job may be indicated.

E. **Forms and Headers:**

1. Forms and headers shall be either wood or metal, and shall be:

a. Set plumb and true to line and grade, with the upper edge thereof set to the grade of the pavement to be constructed.

b. Rigidly installed on a true alignment and so maintained for a distance in advance of placing the pavement to provide for at least a 1-day run of concrete.

2. Headers shall rest firmly on the subgrade or base. They shall be oiled immediately prior to the placing of the concrete and shall remain in place at least 12 hours after concrete has been placed.

3. Forms and headers shall be removed before the work will be accepted.

F. **Wooden Forms:**

1. Wooden forms shall be constructed of 3-inch nominal lumber in pieces not less than 16 feet long except where changes in alignment or grade necessitate the use of material of smaller dimensions. The lumber used shall:

a. Be free from warp and other imperfections that would impair the strength for the use intended.

b. Have square edges (which may be slightly beveled) and square ends.

c. Be surfaced on the upper edge.

d. Not be more than 1/2 inch less in depth than the specified thickness of the edge of the pavement.

2. Wooden forms shall be secured by nailing to side stakes spaced not more than 4 feet apart, driven into the subgrade vertically to a depth not less than 12 inches, and so that the tops will be below the upper edge of the header. The stakes shall be sufficient length and cross-sectional area to adequately resist lateral displacement of the headers during the paving operations.

3. Wooden headers shall be spliced by nailing a board to the outside of the headers. The board shall be at least 4 feet long, 1 inch thick, and at least 6 inches wide (or the depth of the header, whichever is less), and shall be centered on the joint.

G. **Metal Forms:**

1. Metal forms shall be free from warp, have sufficient rigidity to resist springing during the paving operations, and shall be not less in depth than the specified thickness of the edge of the pavement being constructed.

2. The forms shall be secured with metal stakes spaced not more than 5 feet apart and driven below the top of the forms.

3. The stakes shall be designed so as to be driven through openings in the forms to lock the forms in position.

H. **Slip Form Construction:**

1. At the option of the Contractor, and with the approval of the Engineer, concrete pavement may be constructed by the use of slip form paving equipment.

2. Slip form paving equipment shall be provided with traveling side forms of sufficient dimensions, shape, and strength to support the concrete laterally for a sufficient length of time during placement to produce pavement of the required cross section, and the equipment shall spread, consolidate, screed, and float-finish the freshly placed concrete to provide a dense and homogenous pavement.

3. The concrete shall be distributed uniformly into final position by the slip form paver and the horizontal deviation in alignment of the edges shall not exceed 1-1/4 inches from the alignment established by the Engineer.

4. The concrete, for the full paving width, shall be effectively consolidated by internal vibration, with transverse vibrating units, or with a series of longitudinal vibrating units. Internal vibration shall mean vibration by means of vibrating units located within the specified thickness of pavement section and at a minimum distance ahead of the screed equal to the pavement thickness.

5. When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels, offset to run a sufficient distance from the edge of the pavement to avoid breaking or cracking the pavement edge.

6. After the concrete has been given a preliminary finish by finishing devices incorporated in the slip form paving equipment, the surface of the fresh concrete shall be checked by the Contractor with a straightedge to the tolerance and finish required in ***Subsection 409.03.08, "Spreading, Compacting, and Shaping."***

7. The subgrade shall be moist at the time of placing concrete.

   a. The subgrade shall be thoroughly wet the night before or at least 6 hours prior to placing the concrete, and again sprinkled immediately before the concrete is placed on it.

   b. Sprinkling shall be such that mud and pools of water will not be formed.

   c. At the time of placing the concrete, the grade shall not be muddy, soft, or frozen.

409.03.05 REINFORCEMENT

A. Concrete pavement shall be reinforced at structure approaches and other locations as shown on the plans or directed by the Engineer, and as specified in this section.

B. Bar reinforcement shall conform to the provisions in ***Section 505, "Reinforcing Steel."***

C. Bar reinforcement shall be held accurately and firmly in position during the placing and compacting of the concrete without sagging by means of supporting devices which shall be left in place.

D. The supports shall be specially manufactured for the purpose and each support shall be capable of supporting a vertical load of 200 pounds.

409.03.07 PLACING CONCRETE

A. The Contractor shall make adequate advance arrangements for preventing delay in delivery and placing of the concrete.

1. An interval of more than 45 minutes between placing of any 2 consecutive batches or loads shall constitute cause for stopping paving operations.

2. The Contractor shall make a contact joint, at no additional cost to the Contracting Agency, at the location and of the type directed by the Engineer, in the concrete already placed.

B. Unless otherwise specified, concrete pavement shall be placed in 12-foot traffic lane widths separated by contact joints as shown on the plans, or, at the option of the Contractor, the concrete pavement may be placed monolithically 2 or more lanes wide without a contact joint, but with a longitudinal weakened plane joint at each traffic lane line.

C. All concrete shall be used while fresh. The use of water for retempering any concrete will not be permitted.

D. Any concrete showing improper proportions of materials, including water, shall not be used in the pavement and any such unsatisfactory concrete shall be removed and disposed of by the Contractor at no additional cost to the Contracting Agency.

E. The Contractor shall protect freshly placed concrete from damage by any cause and any damage shall be repaired by the Contractor at no additional cost to the Contracting Agency.

F. Expansion joint material shall be protected while depositing fresh concrete adjacent thereto.

G. Concrete work shall be adequately barricaded in all directions to protect the work.

409.03.08 SPREADING, COMPACTING, AND SHAPING

A. The concrete shall be consolidated and the surface finished true to grade and cross section.

1. Upon completion, the surface shall be free of any unevenness greater than 1/8 inch when checked with a 10-foot straightedge placed on the surface of the pavement.

2. The 10-foot straightedge shall be furnished by the Contractor and shall be at the site of the work prior to commencing concrete placement.

B. **Tamping:**

1. The concrete shall be distributed uniformly between the side forms as soon as the concrete is placed, after which the concrete shall be struck off and tamped with a mechanical tamper.

2. The tamper shall be operated at right angles to the centerline of the pavement, and tamping continued until the concrete is thoroughly consolidated to the specified cross section and sufficient mortar for finishing purposes has been brought to the surface.

3. Steel-shod hand tampers or vibrating bars may be substituted in those cases where the use of mechanical spreader and tamper would be obviously impracticable.

4. Approved concrete vibrating equipment shall be used in conjunction with the mechanical tamper to consolidate the concrete adjacent to the forms or existing pavement.

C. **Floating:**

1. After tamping, the surface of the concrete shall be floated by either the finishing machine method or the transverse float method described below.

2. Bridge decks may be floated by the longitudinal float method.

3. **Finishing Machine Method:** The concrete shall be floated smooth and true to grade with an approved finishing machine.

4. **Transverse Float Method:**

   a. The concrete shall be floated at least twice with a long-handled float at least 5 feet wide, after which the surface of the concrete shall be finished smooth and true to grade with a wooden float 16 feet long, 2 inches thick, and 6 inches wide.

   b. The float shall be rigidly ribbed and with adjustable screws between the rib and float board to ensure a true and flat surface on the underside at all times.

   c. The float shall be operated from the side of the pavement, and parallel with the centerline.

   d. The edge of the float shall be used to cut down all high areas, and the material so removed shall be floated into the depressions until a true surface is obtained.

   e. Each successive pass of the float shall halflap the previous pass.

   f. The float shall be operated as far behind the tamping machine as the workability of the concrete will permit before its initial set.

5. **Longitudinal Float Method:**

   a. The concrete shall first be floated with a double-handled longitudinal float not less than 16 feet nor more than 20 feet in length, having a trowelling surface not less than 8 inches nor more than 10 inches wide.

   b. The float shall be operated from bridges over the pavement with its length parallel to the centerline of the improvement, and shall be worked back and forth transversely across the slab, planing off high spots and filling depressions.

c. Floating shall continue until the surface is reasonably smooth, after which the bridges may be advanced not to exceed 2/3 the length of the surface so floated, and the operation continued.

D. After being finished by one of the above methods, the outside edges of pavement shall be rounded to a 1/2-inch radius; and transverse contact joints, expansion joints, and joints adjacent to an existing pavement shall be rounded to a 1/4-inch radius.

E. A strip of wetted burlap shall be provided, of a length not less than the width of the pavement slab.

1. The burlap shall be attached by 1 edge to a rigid frame supported over the pavement so that the free edge of the burlap will rest or drag on the surface of the concrete.

2. The burlap shall be dragged back and forth longitudinally along the pavement until the surface of the slab is of uniform texture appearance throughout its entire length.

409.03.09 JOINTS

A. Joints in concrete pavement will be designated as longitudinal and transverse contact joints, transverse expansion joints, and longitudinal and transverse weakened plane joints. Unless otherwise specified:

1. Transverse joints shall be constructed perpendicular to the centerline of the pavement.

2. Longitudinal joints shall be constructed parallel to the centerline of the pavement.

3. The faces of all joints shall be perpendicular to the finished surface of the pavement.

B. Joint filler, when required, will be as designated on the plans or in the Special Provisions.

C. **Contact Joints:**

1. Contact joints are those made by placing fresh concrete against hardened concrete at planned locations. Contact joints shall be constructed at the locations and in the manner shown on the plans.

2. Longitudinal contact joints shall be constructed by one of the following methods: A plain face, the use of tie bars, or the construction of keyways. Tie bars or keyways will be as designated on the plans or in the Special Provisions.

D. **Transverse Expansion Joints:**

1. Transverse expansion joints shall be installed at locations shown on the plans.

2. Expansion joint filler material shall have a minimum thickness of 1/2 inch, a maximum thickness of 3/4 inch, and a depth equal to the thickness of the pavement, and shall be composed of materials as specified in the Special Provisions or approved by the Engineer.

3. After the concrete has been finished, an edger of 1/4-inch radius shall be used on each side of the expansion joint filler. The expansion joint filler shall be cleaned of all concrete mortar.

E. **Weakened Plane Joints:**

1. Weakened plane joints shall be constructed at the locations shown on the plans and shall be formed by cutting a groove in the pavement with a power driven saw.

a. The groove for a transverse joint shall be cut to a minimum depth of 1-1/2 inches or 1/6 of the pavement thickness, whichever is greater; the groove for a longitudinal joint shall be cut to a depth of 1/4 of the pavement thickness; and the width shall be a minimum width possible with the saw being used, but in no case shall the width exceed 1/4 inch.

b. Any portion of the sealing compound which has been disturbed by sawing operations shall be restored by spraying the areas with additional sealing compound.

c. In the initial lane of concrete, the first transverse weakened plane joint immediately following a transverse contact joint, and every fourth weakened plane joint thereafter, shall be sawed within 10 to 24 hours after the concrete has been placed.

d. The time lapse will be subject to the approval of the Engineer.

e. Every second transverse weakened plane joint shall be sawed within 24 hours after the concrete is placed, and the remaining weakened plane joints may be sawed at such time as the Contractor may elect; except that in any lane, all weakened plane joints shall be sawed before concrete is placed in succeeding adjacent lanes and before any traffic whatsoever is permitted to use the pavement.

2. In succeeding adjacent lanes of concrete pavement, transverse weakened plane joints opposite those which have been sawed in the initial lane shall be sawed within 10 to 24 hours after the concrete has been placed.

a. The time lapse will be subject to the approval of the Engineer.

b. In all cases, no more than three consecutive transverse weakened plane joints shall be bypassed.

3. At the option of the Contractor, longitudinal weakened plane joints may be used at traffic lane lines in multi-lane monolithic concrete pavement in lieu of longitudinal contact joints. Dowel requirements will be as designated on the plans or in the Special Provisions.

409.03.10 CURING

A. **General:**

1. All Portland cement concrete pavement shall be cured for 72 hours by the methods specified in this section, subject to the conditions set forth in ***Subsection 501.03.09.A.1, "General."***

2. In case of low temperatures, the curing period will be increased according to the provisions of ***Subsection 501.03.10.B, "Cold Weather - General."***

B. **Curing Compound Method:**

1. Curing by use of curing compound shall be as specified in ***Subsection 501.03.09.A.3, "Curing Compound Method."*** The curing compound shall not be applied until all patching and surface finishing, except grinding, have been completed.

2. When deemed necessary by the Engineer during periods of hot weather, fogging of the concrete with water shall be continued after curing compound is applied or until the Engineer determines that a cooling effect is no longer required.

C. **Waterproof Membrane Method:** Curing by use of waterproof membrane material shall be as specified in ***Subsection 501.03.09.A.4, "Waterproof Membrane."***

409.03.11 PROTECTION OF PAVEMENT

A. Concrete shall not be placed on frozen ground nor shall concrete be mixed or placed while the atmospheric temperature is below 35 degrees F unless adequate means are employed to heat the aggregates and water, and provision satisfactory to the Engineer has been made for protecting the work.

B. Placing the concrete shall be stopped before rainfall is sufficient to cause a flow or wash the surface.

C. Upon written notice from the Engineer, all concrete which has been damaged shall be replaced by the Contractor at no additional cost to the Contracting Agency.

D. All concrete in pavement shall be protected from freezing or frost for a period of 5 days after placing. The temperature of the surface of the concrete shall not be allowed to drop below 40 degrees F for this period of 5 days.

E. When ordered by the Engineer or shown in the contract documents, pavement crossings shall be constructed for the convenience of public traffic.

1. The material and work necessary for the construction of these ramps, and subsequent removal and disposal of the ramps, will be paid for at the contract unit prices for the items of work involved.

2. BLANK

3. Where public traffic will be required to cross over the new pavement, Type III Portland cement shall be used in concrete.

4. When Type III Portland cement is used in concrete, and if permitted in writing by the Engineer, the pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 450 psi.

F. No traffic or Contractor's equipment, except for subgrading equipment, will be permitted on the pavement before a period of 10 calendar days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 450 psi, as determined by Test Method ASTM C293. Concrete that fails to attain a modulus of rupture of 450 psi within 10 days shall not be opened to traffic until directed by the Engineer.

G. Equipment used to prepare subgrade may be permitted to ride upon one edge of the previously placed concrete at the end of 72 hours, provided, however, that no damage is done to the pavement edge by reason of such operation. Any damage to the pavement resulting from such operations shall be repaired by the Contractor at no additional cost to the Contracting Agency prior to placing the adjacent lane.

END OF SECTION 409

SECTION 501 – PORTLAND CEMENT CONCRETE

DESCRIPTION

501.01.01 GENERAL

A. This work shall consist of Portland cement, fine aggregate, coarse aggregate, water and when specified, an air entraining admixture, proportioned, mixed, placed, and cured as herein specified. All concrete shall meet the most current requirements of American Concrete Institute (ACI) with the following additions and/or exceptions indicated in this specification.

B. As used in this section, the term Portland Cement shall be considered synonymous with the term Hydraulic Cement.

C. The use of mobile mix concrete as specified herein shall require prior written approval by the Contracting Agency. All cement used on the work shall be standard brand Portland cement conforming to the "Specifications for Portland Cement" (ASTM C150), Type V, in accordance with requirements contained in Section 701.

501.01.02 QUALITY CONTROL TESTING AND INSPECTION

A. The testing and inspection of Portland cement concrete shall comply with this specification. The inspection of the mixing plant shall comply with the ACI 311, Chapter 2. In Clark County unincorporated areas and if required by other Contracting Agencies, all field and laboratory sampling and testing for project control shall be performed by NAQTC or ACI certified technicians in an AASHTO Materials Reference Laboratory (AMRL) and Cement and Concrete Reference Laboratory (CCRL), or Construction Materials Engineering Council (CMEC) R-18 AASHTO accredited laboratory. The accreditation shall extend to the test method used on the particular project. The accreditation shall include ASTM C1077. The concrete designs shall comply with Tables 1 and 2 and the IQAC website http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx or comply with Contracting Agency requirements.

B. Testing reports shall be promptly distributed to the owner, licensed design professional responsible for the design, Contractor, appropriate subcontractors, appropriate suppliers, and building official to allow timely identification of either compliance or the need for corrective action.

C. For non-structural mobile mix concrete, the testing shall be a minimum of one set per week. The testing type and frequency shall conform to the tables on the IQAC website.

MATERIALS

501.02.01 GENERAL

A. Materials shall meet the requirements of the following sections and subsections:

Materials	Section
Aggregate for Portland Cement Products	***706***
Concrete Curing Materials and Admixtures	***702***
Hydraulic Cement	***701***
Water	***722***

501.02.02 GRADATION REQUIREMENTS

A. Refer to ACI 304R Chapters 2.1 and 2.2, and comply with the gradation requirements specified in ***Section 706, "Aggregates for Portland Cement Products,"*** and the following:

1. The gradation requirements represent the extreme limits in determining the suitability of material. The gradation from any one source shall maintain a uniformity such that variations in the fineness modulus will not exceed 0.2 from the "Base Fineness Modulus."

    a. The "Base Fineness Modulus" shall be the average of the most recent 10 fineness modulus values (or the average of all preceding values if less than 10 have been completed) from any one source.
    b. Fine aggregate from any one source having a variation in fineness modulus exceeding ±0.2 as prescribed above will be rejected, or at the discretion of the Engineer, may be accepted subject to approved changes.
    c. The fineness modulus of fine aggregate shall be determined by adding the cumulative percentages, by weight, of material retained on each of U.S. Standard sieves No. 4, No. 8, No. 16, No. 30, No. 50, and No. 100, and dividing by 100.

2. Fine aggregates from different sources of supply shall not be mixed or stored in the same stockpile and shall not be used alternately in the same class of construction or job mix without written permission. Such permission will be contingent on amending the job mix and batch masses as necessary to protect the quality of the concrete produced.

3. If the fine aggregate for a job mix is to be a composite material from 2 or more sources, material from respective sources shall be blended by methods that will maintain the degree of uniformity of gradation required by these specifications.

4. Adequate supplies of aggregate shall be produced and stockpiled sufficiently in advance of construction operations to permit sampling and testing before use.

5. Coarse aggregates which vary in gradation shall be placed in separate stockpiles or bins and recombined in approved proportions. Different sizes of aggregates shall be stored in stockpiles sufficiently removed from each other to prevent the materials from becoming intermixed.

6. If the Contractor changes the source of any size of aggregate, a new mix design shall be submitted to the Engineer for approval.

501.02.03 ADMIXTURES

A. Refer to ACI 212. Air-entraining admixtures and water reducers and retarders shall conform to the requirements of ***Subsection 702.03.02, "Air-Entraining Admixtures,"*** and ***Subsection 702.03.03, "Admixtures Other Than Air-Entraining."***

B. Admixtures that are not listed in the mix design shall not be used without written permission from the Engineer, except as otherwise provided in these specifications or in the Special Provisions.

C. Admixtures used in Class EA Concrete, Modified shall be an approved chemical admixture for concrete, meeting the requirements of ASTM C494. Use Type “A” admixture when the anticipated high temperature for the day is 80 degrees F or below. Type “D” admixture shall be used when the anticipated high temperature is above 80 degrees F. The water-cement ratio shall not be adjusted once the chemical admixture has been incorporated into the mix.

D. Admixtures shall not be used to replace cement. Admixtures containing chlorides as Cl- in excess of 1 percent by weight shall not be used in prestressed concrete. If admixtures are used to entrain air, to reduce the water-cement ratio, to retard or accelerate setting time, or to accelerate the development of strength, the admixtures shall be used at the dosage specified in the mix design, or in the contract documents, or as provided by the Engineer.

E. When the use of an air-entraining agent is specified, it shall be added in a quantity conforming to Table 2 in ***Subsection 501.03.04, "Classifications and Proportions."*** It shall be measured into each batch by equipment and methods approved by the Engineer. Adjustments shall be made in the weights of the aggregates used per batch to compensate for increased yield due to air-entrainment so that the quantities of cement per cubic yard of concrete remain constant. Such adjustments shall be made by decreasing the weight of fine aggregate without changing the weight of coarse aggregate unless otherwise approved by the Engineer.

F. When a High Range Water Reducing admixture is used, the initial slump is waived and the slump of the concrete after the admixture is added shall not exceed 8 inches.

G. Admixtures shall be measured accurately into each batch by methods approved by the Engineer.

H. Except as otherwise provided for air-entraining agents, samples of admixtures proposed for use shall be submitted by the Contractor to the Engineer in advance of intended use to permit tests to be made to determine compliance with claimed properties.

I. Any type of admixture shall be uniform throughout its use in the work. Should it be found that the admixture as furnished is not uniform, its use shall be discontinued.

J. Admixtures shall be dispensed in liquid form. Dispensers for admixtures shall have sufficient capacity to measure at one time the full quantity required for each batch. Unless admixtures are added to premeasured water for the batch, their discharge into the batch

shall be arranged to flow uniformly into the stream of water. Dosages of admixtures shall not vary from the dosage indicated in the mix design or as approved by the Engineer by more than 5 percent, with the exception of air entraining admixtures where the dosage is required to achieve the specified range. Equipment for measurement shall be designed for convenient confirmation of the accuracy of measurement. If more than one admixture is used, each shall be dispensed by separate equipment unless otherwise permitted in writing by the Engineer.

K. When water-reducing agents or water-reducing retarders are used, the permitted dosage of the admixture shall not exceed that which will result in an increase in the drying shrinkage of the concrete of 20 percent when used in precast, prestressed concrete; 10 percent when used in cast-in-place prestressed concrete; 10 percent when used in cast-in-place reinforced concrete; or 3 percent when used in non-reinforced concrete pavements.

L. Water reducers shall reduce the water demand of concrete for a given slump at least 7 percent when used at the maximum dosage recommended by the manufacturer. Set retarders shall not be used in greater dosages than those recommended by the manufacturer, nor more than that needed to obtain the desired retardation. The strength of the concrete containing the admixture in the amount approved by the Engineer shall at the age of 48 hours and longer, be not less than that of similar concrete without the admixture.

M. When the Contractor proposes to use an air-entraining admixture which has been previously approved, the Contractor shall submit a certification stating that the admixture is the same as that previously approved.

N. If an admixture offered for use is essentially the same (with only minor differences in concentration) as another previously approved material, a certification will be required stating that the product is essentially the same as the approved admixture and that no other admixture or chemical agent is present.

O. Before or during construction, the Engineer may require that the admixture selected be further tested to determine its effect upon the strength of the concrete. The 7-day compressive strength of concrete containing the admixture under test shall not be less than 88 percent of the strength of concrete made with the same materials, the same cement content, and consistency, but without the admixtures.

p. Subject to the following conditions, pozzolan conforming to ***Subsection 702.03.04, "Pozzolans (Fly Ash),"*** shall be used to a minimum of 20 percent and a maximum of 35 percent, by weight, of the required Portland cement in concrete, or as required by the Engineer.

1. The replacement of cement with pozzolan shall be at a rate of 1 pound of pozzolan for each pound of Portland cement.

2. Silica fume may be used to replace 3 percent to 7 percent, by weight, of the total cementitious material.

3. Store pozzolan in separate weather-tight facilities.

Q. The use of calcium chloride shall not be permitted.

501.02.04 CONCRETE MAKING PROPERTIES

A. The mix design procedure shall comply with the method indicated on the IQAC website (see ***Subsection 501.01.02, "Quality Control Testing and Inspection"***). The type of cement permitted, the minimum sacks of cement required, and the maximum water/cement ratio shall be as shown in Table 1.

Table 1 - Cements Permitted, Sack Requirements, and W/C Ratio

Type of Cement Permitted	Minimum Sacks of Cement Per Cubic Yard [3]	Maximum Water/Cement Ratio
Type II & Fly Ash	6.5 [2, 3]	0.45
Type MS & Fly Ash	6.5 [1, 2]	0.45
Type 1-P (MS)	6.5	0.45
Type V	6.5 [3]	0.45
Type HS	6.5 [2]	0.45
Type V & Fly Ash	6.0 [2, 3]	0.45
Type HS & Fly Ash	6.0 [1, 3]	0.45

B. The testing frequency shall comply with the Contracting Agency requirements or the special provisions.

C. Prior to mix design approval, the Contracting Agency reserves the right to verify the mix design test results, using the sources and proportions of materials as indicated by the mix design.

D. The mix design submittal shall include the information indicated in the concrete design report form on the IQAC website. For mobile mix trucks, the design shall include the model of the mixer with serial number. Each truck shall have a mix design.

501.02.05 ZERO SLUMP CONCRETE FOR THE MANUFACTURING OF PRECAST CONCRETE PRODUCTS

A. Concrete products manufactured by the zero slump method shall comply with ***Subsection 501.02.03, "Admixtures"*** and ***Subsection 501.02.04, "Concrete Making Properties."*** Zero slump concrete shall also exhibit design and performance requirements meeting IQAC and relevant ASTM specifications. Air entrainment is not required in a dry cast manufacturing process.

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[1] Maximum of 8 sacks.
[2] Sacks per cubic yard before replacement with fly ash.
[3] 5.0 sacks per cubic yard for precast products, pipe and box, with zero slump mix design.

B. For zero slump concrete, all other parts of this section do not apply.

501.02.06 LOW SLUMP CONCRETE FOR THE MANUFACTURING OF EXTRUDED SLIP FROM CONCRETE

A. Extruded slip form concrete shall comply with material requirements contained in Table 1, above, and with design and performance requirements meeting IQAC and relevant ACI specifications. The plastic properties may be adjusted on-site with an appropriate type admixture to ensure compliance with ***Subsection 501.03.04, "Classification and Proportions,"*** and to aid Contractor in placement and finishing of low slump slip form concrete.

501.02.07 SELF-CONSOLIDATING CONCRETE

A. The Contractor's use of self-consolidating concrete shall require the approval of the Engineer and shall be subject to the following requirements:

1. Substitutions. Class S concrete may be substituted for selected applications for classes A, D, Modified A, and Modified D; and Class SA concrete may be substituted for selected applications for classes AA, DA, PAA, Modified AA, and Modified DA, as approved by the Engineer.

2. Trial Placement.

   a. The Contractor shall submit details of a representative test section (mockup) for approval.
   b. Produce a trial batch of classes S and SA concrete, conforming to the proposed mix design.
   c. As part of the concrete placement demonstration, provide the labor, equipment, and materials to test the concrete. Evaluate the mixture for strength, air content, slump flow, visual stability index, J-ring value, and hardened visual stability index.
   d. Place a test section when the atmospheric conditions approximate the conditions anticipated for placing the final work. Finish and cure the mockup according to this section.
   e. If it is determined that the trial batch is not workable or not able to be properly placed or finished, modify the mix design or batching sequence. Submit the revised mix design and batching sequence to the Engineer, and place another test section. Repeat the submittal and trial pour process until a workable and finished trial batch is produced.
   f. Do not place any Class S and SA concrete until the Engineer accepts the mockup pour.
   g. A new mix design and a new trial pour will be required whenever there is a change in the source of any component material.
   h. Segregated concrete, as determined by NV Test Method SCC-2, shall not be incorporated into any component of the anticipated concrete work.
   i. When a truck mixer or agitator is used for transporting concrete, deliver the concrete to the site of the work and complete discharge within 60 minutes after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. In hot weather, or under conditions

contributing to quick stiffening of the concrete, a mixing and delivery time of less than 60 minutes may be required. A mixing and delivery time exceeding 60 minutes may be approved by the Engineer if a trial pour is performed with satisfactory results.

j. lace each successive batch within a maximum time interval of 20 minutes. Place the concrete in continuous layers. When it is necessary by reason of emergency or other delay, to place less than a complete horizontal layer in one operation, terminate each layer by using a vertical bulkhead. Do not rod or vibrate the concrete to attempt restoring the fluidity to the mix. Plan and regulate the delivery of concrete so that minor interruptions due to form repair, material testing, etc. will not impact the required 20-minute time interval between successive placements.

3. Concrete Slump Requirements. Except for concrete used in drilled shafts, the requirements of NV Test Method T438 will be performed at 2 hours, 3 hours, or for extended times depending on the concrete placement duration.

4. Drilled Shafts. Use Class S or SA concrete for drilled shaft construction. Upper portions of drilled shafts (top of shaft down to bottom of embedded vertical column reinforcing) may be constructed using the column concrete mix.

CONSTRUCTION

501.03.01 EQUIPMENT

A. With the exception of items indicated in ***Subsection 501.03.05, "Proportioning Methods,"*** and ***Subsection 501.03.06, "Machine Mixing,"*** the measurement of materials and batching shall comply to the ACI 304R, Chapters 3 and 4 recommendations and those in this section or as approved by the Engineer.

1. Certify concrete production facilities and delivery equipment by complying with National Ready-Mix Concrete Association certification requirements.

2. Methods employed in performing the work and all equipment, tools, and machinery used for handling materials and executing any part of the work shall be subject to the approval of the Engineer.

3. All equipment necessary shall be on hand and approved before concrete operations are begun by the Contractor.

B. Provide adequate internal vibrating equipment, including power, to enable the Engineer to fabricate concrete cylinders for testing purposes.

C. Furnish internal vibrators with rigid or flexible shafts, preferably powered by electric motors, capable of operating at a frequency of 7,000 vibrations per minute or greater.

1. The outside diameter or the side dimensions of the vibrating element shall be at least 3/4 inch and not greater than 1-1/2 inches.

2. The length of the shaft shall be at least 24 inches.

D. The Contractor shall maintain the equipment in good condition and adjustment. Concrete mixers and other equipment which are not adequate or suitable for the work shall be removed and suitable equipment shall be provided by the Contractor.

501.03.02 PROTECTING AND SAMPLING CEMENT

A. Suitable means of storing and protecting the cement against moisture or other injurious effects shall be provided by the Contractor. Sacked or bulk cement which, for any reason, has become partially set or which contains lumps of caked cement shall be rejected and shall be immediately removed from the worksite.

B. Different brands of cement shall not be mixed during use or in storage, nor shall different brands be used alternately in any one structure. The same brand and kind of cement shall be used in a given structure above the ground line. A change in brand of cement will require a new mix design.

C. The sacked cement shall be so piled as to permit access for tally, inspection, and identification of each shipment.

D. The Contractor shall obtain from the cement company from which the cement is purchased, a certificate stating that the cement delivered to the work complies with the specifications for the type of cement specified for use, with tests pertaining to the delivered lot. The certificate shall be dated, signed, and indicate the quantity of shipment. Two copies shall be delivered directly to the Engineer.

E. Upon receipt of the certificate of compliance, the Engineer may permit the use of the cement. When a certificate of compliance is not furnished to the Engineer, the cement shall not be used in the work until a release for its use has been received by the Contractor from the Engineer.

F. Whenever it is determined by a laboratory test of mill or field samples that the cement does not comply with the specifications, the use of that cement will be suspended until tests by a third party paid for by the Contractor can be made and the test results are approved by the Engineer.

G. All cement not conforming to the specifications and all cement damaged by exposure to moisture shall be removed immediately and permanently from the work.

501.03.03 STORAGE OF AGGREGATES

A. Refer to ACI 304R, Chapter 2.2.3. The handling and storage of aggregates shall be such as to prevent segregation or contamination by foreign materials.

B. Maintain aggregate stockpiles in saturated surface dry condition.

C. In placing materials in storage or in moving materials from storage to the mixer, any method which may cause the segregation, degradation, or the combining of material of

different gradings which will result in any stockpile or bunker material failing to meet specified requirements shall be discontinued and the materials shall be reprocessed or wasted.

501.03.04 CLASSIFICATION AND PROPORTIONS

A. For non-commercial sources, the Contractor shall notify the Engineer not less than 30 calendar days in advance of use of the proposed sources of materials and shall make arrangements for the Engineer to obtain samples as required for testing purposes.

1. The sources of materials to be used on a project shall not be changed during the job except with the written consent of the Engineer.

2. If permission to change sources of material is granted, a new job mix formula shall be required.

3. Samples shall not exceed 500 pounds for each separate grading.

B. When requested by the Contractor, exceptions to the above requirement may be granted in writing by the Engineer under either of the following conditions:

1. The concrete structures on the project are minor in nature, such as culvert headwalls, manholes, small boxes, sidewalks, etc., generally, when less than 100 cubic yards of concrete are called for on the project.

2. When the aggregate source has been previously tested within the past 1 year and accepted by the Contracting Agency.

C. The Contractor shall give the Engineer advance notice in writing when any changes are to be made in the batch proportions. In the case of Class EA concrete, no changes will be allowed without new laboratory trial testing and subsequent approval.

D. Batches of concrete shall not vary more than ±3 pounds per cubic foot in unit weight from design mix. The cement factor of any individual batch placed in the work shall not be more than 14 pounds per cubic yard less, nor more than 23 pounds per cubic yard greater than the designated cement factor. Batch aggregates and report by weight to the Engineer. The weights used may be varied as necessary to comply with the above tolerances in cement factor and unit weight.

E. For Class EA Concrete, Modified, perform laboratory trial tests to determine strength and compatibility of all materials (as specified in Table 2 of this subsection and in ***Subsection 501.02.03, "Admixtures"***) to be used. Contractor shall have an approved laboratory perform the tests and furnish documentation of such tests. Laboratory trial batches may be observed by the Engineer.

Table 2 - Concrete Mix Designation[4, 5]							
Class of Concrete	**Cementitious Range lb/yd³**	**Max. Nom. Coarse Aggregate Size inches**	**Min. 28-Day Compressive Strength[6] psi**	**Slump Range inches**	**Entrained Air Range %**	**Unit Weight Variation lb/ft³**	**Use**
A	564-705	1-1/2	3000	1-4	4-7	± 3	General use and reinforced structures
AA	564-705						
B	517-705	2	3000	1-5	4-7	± 3	Massive or lightly reinforced sections
BA				1-4			
C	470-611	2-1/2	2500	1-5	4-7	± 3	Massive unreinforced and backfill
CA	517-658						
D	564-705	3/4	3000	1-4	4-7	± 3	Thin reinforced sections, hand rails, etc.
DA	564-752						
PA A	564-752	3/4	Specified on Plans	1-4	Specified on Plans	± 3	Prestressed members
Modified A and AA	564-752	1-1/2	Specified on Plans	1-4	4-7 (AA only)	± 3	Where specified on plans
Modified D and DA	564-752	3/4	Specified on Plans	1-4[7]	4-7 (DA only)	± 3	Where specified on plans
Modified EA[8]	564-752	3/4	Specified on Plans	1/2 -4	4-7	± 3	High Performance Concrete
S and SA	639-925[9]	3/4[10]	Specified on Plans	N/A	4-7 (SA only)[11]	± 3	Self Consolidating Concrete

[4] Blend the coarse aggregate gradation from stockpiles conforming to the requirements of ***Subsection 706.03.01, "Coarse Aggregate,"*** and the stated nominal maximum size. Submit test reports for trial batches showing each stockpile sieve size and the proportions used for blending. Adhere to ***Subsection 706.02.01, "General,"*** for the combined gradation regardless of coarse aggregate gradation. If approved, coarse aggregate nominal maximum size of 1 inch may be used in lieu of 3/4 inch.

[5] Air entrainment on mixes placed above 6000 feet elevation

[6] Comply with ***Subsection 501.02.04, "Concrete Making Properties,"*** of the Standard Specifications for the moving average method of evaluating concrete specified under Statistical Evaluation of Concrete Strength.

[7] For extruding barrier or bridge rail, slump range is 0.5-4 inches.

[8] Aggregates shall consist of a blend of coarse, intermediate, and fine aggregates in order to produce a dense grading. Consideration of the grading, workability factor, and coarseness factor, as outlined in ACI 302 shall be utilized. The aggregate maximum nominal size shall consist of at least a nominal 3/4 inch stone size.

[9] The maximum shrinkage requirement of 0.06% in 28 days air dry after 28-day wet cure, ASTM C157, shall apply if the total cementitious material exceeds 752 pounds per cubic yard.

[10] If approved, 1/2 inch or 3/8 inch may be used in lieu of 3/4 inch.

[11] Air content shall be as follows: For 1/2 inch max. aggregate size, 4.5% - 7.5%, and for 3/8 inch max. aggregate size, 5% - 8%.

F. Concrete shall be composed of cement, admixtures (when approved), aggregates and water. These materials shall be as specified. The exact proportions in which these materials are to be used for different parts of the work shall be determined by the Contractor and submitted to the Engineer for review prior to use in the work. In general, the mix shall be so designed as to produce concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have maximum smoothness of surface. Mix designs where sand represents more than 41 percent of the total weight of fine and coarse aggregate shall not be permitted. The proportions shall be changed whenever necessary or desirable in the opinion of the Engineer. Concrete mixes shall be designed by a Registered Professional Engineer in the State of Nevada representing a qualified independent testing laboratory and approved in advance by the Engineer. Concrete mixing operations shall conform to ASTM C 94. Water shall not be added to concrete after leaving the batch plant unless specifically authorized by the Engineer.

501.03.05 PROPORTIONING METHODS

A. Except as hereinafter noted, aggregate bins shall conform to either 1 or 2 as follows:

1. Each specified size of aggregates shall be stored in a separate bin. Except as hereinafter specified, each bin shall be provided with an individual outlet gate, designed and constructed to prevent leakage when closed. The gates shall cut off quickly and completely.

2. Each size aggregate shall be weighed individually in a single bin, providing there is a satisfactory method employed to eliminate any excess material resulting from over-charging of the bin before the material reaches the surge hopper.

B. Conformance to 1 and 2 above will not be required when batching for culvert headwalls, manholes, small boxes, sidewalks, etc., and the total quantity of concrete called for on the project does not exceed 300 cubic yards.

C. All aggregates for use in Portland cement concrete shall be proportioned by weight, with the exception that aggregates for culvert headwalls, short pieces of curb and gutter, or small sections of sidewalk and related minor work may be proportioned either by weight or volume as the Contractor may elect. Measuring boxes of known capacity shall be furnished and used to measure each size of aggregate proportioned by volume.

D. Water shall be proportioned to maintain batching consistency with regard to stockpile moisture contents and varying absorption values for both coarse and fine aggregates. The Engineer may request the Contractor to submit a new mix design if either the coarse or fine aggregate absorption values vary from the approved mix design by more than 1 percent.Water shall be proportioned to maintain batching consistency with regard to stockpile moisture contents and varying absorption values for both coarse and fine aggregates. The Engineer may request the Contractor to submit a new mix design if either the coarse or fine aggregate absorption values vary from the approved mix design by more than 1 percent.

E. Bulk cement shall be weighed separately when the batch is 1 cubic yard or more.

1. The scale and weigh hopper for the cement shall be separate and cement hopper shall be interlocked against opening before the full amount of cement is in the hopper, against closing before the contents of the hopper are entirely discharged and the scales are back in balance, and against opening when the amount of cement in the hopper is underweight by more than 1 percent of the amount specified.

2. An interlock system will not be required on projects having less than 300 cubic yards in the bid schedule.

F. Scales utilized in the proportioning device may be of the springless dial type or of the multiple beam type.

G. If of the dial type, the dial shall be of such size and so arranged that it may be read easily from the operating platform.

H. If of the multiple beam type, the scales shall be provided with an indicator operated by the main beam which will give positive visible evidence of over or under weight.

1. The indicator shall be so designed that it will operate during the addition of the last 400 pounds of any weighing.

2. The over travel of the indicator hand shall be at least 1/3 of the loading travel.

3. The indicator shall be enclosed against moisture and dust.

I. Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the entire plant is running, the scale reading and cutoff shall not vary from the weight designated by more than 1 percent for cement and 1-1/2 percent for any size aggregate, nor 1-1/2 percent for the total aggregate in any batch.

J. Scales shall be approved with a certificate of inspection as required by ***Subsection 109.01, "Measurement of Quantities."***

K. When the entire plant is running, the scale reading and cutoff weights shall not vary from the mix design by more than 1 percent for cement, fly ash, and silica fume, 1.5 percent for any individual size aggregate, and 1 percent for the total combined aggregate in any batch. The total water shall not exceed the maximum water specified in the mix design.

L. Should separate supplies of aggregate and material of the same size group, but of different moisture content or specific gravity be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the material therein completely exhausted before starting upon another.

M. Stockpiled aggregates shall be in a saturated surface dry condition just prior to batching.

1. The moisture content of the aggregate shall be such that no visible separation of moisture and aggregate will take place during transportation from the proportioning plant to the point of mixing

2. Aggregate containing excess moisture shall be stockpiled prior to use until sufficiently dried to meet the above requirements.

N. Batches with cement in contact with damp aggregates shall be mixed within 30 minutes after being proportioned. Batch trucks hauling more than 1 batch of cement and aggregate shall be so constructed that materials do not flow from one compartment to another during haul or discharge.

O. Coarse and fine aggregate shall be handled and measured separately. Cement shall be emptied directly into the charging skip of the mixer. Water shall be measured either by volume or by weight.

P. The equipment for measuring and supplying the water to the mixer shall be so constructed and arranged that the amount of water added to the mixture can be measured in one operation into the mixing drum without dribbling.

1. The equipment shall be so designed that water from the source of supply cannot enter the measuring tank while the water is being discharged from the measuring tank into the mixer.

2. Tanks or other equipment for measuring and discharging water into the mixer shall be sufficiently accurate that the amount of water delivered to the mixer for any batch shall not vary more than 1 percent from the required quantity of water for any position of the mixer with respect to a level plane.

3. The tanks or other equipment shall be so arranged as to permit the checking of the amount of water delivered by discharging into measured containers.

501.03.06 MACHINE MIXING

A. Concrete manufactured by any procedure which results in any unmixed lumps of cement in the mixed product shall be rejected. The preparation of the mix shall be in accordance to ACI 318, Section 5.8, “Mixing,” and this section. The Cement and Concrete terminology is defined in ACI 116.

B. For structural concrete, the Operator shall provide a computer printed legible ticket and for non-structural concrete, at a minimum, a hand written ticket. The ticket shall be presented with each load, and shall contain the following information:

1. Name of Vendor.

2. Name of Contractor.

3. Number of Cubic Yards in the Load.

4. Amount of Cement and of each Size of Aggregate.

5. Amount of Water Added at the Plant.

6. Amount of Water in the Aggregate.

7. Brand and Type of Cement.

8. Brand and Amount of Admixture.

9. Time and Date of Batching.

10. For Mobile mixer add:

    a. Truck Number (the truck unit the mixer is mounted).
    b. The Model of the mixer with Serial Number.

C. Space shall be provided on the ticket so the amount of water added on the job may be indicated.

D. All concrete shall be mixed in mechanical mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in accordance with the provisions of ***Subsection 501.03.07, "Hand Mixing."***

1. Mixers shall have legible permanently attached plates showing manufacturer's rated capacity, mixing speeds, and serial number.

2. Mixers may be stationary mixers or truck mixers.

    a. Agitators may be truck mixers operating at agitating speed or truck agitators.
    b. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete, and the speed of rotation of the mixing drum or blades.

3. The Contractor, at no additional cost to the Contracting Agency, shall furnish samples of the fresh concrete and provide safe and satisfactory facilities for obtaining the samples.

4. Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer.

5. The temperature of materials as charged into the mixer shall be such that the temperature of the mixed concrete at the time it is placed in final position is not less than 50 degrees F nor more than 90 degrees F as specified in ***Subsection 501.03.10.B, "Cold Weather – General,"*** and

Subsection 501.03.10.C, "Low Temperature Protection." Aggregates and water used for mixing shall not exceed 150 degrees F.

6. Concrete for structures shall be mixed for a period of not less than 60 seconds nor more than 5 minutes after all materials, including water, are in the mixer.

7. Cement shall be batched and charged into the mixer by means that will not result either in loss of cement due to the effect of wind, or an accumulation of cement on surfaces of conveyors or hoppers, or in other conditions which may vary the required quantity of cement in the concrete mixture.

8. Stationary mixers having a capacity of 1 cubic yard or more and all paving mixers shall be operated with an automatic timing device that can be locked by the Engineer. The time device and discharge mechanisms shall be so interlocked that during normal operations no part of the batch will be discharged until the specified mixing time has elapsed.

9. The total elapsed time between the intermingling of damp aggregates and cement and the start of mixing shall not exceed 30 minutes.

10. Mixers and agitators which have an accumulation of hard concrete or mortar or worn blades shall not be used.

11. When central-mixed concrete is furnished and non-agitating hauling equipment is used for transporting concrete to the delivery point for Portland cement concrete pavement, discharge into the laydown machine shall be completed within 45 minutes after the addition of the cement to the aggregates.

E. **Ready-Mixed Concrete.**

1. Ready-mixed concrete shall be central-mixed, shrink-mixed, or transit-mixed concrete. Shrink-mixed concrete is that which has been mixed partially in a stationary mixer and the mixing completed in a truck mixer.

2. The size of batch in truck mixers and truck agitators shall not exceed the rated capacity as determined by the current Standard Requirements of Truck Mixer Manufacturers Bureau. The size of batch in stationary mixers shall not exceed the rated capacity of the mixer as determined by the standard requirements of the Associated General Contractors of America. No batches requiring fractional sacks of cement will be permitted unless all of the cement is weighed when added to the batch.

3. If the use of ready-mixed concrete is approved, the producers shall use only that cement approved by the Contracting Agency for use on the project. Contracting Agency approved cement shall be stored at the concrete plant in such a manner that it can be identified and kept separate from other cement.

4. Ready-mixed concrete for structures shall be transported in truck mixers or truck agitators.

5. The mixer, when loaded to capacity, shall be capable of combining the ingredients of the concrete within the specified time, into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity. The agitator, when loaded to capacity, shall be capable of maintaining the mixed concrete in a thoroughly mixed uniform mass and of discharging the concrete with a satisfactory degree of uniformity.

6. Mixers and agitators shall be examined periodically for changes in condition due to accumulation of hardened concrete or mortar or to wear of the blades.

    a. When any such change in condition is found, the concrete shall be subjected to the slump tests.
    b. If the tests indicate that the concrete is not being properly mixed, the faulty equipment shall be corrected before its further use is allowed.

7. Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may be readily verified. The counters shall be of the continuous-registering, non-resettable type, which accurately register the number of revolutions, and shall be mounted on the truck mixer so that the Engineer may safely and conveniently inspect them from alongside the truck.

8. When a truck mixer is used, each batch of concrete shall be mixed for not less than 70 and no more than 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of the equipment as mixing speed. If any additional mixing is done, it shall be at the speed designated by the manufacturer of the equipment as agitating speed.

9. When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

10. No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless permitted by the Engineer. If the Engineer permits additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.

11. The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of revolution of the drum in the discharge direction with the discharge gate fully open.

12. When truck mixer or truck agitator is used for transporting concrete that has been completely mixed in a stationary mixer, mixing during transportation shall be at the speed designated by the manufacturer of the equipment as agitating speed. Do not exceed a total of 300 revolutions from the time of initial batching to complete discharge of delivered concrete.

13. When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within 90 minutes after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. In hot weather, or under conditions contributing to quick stiffening of the concrete as determined by the Engineer, a delivery time of less than 90 minutes may be required. When a truck mixer is used for the complete mixing of the concrete, the mixing operations shall begin within 30 minutes after the cement has been intermingled with the aggregate.

14. If the mixing plant is such a distance from the site of the work that it is not practical to have the mixed concrete delivered and placed in forms within the time limit specified, cement and water shall not be added until such time as requirements can be complied with.

15. The organization supplying concrete shall have sufficient plant capacity and transporting apparatus to ensure continuous delivery at the rate required.

    a. The rate of delivery of concrete shall be used as to provide for the proper handling and placing of concrete.
    b. An interval of more than 45 minutes between any 2 consecutive batches or loads, or a delivery and placing rate of less than 8 cubic yards of concrete per hour shall constitute cause of shutting down work for the remainder of the day, and if so ordered by the Engineer, the Contractor shall make, at no additional cost to the Contracting Agency, a construction joint at the location and of the type directed by the Engineer in the concrete already mixed.

16. After mixing of ready-mixed concrete has been completed, it shall be agitated continuously at agitating speed until it has been discharged from the drum.

17. Wash water shall be completely discharged from the drum or mixing container before the succeeding batch is introduced. Cement balling (intermittent clumping) and mix foaming shall be prevented by controlling the batch sequence, mixing speed, and mixing time.

    a. When intermittent clumping exceeds 1-2 clumps per yard or 10 clumps per truck, the entire load will be rejected.
    b. The clumps shall not exceed 5 inches in diameter.

F. Mobile Mixers

1. The concrete mobile mix truck and placement of concrete shall comply to the ASTM C685 “Concrete Made by Volumetric Batching and Continuous Mixing” and Volumetric Mixer Manufacturers Bureau manual VMMB 100-01 “Volumetric Mixer Standards” with the exception as follows:

    a. ASTM C685 section 7.8 and VMMB 100-01 section 1.2.4 tolerance table shall be replaced with American Concrete Association 3046R section 6.2.2 tolerance table.

2. Material bins shall conform to Table 1 of VMMB 100-01 with the following addition:

   a. Reinforcing fibers and fly ash, if required, must be stored and dispensed from their own separate bin. Bins for cementitious materials shall be sealed to prevent damage to the cementitious materials by ambient air moisture.

3. Rating Plate

   a. The rating plate shall comply to ASTM C685 and VMMB 100-01. One size of volumetric mixer units of the same design and configuration shall have been approved by the VMMB to be eligible to carry the VMMB plate.
   b. Mixers that were certified by a VMMB member company subsequent to issue of the VMMB 100 standard in 2001 shall have a rating plate furnished by the VMMB attached to the mixer equipment. They shall be certified by completing the qualification report forms. These forms are on the VMMB website and shall be submitted to VMMB for review and approval.
   c. Separate VMMB qualification report forms are required for each individual mixer unit.

4. Prior to the use of the mobile mixer, it shall be inspected by the Contracting Agency. At the time of the inspection, the supplier must provide all of the documentation as required in ASTM C685.

   a. The frequency of the mixer inspection is six months.
   b. The maximum calibration interval of the flow meter shall be six months or 2500 cubic yards of production and a minimum of three calibration runs shall be performed as required by ACI 304.6R.
   c. Mixing uniformity evaluation must be performed on a minimum 1 cubic yard sample and reviewed and approved by the VMMB prior to delivery of a rating plate. Prior to initial submittal of an application package to Clark County, an initial mixing uniformity evaluation must be performed within the last 3 months.
   d. A mixing uniformity evaluation must then be performed at a maximum interval of 6 months as required by ASTM Standard C685. A mixing uniformity evaluation must be performed within the last 3 months, prior to submittal of an annual application for renewal as an approved concrete fabricator with Clark County.

5. Material

   a. For onsite materials, it shall be placed in stockpiles with tests of each in accordance to the table one test methods in section 706 and frequencies on the Clark County QAQC website:
      http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx
   b. For established offsite material sources, test results within 6 months of the mix design date shall be attached to the mix design based on the Table 1 requirements.
   c. The mix design shall include the source name and location. If the material source changes, the mix shall be re-designed and be resubmitted.
   d. The data shall include the material ASTM C33 information.

e. The documentation shall be delivered to the Contracting Agency.
f. The source material test data and vendor sheets shall be attached to the mix design.

501.03.07 HAND MIXING

A. Hand mixing shall not be permitted, except in case of an emergency or under written permission of the Engineer.

B. When permitted, hand mixing shall be done only on watertight platforms.

1. The sand shall be spread evenly over the platform and the cement spread upon it.

2. The sand and cement shall then be thoroughly mixed while dry by means of shovels until the mixture is of uniform color, after which it shall be formed into a "crater" and water added in the amount necessary to produce mortar of the proper consistency.

3. The material upon the outer portion of the "crater" ring shall then be shoveled to the center and the entire mass turned and sliced until a uniform consistency is produced.

4. The coarse aggregate shall then be thoroughly wetted and added to the mortar and the entire mass turned and returned at least 6 times and until all of the stone particles are thoroughly covered with mortar and the mixture is of a uniform color and appearance.

C. Hand mixing will not be permitted for concrete to be placed under water.

D. Preproportioned sack concrete may be used for grout caps or other nonstructural uses as approved by the Engineer.

501.03.08 RETEMPERING

A. Concrete shall be mixed only in such quantities as are required for immediate use and shall be placed before initial set has taken place. Any concrete in which initial set has begun shall be wasted and not used in the work.

B. No retempering of concrete shall be allowed.

501.03.09 CURING

A. Comply with ACI 308, Standard Specification for Curing Concrete, with the following exceptions or additions:

1. General. All concrete shall be cured for the length of time hereinafter specified. If Type III cement is used, the curing time may be reduced as directed by the Engineer. In the event of low temperatures, the time will be increased according to the procedures specified in ***Subsection 501.03.10.B, "Cold Weather – General."***

a. Cure all bridge decks and approach slabs according to Subsection 501.03.09.A.6, "Bridge Deck Curing."
b. Curing shall commence immediately upon completion of the finish. In the event that the application or placement of the curing medium is delayed, curing will be as described under 2 below.

2. **Water Method.** The concrete shall be kept continuously wet by the application of water for a minimum period of 7 days after the concrete has been placed.

a. Use fogging equipment capable of applying water through an atomizing nozzle in the form of a fine mist, not a spray. The equipment may use water pumped under adequate high pressure, or a combination of air and water pumped under high pressure. Use equipment sufficiently portable for use in the direction of any prevailing wind. Adapt equipment for intermittent use as directed to prevent excessive wetting of the concrete.
b. Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period. The cotton mats, rugs, or carpets shall be of such character that they will retain water.

3. **Curing Compound Method.** The entire surface of the concrete shall be sprayed uniformly with a curing compound. It shall be applied when just a light film of water is present on the surface. If the surface is dry, water shall be added as specified in 2 above before the curing compound is applied.

a. On decks or slabs cured by this method, foot traffic shall be held to a minimum and these surfaces shall not be used as a work area during the cure period. Should the film of the compound be damaged before the expiration of 7 days, the damaged portions shall be repaired immediately with additional compound.
b. Uniformly spray the entire surface of the concrete with a curing compound conforming to Subsection 702.03.01, "Curing Materials," except as hereinafter specified for concrete bridge decks that are to be the roadway surface. The curing compound shall be applied to the exposed surface at a uniform minimal rate of 1 gallon per 150 square feet of area.
c. Do not apply the curing compound until all patching and surface finishing, except grinding, have been completed. When ordered during periods of hot weather, continue fogging of the concrete with water after curing compound is applied until no longer required.
d. The curing compound shall be delivered to the work in ready-mixed form. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. The compound shall not be diluted or altered in any manner, unless dilution is recommended by the manufacturer.
e. Provide curing compounds which remain sprayable at temperatures above 40 degrees F and do not hard settle in storage.
f. Curing compound that has become chilled to such an extent that it is too viscous for satisfactory application shall be warmed to a temperature not exceeding 100 degrees F

g. Curing compound shall be packaged in clean 55-gallon steel barrels or round 5-gallon steel containers or supplied from a suitable storage tank located at the jobsite.
   1) Each 55-gallon barrel shall be equipped with a built-in agitator having 2 sets of blades, one at the bottom and one midway between top and bottom, and with removable lids and airtight band fasteners.
   2) On-site storage tanks shall be kept clean and free of all contaminants. Each tank shall be provided with a permanent system designed to completely redisperse any settled material without introducing air or any other foreign substance.
   3) Barrels shall be filled in a manner that will prevent skinning.
   4) Ring seals and lug type crimp lids shall be used to seal 5-gallon containers well.
   5) Containers shall be provided with lining that will resist the solvent of the curing compound and will not permit skins to be loosened into the body of the curing compound.
   6) Each container shall be labeled with the manufacturer's name, batch number, type of compound, number of gallons, and date of manufacture. Each container shall also be labeled with an Interstate Commerce Commission Red Label warning concerning flammability. The label shall also warn that the curing compound shall be well stirred before use.
   7) When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall be supplied with each load containing the same information as that required herein for container labels.

h. Curing compound may be sampled by the Engineer at the source of supply, at the job site, or at both locations.
i. Curing compound not used within 6 months of the date of manufacture will require certification from the manufacturer that the curing compound still conforms to ASTM C309. Curing compound more than 1 year old or without a manufacture date on the container will not be allowed for use.

4. Waterproof Membrane.

a. Keep the exposed finished surfaces of concrete damp with water using an atomizing nozzle, as specified in Subsection 501.03.09.A.2, "Water Method," until the concrete has set.
b. Place the curing membrane after the concrete has set.
   1) The membrane shall be formed into sheets of such width as to provide a complete cover of the entire concrete surface.
   2) All joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint.
   3) Overlap of sheets shall have a minimum lap of 18 inches.
   4) The sheets shall be securely weighted down by placing a bank of earth on the edges of sheets or by other means satisfactory to the Engineer.
   5) Sheeting material shall conform to Subsection 702.03.01, "Curing Materials."
c. The curing membrane shall remain in place for a period of not less than 7 days.

d. Should any portion of the sheets be broken or damaged before the expiration of the curing period, the broken or damaged portion shall be immediately repaired with new sheets properly cemented into place, or water curing as described above shall commence immediately.
e. Sections of the membrane which have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing shall not be used.

5. Form Method.

a. If forms are kept on the concrete surfaces, this will be considered adequate cure for these surfaces.
b. However, should the forms be removed within 7 days after the concrete has been placed, one of the above methods shall be used on the exposed surfaces.
c. Comply with Subsection 502.03.11, "Removal of Falsework and Forms."

6. Bridge Deck Curing.

a. Submit a quality control plan for concrete placement and curing, for review and approval, a minimum of 30 days prior to the pre-pour conference for bridge decks and approach slabs. The plan shall include, but not be limited to, information on the procedures for when and how the concrete and the curing system is to be placed, frequency for monitoring, maintaining, and re-wetting the curing system chosen, and a list of personnel responsible for performing such work. Include in the plan, equipment to be used for placement of concrete and the curing system, methods of protecting the covers from displacement from wind or weather, and methods of preventing loss of heat and moisture.
b. Describe procedures to be followed in the event of equipment breakdown or inclement weather during concrete placement. In addition, describe the method to be used to protect pedestrian and vehicular traffic under the structure.
c. Use Figure 2.1.5 from ACI 305R, Hot Weather Concreting, to determine the evaporation rate. Additional protection measures shall be provided if the rate of evaporation exceeds 0.1 pound per square foot per hour.
    1) Accurate record of placement location, air temperature, relative humidity, concrete temperature, and wind velocity shall be provided.
    2) Readings shall be taken an hour prior to the concrete placement and at 1-hour increments during concrete placement, until the final curing blanket is placed.
    3) Required data shall be submitted to the Engineer.

d. Concrete temperature shall be monitored during the entire curing period by utilizing recording thermocouples embedded at 1 inch below the concrete surface and 1 inch above the bottom concrete surface.
    1) A minimum of 2 sets of thermocouple installations will be required per each day's placement.
    2) The thermocouple shall be capable of recording the concrete temperature as a function of time.
    3) Acceptable devices include thermocouples connected to electronic data loggers.

4) The recording time intervals shall be a maximum of 30 minutes.
5) The recording devices shall be accurate to within ±1.8 degrees F. Concrete temperature between the top and bottom of the slabs and the supporting girders shall be maintained to a maximum differential temperature of 30 degrees F.
6) If differential temperatures exceed the requirements, measures shall be taken to correct the curing process.
7) Required data shall be submitted to the Engineer.

e. Immediately after the concrete is placed, the moisture content shall be maintained by humidifying the air directly above the concrete surface until the curing covers are placed. Fogging equipment described in Subsection 501.03.09.A.2, "Water Method," shall be used, mounted on a finishing bridge that is separate from the concrete placing equipment.
f. Begin placing pre-soaked burlap within 30 minutes after finishing has started. Wet curing of the surface shall be performed for 10 days, unless otherwise directed, with the following covering:
   1) Burlap and Polyethylene Covering. Burlap conforming to Subsection 702.03.01, "Curing Materials," and polyethylene (white or reflective) conforming to ASTM C171 shall be furnished. Soaker hose shall be placed or other approved method shall be used to provide continuous wetting of burlap between the burlap and polyethylene covering.
g. Pre-wetted curing coverings shall be placed with a finishing bridge. Covers shall be placed directly behind the concrete fogging operation.
h. The covering shall be maintained uniformly wet during the entire curing period. Provide 24-hour monitoring of the wet curing for the full length of the curing period. Water temperature shall not be more or less than 20 degrees F from the temperature of top of bridge deck.
i. Covers shall be lapped a minimum of 18 inches. All lapped edges shall be sealed to prevent loss of heat and moisture.
j. If the ambient temperature drops below 45 degrees F during the first 4 days of curing, additional protection shall be provided according to Subsection 501.03.10.C, "Low Temperature Protection."
k. After completion of wet curing and removal of curing covering, immediately remove excess water and apply an application of curing compound according to Subsection 501.03.09.A.3, "Curing Compound Method."
l. All cracks on new bridge decks and approach slabs shall be repaired. Requested method of repair shall be submitted for approval.

7. Maturity Meter Method:

a. This method may be used if referred to in the contract special provisions.
b. The method specified in ASTM C1074 may be used in order to reduce the cure time. This method requires training and certification of the Quality Assurance and Control personnel.
c. This method shall not be used for acceptance but for reducing the time required for form removal. The Contractor shall have a plan of action approved by the Engineer and monitored by a third party engineer for meter placement and monitoring.

501.03.10 WEATHER LIMITATIONS

A. **General.** If impending inclement weather conditions exist, the Contractor shall decide whether or not to begin the placement and the Contractor shall have sole responsibility for Contractor's decision.

1. Before any concrete is placed, the Contractor shall have adequate provisions readily available as approved by the Engineer, to protect the concrete from any impending weather conditions.

2. In case precipitation should occur after placing operations have started, the Contractor shall provide ample covering to protect the work.

3. The placing of concrete shall be stopped before the quantity of precipitation is sufficient to cause a flow or to wash the surface.

4. All exposed concrete surfaces shall be sprayed liberally with an evaporation retarder such as Confilm by Masterbuilders or approved equal, when the ambient air temperature is greater than 100 degrees F.; or when the ambient air temperature is above 90 degrees F. and the wind speed is above 20 mph; or as directed by the Engineer. Spraying shall be per manufacturer's recommendation and shall occur immediately upon completion of the finish.

B. **Cold Weather – General.** Comply with ACI 306, Cold Weather Concreting, with the following exceptions or additions:

1. All concrete shall be maintained at a temperature of not less than 50 degrees F for 3 days or not less than 40 degrees F for 7 days. The count of time shall commence immediately upon completion of final placement and vibration. The three 50-degree F days need not be consecutive.

2. One 24-hour period shall constitute 1 day.

3. The temperature of the concrete shall be determined by placement of thermometers on the concrete surfaces and properly insulating these devices to record the surface temperature of the concrete.

    a. Temperature shall be monitored continuously throughout the total protection time required by this subsection.
    b. In case the surface temperature of the concrete falls below 40 degrees F for a duration of 3 hours or more in any 24-hour period during the time of temperature protection, the time shall be increased 1 day for each day this occurs.
    c. An absolute minimum temperature of 35 degrees F shall be maintained for the total time of protection specified in this subsection.
    d. Should the temperature of the concrete fall below 35 degrees F at any time, damage may occur.
    e. The assessment of damage will be determined by a professional engineer registered in Nevada and paid for by the contractor and concrete so damaged may require repair or replacement at the option of the Engineer.

4. The concrete shall have a temperature of at least 50 degrees F and not more than 90 degrees F at the time of placing. (Also, comply with temperature constraints specified in ***Subsection 501.03.06, "Machine Mixing."***)

   a. Heating equipment or methods which alter or prevent the entrainment of the required amount of air in the concrete shall not be used.
   b. The equipment shall be capable of heating the materials uniformly.
   c. Aggregates and water used for mixing shall not be heated to a temperature exceeding 150 degrees F.
   d. Concrete containing frost or lumps at the time of placing shall not be used.

5. Stockpiled aggregates may be heated by the use of dry heat or steam. Aggregates shall not be heated directly by gas or oil flame or on sheet metal over fire.

6. Reinforcing steel shall be free of ice, snow, and frost during placement of concrete. Concrete shall not be placed on frozen ground.

7. Concrete shall not be placed on frozen ground, nor shall it be placed when atmospheric temperature is below 40 F. and within 24 hours of the time that the concrete is to be placed, except with the written permission of the Engineer and only after such precautionary measures for the protection of the concrete have been taken as the Engineer may direct.

C. **Low Temperature Protection.** Refer to guidelines in ACI 306, Cold Weather Concreting, with the following exceptions or additions:

1. **General.** After the concrete has been placed, means shall be taken to protect the concrete from any impending low temperatures.

   a. Methods and materials not hereinafter prescribed may be used if approved by the Engineer and the following requirements adhered to:
      1) Materials shall be fire resistant
      2) Materials shall be waterproof
      3) Materials shall not adhere, abrade or damage the surface of the concrete.

   b. Approval of the Engineer shall not relieve the Contractor from obtaining specification results.

2. **Insulating Blankets.**

   a. Insulating blankets used to protect concrete from low temperatures shall be fire resistant and waterproof.
   b. The blankets shall be secured and overlapped along the edges and joints to ensure that no opening will exist in the protection during high winds or other adverse conditions.
   c. Provisions shall be made to allow the reading of thermometers placed inside of the protection.

d. When depositing concrete against previously cast concrete, the blanket insulation shall extend at least 14 inches onto the existing concrete and shall be securely held in place.

3. **Low Temperatures Protection – Heating and Housing.**

a. In order to meet the provisions of ***Subsection 501.03.09, "Curing,"*** paragraphs A and B, the concrete may be protected by applying artificial heat within an enclosure.
b. The enclosure shall be constructed with fire resistant material, unless otherwise directed by the Engineer, and shall be subject to Engineer's approval.
c. The heating system shall be so arranged as to provide uniform heating, ensuring that the concrete farthest from the source of heat is receiving adequate protection without drying the concrete near the source of heat so as to cause shrinkage cracks.

4. The temperature of the concrete will be determined by placement of thermometers on the concrete surfaces and properly insulating these devices to record the surface temperature of the concrete according to NV Test Method T440.

a. Temperature will be monitored continuously throughout the total projection time required by this subsection.
b. If the surface temperature of the concrete falls below 50 degrees F during the first 3 days and 40 degrees F during the next 4 days of the temperature protection for a duration of 3 hours, the curing time will be increased 1 day for each day this occurs.
c. Should the temperature of the concrete fall below 35 degrees F at any time during the 7 days of temperature protection or if the surface temperature of the concrete falls below 40 degrees F during the first 24 hours of temperature protection period, the assessment of damage will be determined by a Nevada registered professional engineer paid for by the Contractor and damaged concrete shall be repaired or replaced at the option of the Engineer.
d. Contractor shall be responsible for all costs associated with damage assessment and repair.

D. **Hot Weather.** Comply with guidelines in ACI 305, Hot Weather Concreting, with the following exceptions or additions:

1. The maximum temperature of cast-in-place concrete shall not exceed 90 degrees F immediately before placement.

2. For continuous placement of concrete on the deck with reinforcing steel units, retard the initial set of the concrete sufficiently to ensure that concrete remains plastic for subsequent placement.

3. For both simple and continuous spans, submit a retardation schedule for approval.

4. The consistency of the concrete as placed shall allow the completion of initial finishing operations without the addition of water to the surface. When conditions are

such that additional moisture is needed for initial finishing, the required water shall be applied to the surface fog spray only, and shall be held to a minimum amount. Apply fog spray for this purpose as specified in ***Subsection 501.03.09.A.2, "Water Method."*** Fog spray for this purpose may be applied with hand-operated fog equipment, as approved by the Engineer.

5. From the time of initial strike-off until final finish is complete, the unformed surfaces of slab concrete shall be protected from rapid evaporation of mixing water from the concrete due to wind, high temperature, low humidity, or combination thereof.

6. Equipment for fogging, type of evaporation retarder, and method of application shall be approved by the Engineer. Equipment shall be portable, adapted for intermittent use, and operable in the direction of any prevailing wind.

7. Use fogging equipment capable of providing a fog mist, as necessary, to the area between the finishing machine and the tining machine. The fogging equipment shall meet the requirements of ***Subsection 501.03.09.A.2, "Water Method."*** If at any time it becomes apparent that the combination of fogging and curing application are not, or will not be effective in preventing plastic shrinkage cracking, stop the concrete placement until environmental conditions improve substantially, or until other preventative measures are approved in writing by the Engineer.

8. After all finishing operations are complete a final curing membrane shall be applied.

9. When the temperature is 90 F. or above, or is likely to rise above 90 F. within the 24-hour period after concrete placement; or when there is any combination of high air temperature, low relative humidity and wind velocity which would impair concrete strength or quality, follow the recommendations of ACI 305R and the following:

   a. Keep concrete as cool as possible during placement and curing
   b. Do not allow concrete temperature to exceed 90° F. at placement.
   c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
   d. Dampen subgrade and forms with cool water immediately prior to placement of concrete.
      Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.
   e. Take appropriate precautions per ACI 305R when the actual or anticipated evaporation rate equals or exceeds 0.2 pounds per square foot per hour as determined from ACI 305R, Figure 2.1.4.

501.03.11 TRIAL SLAB AND PROCESS CONTROL TESTING

A. If silica fume is used in bridge deck concrete, construct a trial slab at least 30 days prior to placement of concrete on a bridge deck. Submit a written plan for the casting of decks. Include in this plan, at a minimum, the location of slab, the equipment and personnel used for construction, and disposal of slab. Prior to placement of the trial slab, conduct a Pre-Activity Meeting.

B. Use approved mix designs. Place concrete at a location other than the bridge deck, but under similar conditions to those that exist during bridge deck concrete placement.

1. The trial slab shall have a minimum length and width of 50 feet and a depth of 8 inches.

2. Reinforce slab with a top and bottom mat of no. 5 bars spaced 6 inches longitudinally and transversely.

3. Place top mat at a depth of 2-1/2 inches from the top of the slab.

4. Place bottom mat at a depth 1-1/2 inches from the bottom of slab.

5. The trial slab shall be wet-cured in accordance with the specifications.

6. Use personnel such as superintendent, key operators, and finishers that are the same personnel who will be involved in the final construction of the bridge deck.

7. Demonstrate the use of equipment, proficiency of personnel, and techniques for mixing, transporting, placing, and curing of the concrete during the trial.

8. Fifteen days after the placement of the trial slabs, conduct a post construction critique of the trial slab placement in writing.

C. Do not commence placement of bridge deck concrete until after any issues from the post construction critique of trial slab construction have been resolved to satisfaction of the Engineer.

D. Upon notification, remove and dispose of trial slabs according to ***Subsection 107.14, "Disposal of Material Outside Project Right-of-Way."***

501.03.12 MORTAR

A. Cement mortar shall consist of a mixture of Portland cement, sand, and water. Cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with the required amount of water.

1. Cement mortar shall be designated by class and proportioned by loose volume as follows:

Table 3 - Mortar Proportioning

Designation	Proportions
Class "A" Mortar	1 Part Cement to 1 Part Sand
Class "B" Mortar	1 Part Cement to 1-1/2 Parts Sand
Class "C" Mortar	1 Part Cement to 2 Parts Sand
Class "D" Mortar	1 Part Cement to 2-1/2 Parts Sand
Class "E" Mortar	1 Part Cement to 3 Parts Sand
Class "F" Mortar	1 Part Cement to 3-1/2 Parts Sand

2. The quantity of water to be used in the preparation of mortar shall be only that required to produce a mixture sufficiently workable for the purpose intended.

3. Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Re-tempering of mortar will not be permitted.

B. **Cement.** Cement shall conform to the requirements of ***Section 701, "Hydraulic Cement."***

C. **Sand.** Sand shall conform to the requirements of ***Subsection 706.03.04, "Grout and Mortar Sand."*** In proportioning the sand it shall be measured loose (without shaking or compacting) in measuring boxes or other suitable containers of known capacity.

D. **Admixtures.** No admixture shall be used in mortar unless otherwise specified or approved by the Engineer.

501.03.70 CORROSION PROTECTION REQUIREMENT

A. Pipe, conduit, dowels and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there shall be a minimum of two inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement shall not be permitted.

501.03.71 PREPARATION OF SURFACES FOR CONCRETING

A. Native material surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud and debris at the time of placing concrete.

B. Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, in the opinion of the Engineer, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be leveled with a wooded float to provide a reasonably smooth surface. A surface consisting largely of coarse aggregate shall be avoided. The joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material.

C. No concrete shall be placed until all form work, installation of parts to be embedded, and preparation of surfaces involved in the placing have been approved by the Engineer.

501.03.72 EXCLUSION OF WATER

A. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited under water without the explicit permission of the Engineer and then only in strict accordance with the Engineer's directions, nor shall the Contractor, without explicit permission from the

Engineer, allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as to injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing groundwater, if required, shall be subject to the approval of the Engineer and shall be the responsibility of the Contractor. Said items shall be considered incidental to construction and no additional compensation shall be made.

501.03.73 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogenous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement.

501.03.74 CARE AND REPAIR OF CONCRETE

B. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which for any other reason does not conform to the specifications, shall be removed and replaced at the Contractor's expense.

METHOD OF MEASUREMENT

501.04.01 MEASURMENT

A. Portland cement concrete will be measured for payment in accordance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

BASIS OF PAYMENT

501.05.01 PAYMENT

A. Portland cement concrete shall be paid for in accordance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

501.05.02 TRIAL SLAB PAYMENT

A. Full compensation for construction and removal of trial slabs and trial pours shall be considered as included in the contract unit price paid for other appropriate items and no separate payment will be made therefor.

END OF SECTION 501

SECTION 502 – CONCRETE STRUCTURES

DESCRIPTION

502.01.01 GENERAL

A. This work shall consist of furnishing and placing Portland cement concrete in bridges, culverts, headwalls, retaining walls, barrier rail, and all other types of concrete structures.

B. The concrete structures shall be constructed to the lines and grades given by the Engineer and in accordance with the design shown on the plans.

C. The concrete shall be of the class or classes of concrete specified in the contract documents and shall conform to the requirements of Section 501, "Portland Cement Concrete," unless otherwise specified.

D. This work shall also include construction of headwalls, wingwalls, u-channels, trapezoidal channels, stilling basins, outlet structures, connection and transition/splitter structures, and pre-cast concrete box culverts. This shall include the construction of temporary head walls necessary to support the travel lanes and/or work adjacent to the excavation for the reinforced concrete box culvert and roadway.

MATERIALS

502.02.01 GENERAL

A. The materials used shall be those prescribed for the several items which constitute the finished work and shall conform to the requirements for such materials in the following sections:

Materials	Section
Portland Cement Concrete	501
Concrete Curing Materials and Admixtures	702
Joint Material	707
Reinforcement	713
Miscellaneous Metal	712
Elastomeric Bearing Pads	725

CONSTRUCTION

502.03.01 DEPTH OF FOOTINGS

A. The elevation of the bottoms of footings as shown on the plans shall be considered as approximate only and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be necessary to secure a satisfactory foundation.

502.03.02 FORMS

A. All forms shall be built mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations.

1. Forms previously used shall be thoroughly cleaned of all dirt, mortar, and foreign matter before being reused.
2. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly coated with an approved coating or form oil.
3. Coating or form oil shall leave no film on the surface of the form that can be absorbed by the concrete.
4. When required by the Engineer and immediately before placing concrete, the forms shall be thoroughly wetted with water.

B. When requested by the Engineer, the Contractor shall submit detailed plans of form work for examination by the Engineer. If such plans are not satisfactory to the Engineer, the Contractor shall make such changes as may be required, but it is understood that the Engineer's concurrence in the use of the plans as submitted or corrected shall in no way relieve the Contractor of responsibility in obtaining satisfactory results.

C. The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours.

1. The design of the forms shall take into account the effect of vibration on the concrete as it is placed.
2. Forms shall be filleted at all exposed corners unless corners are rounded as hereinafter provided.
    a. Triangular molding used for fillets shall have 2 equal sides.
    b. In general, the width of the equal sides of moldings shall be 3/4 inch.
    c. For massive work, such as heavy pier copings and columns, the width shall be 1-1/2 to 2 inches.
    d. Top edges of walls may be filleted or rounded as hereinafter provided for curbs.
    e. Top edges of curbs and slabs shall be rounded with an edging tool to a radius of 1/2 inch to 3/4 inch.

D. When concrete is placed in excavation, forms shall be provided for all vertical surfaces unless otherwise permitted by the Engineer.

1. On thin walls, such as abutments, wing walls, and retaining walls, the forms on 1 face may be built up as the concrete is poured, but only to such elevation as will permit proper placing and thorough spading, and in no case greater than the height which can be placed in 1 day's run.
2. Ports shall be provided in high, thin walls to permit thorough cleaning before placing concrete.
3. If the forms develop any defects, such as bulging or sagging, after the concrete has been placed, that portion of the work shall be corrected in a manner satisfactory to the Engineer, without additional compensation to the Contractor.
4. During the erection and after the completion of the forms, the forms shall be protected in such a manner as to preclude shrinkage, warping, curling, and distortion.

5. Form lumber used a second time shall be free from bulge or warp and shall be thoroughly cleaned.

E. Forms for concrete over or in the vicinity of operating railroads shall be so constructed and placed that standard clearances demanded by the railroad company will be maintained at all times.

F. The falsework and forms supporting the bottom slab of the superstructure of box girder structures shall remain in place until the curing period of the deck of the superstructure has expired.

1. Unless otherwise permitted by the Engineer, forms for the webs of box girders shall be removed before the deck slab is poured.

2. All interior forms in box girders, except those permitted to remain in place, shall be completely removed and the inside of the box girder cleared of all loose material and swept clean.

G. Side Forms:

1. Side forms for beams, girders, columns, railing, or other members of the structure wherein the forms do not resist dead load bending may be removed as specified in ***Subsection 502.03.11, "Removal of Falsework Forms."***

2. The side forms for arch rings, columns, and piers shall be removed before the members of the structure which the forms support are poured or placed, so that the quality of the concrete may be inspected.

3. All such side forms shall be so constructed that the forms may be removed without disturbing other forms which resist direct load or bending stresses.

H. The condition of the forms will have a direct bearing upon the amount of finishing required.

I. Form Requirements and Physical Design:

1. Full pieces of forms shall be used and shall extend from the bottom to the top of the wall or post.

2. Curved surfaces shall be formed to provide a smooth surface without visible breaks.

3. The forms shall be so constructed that portions, where finishing is required, may be removed without disturbing portions of forms to remain.

4. Forms shall be of sufficient strength to carry the dead weight of the concrete as a liquid without a deflection in excess of L/270, and if such deflection occurs, the deflection shall be sufficient cause for rejection of the work.

5. Forms for girders and slabs shall be cambered in such amounts as may be required by the Engineer.

6. Approved form clamps or bolts shall be used to fasten forms. The use of ties consisting of twisted wire loops to hold forms in position during the placing of concrete will not be permitted.

7. Bolts or form clamps shall be positive in action and shall be of sufficient strength and number to prevent spreading of the forms.

a. The clamps shall be of such type that the clamps can be entirely removed or cut back sufficiently to allow finishing of the concrete.

b. All forms for the outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales.

8. Plywood for forms shall be "exterior type" of the grade Concrete-Form Exterior.

a. Plywood form panels shall be furnished and placed in 4-foot widths and in uniform lengths of not less than 8 feet, except where the dimensions of the member form are less than the specified panel dimensions.

b. Where form panels are attached directly to the studding of joints, the panel shall not be less than 5/8 inch thick.

c. Form panels less than 5/8 inch thick, otherwise conforming to the requirement herein specified, may be used with continuous backing of 1 inch nominal thickness surfaced material.

d. All form panels shall be placed in a neat symmetrical pattern subject to the approval of the Engineer.

e. The panel shall be placed with the long dimensions perpendicular to the studs.

9. Plywood for left-in-place forms in box girders may be of any grade and thickness that will satisfy the other requirements of this subsection.

10. Fabricated stay-in-place metal forms may be used for concrete floor slabs at the Contractor's option when so noted on the plans.

11. Metal forms to remain in place for concrete floor slabs shall be fabricated from steel conforming to ASTM A466 (Grades A through E) having a coating class of G165.

12. The following criteria shall govern the design of permanent stay-in-place steel bridge deck forms:

a. The steel forms shall be designed on the basis of dead load of form, reinforcement, and plastic concrete plus 50 pounds per square foot for construction loads. The unit working stress in the steel sheet shall not be more than 0.725 of the specified minimum yield strength of the material furnished, but shall not exceed 36,000 pounds per square inch.

b. Deflection under the weight of the forms, the plastic concrete and reinforcement shall not exceed L/180 of the form span or 1/2 inch, whichever is less, but in no case shall this loading be less than 120 psf total.

c. The permissible form camber shall be based on the actual dead load condition. Camber shall not be used to compensate for deflection in excess of foregoing limits.

d. The design span of the form sheets shall be the clear span of the form plus 2 inches measured parallel to the form flutes.

e. Physical design properties shall be computed in accordance with requirements of the American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members, latest published edition.

f. All reinforcement shall have minimum concrete cover of 1 inch.

g. The plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck shall be maintained.

h. Permanent steel bridge deck form shall not be considered as lateral bracing for compression flanges of supporting structural members.

i. Permanent steel bridge deck form shall not be used in panels where longitudinal deck construction joints are located between stringers.

j. Welding shall not be permitted to flanges in tension or to structural steel bridge elements fabricated from nonweldable grades of steel.

J. Fabricator's shop and erection drawings shall be submitted to the Engineer for approval. These drawings shall indicate the material properties and grade of steel, the properties of geometric sections for all permanent steel bridge deck form sheets, and all locations where the forms are in the vicinity of steel beam flanges subject to tensile stresses.

K. Form Supports:

1. Form sheets shall not be permitted to rest directly on the top of the stringer or floor beam flanges.

2. Sheets shall be securely fastened to form supports and shall have a minimum bearing length of 1 inch at each end.

3. Form supports shall be placed in direct contact with the flange of stringer or floor beam.

4. All attachments shall be made by permissible welds, bolts, clips, or other approved means.

5. Welding of form supports to flanges of steel not considered weldable and to portions of flange subject to tensile stresses shall not be permitted.

6. Welding and welds shall be in accordance with the provisions of AWS D2.0 pertaining to fillet welds except that 1/8-inch fillet welds will be permitted.

L. Any permanently exposed form metal where the galvanized coating has been damaged shall be thoroughly cleaned, wire brushed, and painted with 2 coats of zinc oxide zinc dust primer, Federal Specification TT-P-641D, Type II, no color added, to the satisfaction of the Engineer. Minor heat discoloration in areas of welds need not be touched up.

M. Transverse construction joints shall be located at the bottom of the flute and 1/4-inch weep holes shall be field drilled at not more than 12 inches on center along the line of the joint.

N. Emphasis shall be placed on proper vibration of the concrete to avoid honeycomb and voids.

1. Pouring sequences, procedures, and mixes shall be approved by the Engineer.

2. Calcium chloride or any other admixture containing chloride salts shall not be used in the concrete placed on permanent steel bridge deck forms.

O. The Contractor's method of construction shall be carefully observed during all phases of the construction of the bridge deck slab.

1. These phases include installation of the metal forms; location and fastening of the reinforcement; composition of concrete items; mixing procedures, concrete placement, and vibration; and finishing of the bridge deck.
2. Should the Engineer determine that the procedures used during the placement of the concrete warrant inspection of the underside of the deck, the Contractor shall remove at least 1 section of the forms at a location and time selected by the Engineer for each span in the contract.
3. This should be done as soon after placing the concrete as practicable in order to provide visual evidence that the concrete mix and the Contractor's procedures are obtaining the desired results.
4. An additional section shall be removed if the Engineer determines that there has been any change in the concrete mix or procedures warranting additional inspection.

P. After the deck concrete has been in place for a minimum period of 2 days, the concrete shall be tested for soundness and bonding of the forms by sounding with a hammer as directed by the Engineer.

1. If areas of doubtful soundness are disclosed by this procedure, the Contractor will be required to remove the forms from such areas for visual inspection after the pour has attained adequate strength.
2. This removal of the permanent steel bridge deck forms shall be at no additional cost to the Contracting Agency.
3. At locations where sections of the forms are removed, the Contractor will not be required to replace the forms, but the adjacent metal forms and supports shall be repaired to present a neat appearance and ensure their satisfactory retention.
4. As soon as the form is removed, the concrete surfaces will be examined for cavities, honeycombing and other defects.
5. If irregularities are found, and it is determined by the Engineer that these irregularities do not justify rejection of the work, the concrete shall be repaired as the Engineer may direct and shall be given an Ordinary Surface Finish.
6. If the concrete where the form is removed is unsatisfactory, additional forms, as necessary, shall be removed to inspect and repair the slab, and the Contractor's methods of construction shall be modified as required to obtain satisfactory concrete in the slab.
7. All unsatisfactory concrete shall be removed or repaired as directed by the Engineer.

Q. The amount of sounding and form removal may be moderated, at the Engineer's discretion, after a substantial amount of slab has been constructed and inspected, if the Contractor's methods of construction and the results of the inspections as outlined above indicate that sound concrete is being obtained throughout the slabs.

502.03.03 FALSEWORK

A. Detailed plans of the falsework or centering shall be furnished by the Contractor to the Engineer in accordance with ***Subsection 105.02, "Plans and Working Drawings,"*** for

any structures having a clear cast-in-place span of 20 feet or over or any cast-in-place structure over traffic. If such plans are not satisfactory to the Engineer, the Contractor shall make such changes in the plans as may be required.

B. In addition to the detailed drawings of the falsework or centering which are to be furnished to the Engineer as specified herein, the Contractor shall also furnish the Engineer with a copy of falsework or centering design calculations.

C. All falsework or centering shall be designed and constructed to provide the necessary rigidity and to support the loads.

1. Falsework for the support of superstructures for box girder spans shall be designed to support the loads that would be superimposed were the entire superstructure poured at 1 time.

2. For designing falsework and centering, a weight of 150 pounds per cubic foot shall be assumed for green concrete (120 pounds for lightweight concrete) and an allowance of not less than 25 pounds per cubic foot for forms, live load, and impact.

3. Falsework or forms shall be constructed to produce in the finished structure the lines and grades indicated on the plans.

4. Suitable screw jacks or wedges in pairs shall be used in connection with falsework or centering to set the forms to grade or cambered as shown on the plans, or to take up any settlement in the form work either before or during the placing of concrete.

5. Excessive use of blocking and shims shall be cause for rejection of the falsework.

6. Falsework failures shall become the sole responsibility of the Contractor.

D. Immediately prior to placing bridge or slab concrete, the Contractor shall check all falsework and wedges or jacks and shall make all necessary adjustments.

1. Care shall be exercised to ensure that settlement and deflection due to the added weight of the deck or slab concrete will be minimal.

2. Suitable means such as telltales shall be provided by the Contractor to permit ready measurement of settlement and deflection as it occurs.

E. Falsework or centering shall be founded on a solid footing safe from undermining and protected from softening. Falsework which cannot be founded on a satisfactory footing shall be supported on piling which will be spaced, driven, and removed in a manner approved by the Engineer.

F. Arch span shall be removed uniformly and gradually beginning at the crown and working toward the spring, to permit the arch to take its load slowly and evenly. Centering for bridges having 2 or more adjacent arch spans will be struck simultaneously.

G. Falsework supporting the main carrying members of all continuous structures shall not be removed from any span until all spans between expansion joints are cured.

H. Falsework and forms left in place in the cells of box girders shall not exceed 12 pounds per square foot of deck. All supports between the top and bottom slabs in the cells of box girders shall be water soaked for a period of not less than 48 hours.

502.03.04 REINFORCEMENT

A. Reinforcing shall be furnished and placed as shown on the plans and in accordance with the applicable provisions of ***Section 505, "Reinforcing Steel,"*** of these specifications.

502.03.05 COFFERDAMS AND CRIBS

A. Cofferdams for foundation construction shall be carried well below the bottom of the footings and shall be well braced and as watertight as practical. The interior dimensions of cofferdams shall be such as to provide sufficient clearance for constructing forms and, when no seal is placed, to permit pumping outside the forms.

B. The Contractor shall submit for approval, drawings showing proposed method of construction of cofferdams or cribs in accordance with ***Subsection 105.02, "Plans and Working Drawings."***

1. Approval of such drawings shall in no way relieve the Contractor of Contractor's responsibility under the contract for the successful completion of the improvement.

2. Cofferdam construction shall not start before the submitted drawings are approved and returned.

C. After the completion of the substructure, the cofferdams with all sheeting and bracing shall be removed to 1 foot below the stream bed, by the Contractor, and such removal shall be performed in such a manner as not to disturb or mar the finished concrete foundation. Removal of cofferdams, sheeting, and bracing shall be considered subsidiary to other pay items of work and no further payment will be made therefor.

502.03.06 PUMPING WATER

A. Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete.

B. No pumping will be permitted during the placing of concrete or for a period of at least 24 hours thereafter, unless it be done from a suitable pump separated from the concrete work by a watertight wall or other effective means.

C. Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure.

502.03.07 MIXING CONCRETE

A. All concrete shall be mixed and proportioned as specified in ***Section 501, "Portland Cement Concrete."***

502.03.08 HANDLING AND PLACING CONCRETE

A. **General.** In preparation for the placing of concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from the interior of forms.

1. Struts, stays, and braces serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary.

2. These temporary members shall be entirely removed from the forms and not buried in the concrete.

B. No concrete shall be used which does not reach its final position in the forms within the time and temperature stipulated under ***Section 501, "Portland Cement Concrete."***

C. Surfaces on which concrete is to be placed shall be thoroughly moistened with water immediately before placing concrete.

D. Concrete shall be placed so as to avoid segregation of the material and the displacement of the reinforcement.

1. The use of long troughs, chutes, and pipes for conveying concrete from the mixer to the forms shall be permitted only on written authorization of the Engineer.

2. In case an inferior quality of concrete is produced by the use of such conveyors, the Engineer may order discontinuance of their use and the substitution of a satisfactory method of placing.

3. Open troughs and chutes shall be of metal or metal lined; where steep slopes are required, the chutes shall be equipped with baffles or be in short lengths that reverse the direction of movement.

4. All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run; water used for flushing shall be discharged clear of the structure.

E. When placing operations would involve dropping the concrete more than 5 feet, concrete shall be deposited through sheet metal or other approved pipes, except when placing concrete for thin vertical walls less than 15 inches thick, double belting may be used in lieu of adjustable pipes or elephant trunks.

1. As far as practicable, the pipes shall be kept full of concrete during placing and the lower ends of pipe shall be kept buried in the newly placed concrete.

2. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the projecting ends of reinforcement bars.

F. All concrete placed in concrete structures, except tremie seal concrete, shall be compacted by means of mechanical vibration subject to the following provisions:

1. The number of vibrators employed shall be ample to consolidate incoming concrete to a proper degree within 15 minutes after concrete is deposited in the forms. In all cases, at least 2 vibrators shall be available at the site of the structures in which more than 25 cubic yards is being placed.

2. The vibration shall be internal unless special authorization of other methods is given by the Engineer or as provided herein.

3. Vibrators shall be capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.

4. The intensity of vibration shall be such as to visibly affect a mass of concrete of 1-inch slump over a radius of at least 18 inches.

5. Vibrators shall be manipulated to thoroughly work the concrete around the reinforcement and imbedded fixtures and into the corners and angles of the forms.

6. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators shall be inserted and withdrawn out of the concrete slowly.

7. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued at any 1 point to the extent that localized areas of grout are formed.

8. Application of vibrators shall be at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibly effective.

9. Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration.

10. Vibration shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

11. Vibration shall be supplemented by such spading as is necessary to ensure smooth surfaces and dense concrete, along form surfaces and in corners and locations impossible to reach with the vibrators.

12. The provisions of this article shall apply to the filler concrete for steel grid floor except that the vibrator shall be applied to the steel.

G. Immediately following the discontinuance of placing concrete, all accumulations of mortar splashed upon the reinforcement steel and the surface of forms shall be removed.

1. Dried mortar chips and dust shall not be puddled into the unset concrete.

2. If the accumulations are not removed prior to the concrete becoming set, care shall be exercised not to injure or break the concrete-steel bond at and near the surface of the concrete while cleaning the reinforcement steel.

H. **Culverts.**

1. The base slab or footings of box culverts shall be placed and allowed to set before the remainder of the culvert is constructed. Suitable provisions shall be made for bonding the sidewalls to the culvert base.

2. Walls and top slab shall not be constructed as a monolith on box culverts where the depth of pour below the bottom of the top slab exceeds 4 feet unless approved in writing by the Engineer. When this method of construction is used, any necessary construction joints shall be vertical and at right angles to the axis of the culvert.

3. When walls are poured separately, in non-rigid frame box culverts, the concrete in the walls shall be placed and allowed to set a minimum of 2 hours before the top slab is placed.

4. When walls are poured separately, in rigid frame box culverts, the concrete in the walls shall be placed and allowed to set a minimum of 12 hours before the top slab is placed.

5. Each wing wall shall be constructed, if possible, as a monolith. Construction joints, where unavoidable, shall be horizontal and so located that no joint will be visible in the exposed face of the wing wall above the ground line.

I. **Girders, Slabs, and Columns.**

1. When the height of a web in a "T" beam is more than 3 feet, the top slab shall be poured independently.
2. When the distance from a construction joint to the top of the web in a box girder exceeds 3 feet, the top slab shall be poured independently.
3. Concrete in slab spans shall be placed in 1 continuous operation for each span unless otherwise specified.
4. Concrete in columns shall be placed in 1 continuous operation, unless otherwise specified. The concrete shall be allowed to set at least 12 hours before the succeeding pour is started.
5. Before pouring concrete for superstructure, the forms on base of columns shall be exposed sufficiently to determine the character of the concrete in the columns.

502.03.09 CONCRETE DEPOSITED UNDER WATER

A. If conditions render it impossible or inadvisable, in the opinion of the Engineer, to dewater excavation before placing concrete, the Contractor shall deposit under water, by means of a tremie or underwater bottom dump bucket, a seal course of concrete of sufficient thickness to thoroughly seal the cofferdam.

1. The concrete shall be carefully placed in a compact mass and shall not be disturbed after being deposited.
2. Still water shall be maintained at the point of deposit.

B. The use of an aluminum tremie for placing concrete is prohibited.

C. A tremie shall consist of a watertight tube having a diameter of not less than 10 inches with a hopper at the top.

1. The tube shall be equipped with a device that will prevent water from entering the tube while charging the tube with concrete.
2. The tremie shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering when necessary to retard or stop the flow of concrete.
3. The tremie shall be filled by a method that will prevent washing of the concrete.
4. The discharge end shall be completely submerged in concrete at all times and the tremie tube shall contain sufficient concrete to prevent any water entry.
5. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete.
6. The flow shall be continuous until the work is completed and the resulting concrete seal shall be monolithic and homogeneous.

D. The underwater bucket shall have an open top and the bottom doors shall open freely and outward when tripped.

1. The bucket shall be completely filled and slowly lowered to avoid backwash and shall not be dumped until it rests on the surface upon which the concrete is to be deposited.

2. After discharge, the bucket shall be raised slowly until well above the concrete.

E. Concrete deposited in water shall be in accordance with ***Section 501, "Portland Cement Concrete,"*** with 10 percent extra cement added.

1. The exact thickness of the seal will depend upon the hydrostatic head, bond, and spacing of piles, size of cofferdam, and other related factors, but in no case shall the seal be less than 2 feet in thickness, unless otherwise shown on the plans.

2. Before dewatering, the concrete in the seal shall be allowed to cure for not less than 5 days after placing.

F. If a seal which is to withstand hydrostatic pressure is placed in water having a temperature below 45 degrees F, the curing time before dewatering shall be increased.

1. Periods of time during which the temperature of the water has been continuously below 38 degrees F shall not be considered as curing time.

2. After sufficient time has elapsed to ensure adequate strength in the concrete seal, the cofferdam shall be dewatered and the top of the concrete cleaned of all scum, laitance, and sediment.

3. Before fresh concrete is deposited, local high spots shall be removed as necessary to provide proper clearance for reinforcing steel.

G. Groundwater may be encountered on this project. In such case, the Contractor will dewater the excavated area and subbase for the concrete structures improvements in such a manner that the concrete will not be placed in any standing water.

502.03.10 CONSTRUCTION JOINTS

A. Construction joints shall be made only where located on the plans or shown in the pouring schedule, unless otherwise approved by the Engineer.

B. Construction joints where the placing of concrete is delayed until the concrete has taken its initial set and for which no expansion is provided, shall be planned in advance and shall be subject to approval by the Engineer.

1. The placing of concrete shall be continuous from joint to joint.

2. These joints shall be perpendicular to the principal lines of stress and, in general, located at points of minimum shear.

3. Only joints shown on the plans will be permitted in a cantilevered member.

4. Horizontal joints at piers and abutments, except where specified, shall be avoided, and when used shall not be located within 2 feet of the normal water level.

C. Unless otherwise specified, construction joints shall be struck off but not troweled.

D. When making a horizontal construction joint, care shall be taken to have the concrete as dry as possible, and any excess water or creamy material shall be drawn off before the concrete sets. On all exposed surfaces, the line of the proposed joint shall be made

straight by placing a temporary straightedge on the inside of the form and pouring the concrete so that it will set flush with the edge as provided.

E. To avoid visible joints as far as possible upon exposed faces, the top surfaces of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather edge" might be produced at a construction joint, as in the slope top surface of a wing wall, an insert form block shall be used to produce a blocked out portion in the proceeding layer which shall produce an edge thickness of not less than 6 inches in the succeeding layer.

F. When the work is unexpectedly interrupted by breakdowns, storm, or other causes, and the concrete as placed would produce an improper construction joint, the Contractor shall either rearrange the freshly deposited concrete or continue by hand mixing, if necessary, until a suitable arrangement is made for a construction joint. When such a joint occurs at a section on which there is shearing stress, the Contractor shall provide adequate mechanical bond across the joint by inserting reinforcing steel or by some other means satisfactory to the Engineer, which will prevent a plane of weakness.

G. In resuming work, the surface of the concrete previously placed shall be thoroughly cleaned of dirt, scum, laitance, or other soft or porous materials by 1 of the following methods:

1. Concrete surface of fresh concrete (not more than 8 hours after placement) shall be cleaned with air and water jets in such a manner that the surface is thoroughly cleaned and the aggregate is not loosened.

2. Hardened concrete surface (more than 8 hours after placement) shall be cleaned by abrasive blast methods in such a manner that the aggregate is not loosened or the edges of the concrete shattered.

H. The surface of the joint shall be thoroughly washed with clean water and the forms tightened to close contact with the previously placed work, after which the concreting may proceed. The surface of the joint shall be wet just prior to placing new concrete.

502.03.11 REMOVAL OF FALSEWORK AND FORMS

A. **General.**

1. Methods of form removal likely to cause overstressing of the concrete shall not be used.

   a. Forms and their supports shall not be removed without the approval of the Engineer.

   b. Supports shall be removed in such a manner as to permit the concrete to uniformly and gradually take the stresses due to its own weight.

2. Compressive strengths will be determined by ASTM C39 and ASTM C31 and will be considered information tests only and not acceptance tests as described in ***Subsection 501.02.04, "Concrete Making Properties."***

3. Comply with ***Subsection 501.03.09, "Curing."***

B. **Falsework.**

1. Where stresses will be placed on the concrete, in arch centers, centering under beams and girders, and in floor slabs, falsework shall not be removed until the

concrete has reached an age of 10 days and it has reached 75 percent of the required 28-day compressive strength.

2. In the event of cold weather, the 10-day time requirements shall be increased 1 day for every day the curing time is increased as prescribed in ***Subsection 501.03.10.B, "Cold Weather — General."***

3. In case the concrete does not reach the desired strength within the time specified, the Engineer shall determine when the strength is adequate to allow removal of falsework.

4. Form removal and replacement with shoring will not be permitted.

C. **Forms.**

1. Forms on parapets and curbs shall not be removed until concrete has set sufficiently to prevent distorting or cracking.

2. Forms for columns, walls, side of beams, girders and all other parts that are not subjected to stress shall not be removed until the concrete has reached a minimum age of 40 hours unless authorized by the Engineer.

3. Forms that are subjected to stresses shall not be removed until the requirements of Subsection 502.03.11.B have been satisfied, unless otherwise approved by the Engineer.

502.03.12 EXPANSION AND FIXED JOINTS AND BEARINGS

A. All joints shall be constructed according to details shown on the plans and as specified in this subsection.

B. **Open Joints.**

1. Open joints shall be placed in the locations shown on the plans and shall be constructed by the insertion and subsequent removal of a wood strip, metal plate, or other approved material.

2. The insertion and removal of the template shall be accomplished without chipping or breaking the corners of the concrete.

3. Reinforcement shall not extend across an open joint unless so specified on the plans.

C. **Filled Joints.**

1. Poured expansion joints shall be constructed similar to open joints.

2. When premolded types are specified, the filler shall be placed in correct position before concrete is placed against the filler.

3. Holes and joints in the filler shall be filled with mastic to prevent the passage of mortar or concrete from 1 side of the joint to the other.

4. The edges of the concrete at the joint shall be edger finished.

D. **Steel Joints.**

1. The plates, angles, or other structural shapes shall be accurately shaped, at the shop, to conform to the section of the concrete floor.

2. The fabrication and painting shall conform to the requirements of these specifications covering those items.
3. When called for on the plans or in the Special Provisions, the materials shall be galvanized in lieu of painting.
4. Care shall be taken to ensure that the surface in the finished plane is true and free of warping.
5. Positive methods shall be employed in placing the joints to keep the joints in correct position during the placing of the concrete.
6. The opening at expansion joints shall be that designated on the plans at normal temperature, and care shall be taken to avoid impairment of the clearance in any manner.

E. **Waterstops.**

1. Waterstops shall be furnished and installed in accordance with the details shown on the plans.
2. The edge of the waterstop shall be supported in a manner satisfactory to the Engineer.
3. Waterstops shall be manufactured from either natural rubber, synthetic rubber, or polyvinyl chloride (PVC) at the option of the Contractor.
4. Waterstops shall be manufactured with an integral cross section which shall be uniform within ±1/8 inch in width, and the web thickness or bulb diameter, within +1/16 inch and -1/32 inch .
    a. No splices will be permitted in straight strips.
    b. Strips and special connection pieces shall be well cured in a manner such that any cross section shall be dense, homogeneous, and free from porosity.
    c. Junctions in the special connection pieces shall be fully molded.
    d. During the vulcanizing period, the joint shall be securely held by suitable clamps.
    e. The material at the splices shall be dense and homogeneous throughout the cross section.
5. Field splices for either natural or synthetic rubber waterstops shall be either vulcanized, mechanical, using stainless steel parts, or made with a rubber splicing union of the same stock as the waterstop, at the option of the Contractor. All finished splices shall have a full size tensile strength of 600x (width in inches) pounds.
6. Field splices for polyvinyl chloride waterstops shall be formed by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations.
    a. A thermostatically controlled electric source of heat shall be used to make all splices.
    b. The heat shall be sufficient to melt but not char the plastic.

7. Waterstops, when being installed, shall be cut and spliced at changes in direction as may be necessary to avoid buckling or distortion of the web or flange.

F. **Bearing Devices.**

1. Bearing plates, bars, rockers, assemblies, and other expansion or fixed devices shall be constructed in accordance with the details shown on the plans and shall be hot-dip galvanized after fabrication in accordance with ***Section 715, "Galvanizing."***

2. Structural steel and cast steel shall conform to the provisions in ***Section 506, "Steel Structures,"*** for those items.

3. The bearing plates shall be set level and the rockers or other expansion devices shall be set to conform to the temperature at the time of erection or to the setting specified.

4. When bearing assemblies or masonry plates are shown on the plans to be placed (not embedded) directly on concrete, the concreted bearing area shall be constructed slightly above grade and shall be finished by grinding or other approved means to a true level plane which shall not vary perceptibly from a straightedge placed in any direction across the area. The finished plane shall not vary more than 1/8 inch from the elevation shown on the plans.

5. When elastomeric bearing pads, elastic bearing pads, preformed fabric pads, or asbestos sheet packing are shown on the plans, the concrete surfaces on which pads or packing are to be placed shall be wood float finished to a level plane which shall not vary more than 1/16 inch from a straightedge placed in any direction across the area. The finished plane shall not vary more than 1/8 inch from the elevation shown on the plans.

6. Where bearing assemblies or masonry plates are shown on the plans to be placed on grout pads, they shall be placed in accordance with the provisions in ***Subsection 506.03.25, "Bearing and Anchorage."***

G. **Elastomeric Bearing Pads.**

1. Pads over 1 inch in thickness shall be laminated.

2. Laminated pads shall consist of alternate laminations of elastomer and metal or elastomer and fabric bonded together.

3. All elastomeric bearing pads shall be 50 durometer.

4. Pads shall be installed where designated on the plans.

502.03.13 CURING

A. Curing of formed concrete shall conform to the requirements of ***Subsection 501.03.09, "Curing."***

502.03.14 PATCHING

A. After removal of forms, all metal ties except those to be used to aid future forming shall be cut back and patched.

1. Honeycomb shall be removed and patched.

2. When honeycomb is determined by the Engineer to be excessive, the excessive honeycombing shall be sufficient cause for rejection of all or a part of the structure.

B. Loose or broken material shall be chipped away until a dense, uniform surface exposing solid coarse aggregate is obtained.

1. Feather edges shall be cut away to form a face perpendicular to the surface being patched.

2. All surfaces of the cavity shall be thoroughly saturated with water.

3. Contact surfaces shall be coated with an approved bonding agent.

4. Bonding agent may be mixed with mortar in lieu of coating the contact surfaces.

C. Patching mortar shall consist of 1 part cement and 3 parts sand.

1. White cement or other approved tinting materials shall be used on all surfaces where an "ordinary finish" is final.

2. For patching large or deep areas, coarse aggregate shall be added to the patching mortar.

D. The patching mortar shall be thoroughly tamped into place.

1. Mortar may be placed pneumatically when approved by the Engineer.

2. The surface of the mortar shall be floated with a wooden float before initial set takes place.

3. The patch shall present a neat and workmanlike appearance.

E. The patched surface shall be cured by 1 of the methods described in ***Subsection 501.03.09, "Curing."***

F. Patching is the only treatment required for those portions of the structure below ground.

502.03.15 FINISH OF HORIZONTAL SURFACES

A. Concrete bridge decks shall be struck off with a template immediately after pouring to provide the proper crown and shall be finished to a smooth even surface by means of both longitudinal and transverse wooden floats, or other suitable means.

1. When a transversely broomed finish is used, the allowable variations noted herein shall be independent of the depth of the broom marks.

2. No variations will be permitted that will tend to prevent complete drainage on all parts of the deck.

3. The surface shall be corrected by grinding off the high spots, or other approved method, as may be required to conform to these limits.

4. An edging tool shall be used at expansion joints and deck edges not armored.

B. Approach slabs to concrete bridges shall be finished to the tolerances specified for bridge decks.

C. Finishing Bridge Decks.

1. A smooth riding surface of uniform texture, true to the required grade and cross section, shall be obtained on all bridge roadway decks.

2. The Contractor may use hand tools, or finishing machines, or a combination of both, conforming to the requirements specified herein for finishing bridge roadway deck concrete.

3. Finishing of concrete placed in bridge decks shall consist of striking off the surface of the concrete as placed and floating with longitudinal floats the surface so struck off.

4. The placing of concrete in bridge roadway decks will not be permitted until the Engineer is satisfied that:

    a. The rate of producing and placing concrete will be sufficient to complete the proposed placing and finishing operations within the scheduled time.

    b. Experienced finishing machine operators and concrete finishers are employed to finish the deck.

    c. Fogging equipment and all necessary finishing tools and equipment are on hand at the site of the work and in satisfactory condition for use.

5. Finishing machines shall be set up sufficiently in advance of use to permit inspection by the Engineer during the daylight hours before each pour.

6. The adjustment and operation of deck finishing machines shall be verified by moving the machine over the full length of the deck section to be placed and traversing the float completely across all end bulkheads before placement of concrete is begun.

7. Unless adequate lighting facilities are provided by the Contractor, the placing of concrete in bridge decks shall cease at such time that finishing operations can be completed during daylight hours.

8. Rails for the support and operation of finishing machines and headers for hand-operated strike off devices shall be completely in place and firmly secured for the scheduled length for concrete placement before placing of concrete will be permitted.

    a. Rails for finishing machines shall extend beyond both ends of the scheduled length for concrete placement a sufficient distance that will permit the float of the finishing machine to fully clear the concrete to be placed.

    b. Rails or headers shall be adjustable for elevation and shall be set to elevations, with allowance for anticipated settlement, camber, and deflection of falsework, as required to obtain a bridge roadway deck true to the required grade and cross section.

    c. Rails or headers shall be of a type and shall be so installed that no springing or deflection will occur under the weight of the finishing equipment, and shall be so located that finishing equipment may operate without interruption over the entire bridge roadway deck being finished.

    d. Rails or headers shall be adjusted as necessary to correct for unanticipated settlement or deflection which may occur during finishing operations.

9. Should settlement or other unanticipated events occur, which in the opinion of the Engineer would prevent obtaining a bridge deck conforming to the requirements of

these specifications, placing of deck concrete shall be discontinued until corrective measures satisfactory to the Engineer are provided.

a. In the event satisfactory measures are not provided prior to initial set of the concrete in the affected area, the placing of concrete shall be discontinued and a bulkhead installed at the location determined by the Engineer.

b. All concrete in place ahead of the bulkhead shall be removed.

10. Unless otherwise permitted by the Engineer, bridge deck concrete shall be placed in a uniform heading approximately parallel to the bridge pier or bent caps. The rate of placing concrete shall be limited to that which can be finished before the beginning of initial set, except that concrete for the deck surface shall not be placed more than 10 feet ahead of strike-off.

11. After the concrete has been placed and consolidated, the surface of the concrete shall be carefully struck off by means of a hand-operated strike board operating on headers, or by a finishing machine operating on rails. A uniform deck surface true to the required grade and cross section shall be obtained.

12. Following strike off, the surface of the concrete shall be floated longitudinally.

a. In the event strike off is performed by means of a hand-operated strike board, 2 separate hand-operated float boards for longitudinal floating shall be provided.

b. The first float shall be placed in operation as soon as the condition of the concrete will permit and the second float shall be operated as far back of the first float as the workability of the concrete will permit.

13. In the event the strike off is performed with a finishing machine, longitudinal floating of the concrete shall be performed by means of a hand-operated float board or a finishing machine equipped with a longitudinal wooden float.

a. The longitudinal wooden float on the finishing machine shall have a length of not less than 8 feet nor more than 12 feet.

b. When both strike off and longitudinal floating are to be performed by finishing machines, 1 machine, with operator, shall be used for strike off and a second machine, with second operator, shall be used for longitudinal floating.

c. Longitudinal floating may be performed with the same finishing machine that is used for strike off provided that the length of deck unit being placed is not more than 30 feet and the strike off operation is completed for the deck unit before the condition of the concrete requires that longitudinal floating be started.

14. Finishing machines used for strike off having a wheel base 6 feet or less shall be followed by 2 separate hand-operated float boards for longitudinal floating. All the provisions in this section pertaining to hand-operated float boards shall apply to the 2 separate float boards for longitudinal floating.

15. Longitudinal floats, either hand-operated or machine-operated, shall be used with the long axis of the float parallel to the centerline of the bridge roadway.

a. The float shall be operated with a combined longitudinal and transverse motion planing off the high areas and floating the material removed into the low areas.

b. Each pass of the float shall lap the previous pass by 1/2 the length of the float.

c. Floating shall be continued until a smooth riding surface is obtained.

D. In advance of curing operations, the surface of the concrete shall be textured by brooming with a stiff bristled broom or by other suitable devices which will result in uniform scoring. Brooming shall be performed transversely from finishing bridges.

E. Hand-operated float boards shall be from 12 feet to 16 feet long, ribbed and trussed as necessary to provide a rigid float and shall be equipped with adjustable handles at each end.

1. The float shall be wood, not less than 1 inch thick and from 4 inches to 8 inches wide.

2. Adjusting screws spaced at not to exceed 24 inches on centers shall be provided between the float and the rib.

3. The float board shall be maintained true and free of twist.

F. Hand-operated float boards shall be operated from transverse finishing bridges.

1. The finishing bridges shall span completely the roadway area being floated and a sufficient number of finishing bridges shall be provided to permit operation of the floats without undue delay.

2. Not less than 2 transverse finishing bridges shall be provided when hand-operated float boards are used.

3. When a finishing machine is used for longitudinal floating, 1 finishing bridge equivalent to the transverse finishing bridge specified herein shall be furnished for use by the Engineer.

G. Finishing bridges shall be of rigid construction and shall be free of wobble and springing when used by the operators of longitudinal floats and shall be easily moved.

H. Fogging equipment furnished shall be capable of applying water to the concrete in the form of a fine fog mist in sufficient quantity to curb the effects of rapid evaporation of mixing water from the concrete on the deck. The fog mist shall be applied at the time and in the manner approved by the Engineer.

I. Immediately following completion of the deck finishing operations, the concrete in the deck shall be cured as specified in ***Subsection 501.03.09, "Curing."***

J. The finished surface of the concrete shall be tested by means of a straightedge 12 feet long.

1. The surface shall not vary more than 0.01 foot from the lower edge of the straightedge.

2. All high areas in the hardened surface in excess of 0.01 foot as indicated by testing shall be removed by abrasive means.

3. After grinding by abrasive means has been performed, the surface of the concrete shall not be smooth or polished, but shall have a surface texture satisfactory to the Engineer.

4. Ground areas shall be of uniform texture and shall present neat and approximately rectangular patterns.

K. Where the concrete of the bridge deck is to be covered by bituminous surfacing, earth, or other cover, 1 inch or more in thickness, the surface of the concrete shall not vary more than 0.03 feet from the lower edge of the 12-foot straightedge.

L. Bridge deck surfaces under the curbs, railings, and sidewalks shall be struck off to the same plane as the roadway and left undisturbed when future widening is shown on the plans.

M. The top and face of the finished parapet and curb shall be true and straight, and the top surface shall be of uniform width, free from humps, sags, or other irregularities. When a straightedge 12 feet long is laid on top of the face of the curb or on the face of the parapet, the surface shall not vary more than 1/8 inch from the theoretical grade or alignment in 12 feet, except that proper allowance shall be made for curves and camber.

N. Manual methods, other than specified in this subsection, or other machine methods for finishing bridge deck concrete may not be permitted, unless directed by Engineer.

502.03.16 FORMED SURFACES REQUIRING FINISHING

A. Structures requiring a "fine surface finish (F.S.F.)" will be noted on the plans.

B. All structures not requiring a fine surface finish shall be given an ordinary surface finish.

C. Only exposed surfaces of structures will require finishing (ordinary or fine).

D. Exposed surfaces are defined as follows:

1. Exterior vertical faces of slab spans, rigid frames, arches, and box girders.

2. The underside of overhanging slabs to point of junction of the supporting beams.

3. Vertical surfaces of piers, columns, bent caps, abutments, wing walls, and retaining walls which are exposed to view after all backfill and embankment is placed. Exposed surfaces in this case are considered to extend to 1 foot below finished grade.

4. The inside of culvert barrels over 4 feet in height for the same distance as the height of the opening when seen from a traveled way.

5. The underside of superstructures in urban areas.

502.03.17 ORDINARY SURFACE FINISH

A. The surface shall have all holes left by form ties and all other holes 1/4 inch or more in largest diameter repaired in accordance with ***Subsection 502.03.14, "Patching."*** The surface shall be true and even, free from stone pockets, depressions, or projections beyond the surface.

B. All fins and projections shall be knocked off or ground flush. Offsets greater than 1/8 inch shall be filled or tapered back to present a smooth appearance. A uniform color and appearance shall be obtained on all patched surfaces.

502.03.18 FINE SURFACE FINISH

A. Where it is indicated on the plans that a fine surface finish is required, the finish shall conform to the requirements for "Bonded Grout Finish" as specified below.

1. Before the finish is applied, the surface shall be true and even and free from stone pockets, depressions, or projections beyond the surface.
2. All fins and projections shall be knocked off or ground flush.
3. Offsets greater than 1/8 inch shall be filled or tapered back to present a smooth appearance.
4. All holes 1/4 inch or more in largest diameter shall be patched in accordance with ***Subsection 502.03.14, "Patching."***

B. **Bonded Grout Finish.**

1. This finish shall be an application of grout consisting of sand and other pigments and mineral fillers combined with a suitable binder.
   a. The sand shall pass a No. 30 sieve.
   b. The binder shall be either an epoxy, acrylic, vinyl, or phenolic resin.
   c. This mixture may be thinned by not more than 25 percent water by volume.
2. The finish shall be of such consistency and composition that it will provide a uniform appearance in color and texture when applied as specified below, and shall meet the requirements set forth in ***Section 727, "Concrete Surface Finishing Material."***
3. At least 30 days in advance of placing bonded grout finish, the Contractor shall furnish the Engineer a quart sample or larger, of the complete mixture for testing.
   a. The Contractor shall also furnish 2 certificates, issued by the manufacturer, certifying that the product complies with the specifications.
   b. The certificates shall be delivered to the Engineer at least 30 days in advance of placing the material.
4. The grout shall be applied by spray, using conventional spray equipment with a 1/4-inch round spray head.
   a. Material shall be supplied by either a surge pump with a 12-to-1 ratio or an auger type pump, with air pressure sufficient to achieve uniform texture.
   b. Worn spray heads shall be replaced as required to achieve a uniform finish.
5. Application shall be at the rate of 25-40 square feet per gallon.
6. The finish surface shall present a uniform appearance.
7. Color of fine surface finish to be applied will be shown on the plans. Where the color of the fine surface finish that is to be applied is not indicated on the plans, it

shall conform to Federal Color No. 37875 as shown in Table I of Federal Standard No. 595.

8. Surfaces of concrete shall be thoroughly cleaned just before applying fine surface finish. This may be accomplished by:

   a. Application of a 10 percent solution of muriatic acid or a 25 percent zinc sulfate solution, which shall be applied to completely remove oily film and to lightly etch the surface, or

   b. Thorough cleaning by an approved abrasive as required to remove all oily film.

9. Following cleaning, the surface shall be thoroughly rinsed with clean water. Surface to be finished need not be completely dry, but may be damp, prior to application of finish.

10. **CAUTION:** Do not apply finish unless temperature is at least 40 degrees F and is rising. Application shall be stopped if temperature is 40 degrees F and is dropping.

502.03.19 LIVE LOADS

A. Live loads such as traffic or superimposed earth loads shall not be allowed on the structure until concrete has reached an age of 14 days and has reached the 28-day compressive strength required.

B. Live loads may be allowed on the structure, with the approval of the Engineer, when the concrete has reached an age of 8 days and/or the 28-day compressive strength required in cases where the use of a special high-early strength concrete mix design has been approved.

C. Approach slabs shall be treated as concrete paving under ***Section 409, "Portland Cement Concrete Pavement."***

D. In the event of cold weather, the above specified time requirement shall be increased 1 day for every day the curing time is increased as prescribed in the ***Subsection 501.03.10.B, "Cold Weather — General."***

E. In case the concrete does not reach the desired strength within the time specified, the Engineer shall determine when the strength is adequate to carry live loads.

502.03.70 TEMPORARY HEAD WALL

A. The Contractor may utilize the temporary head walls for support of the required travel lane(s) and/or work areas adjacent to open excavation. If the Contractor chooses to utilize temporary head walls, the Contractor shall provide the Engineer with design plans and calculations for such head walls and/or supports. The design plans shall be in detail, showing all information as required by the Engineer, and shall bear the seal of a Nevada Registered Engineer.

END OF SECTION 502

SECTION 505 – REINFORCING STEEL

DESCRIPTION

505.01.01 GENERAL

A. This work shall consist of furnishing and placing reinforcing steel and mesh reinforcing in accordance with ACI 318 Chapter 7 and ACI 315 with the additions or exceptions listed below.

MATERIALS

505.02.01 GENERAL

A. Materials shall conform to the requirements specified in the following subsections:

Materials	Subsection
Fabricated Steel Bar or Rod Mats Reinforcement	***713.03.02***
Bar Steel Reinforcement	***713.03.01***
Welded Steel Wire Fabric Reinforcement	***713.03.03***

B. Bar steel reinforcement shall be Grade 60 bar steel reinforcement unless otherwise specified on the plans.

C. Spiral Reinforcement may be either Bar Steel Reinforcement or Steel Wire, of the equivalent size of the bar steel.

D. Epoxy coatings for steel reinforcing bars shall conform to ASTM D3963. Epoxy coatings listed in the NDOT QPL, found on the web at http://www.nevadadot.com, shall be used.

E. Tie wire shall be commercial quality 16 gage minimum, black annealed soft iron wire, unless otherwise approved. Tie wires used on epoxy coated reinforcing steel shall be coated with plastic or an equal type coating as approved.

F. At selected locations as indicated on the Contract Drawings, reinforcing steel shall be galvanized (zinc coated), in accordance with ASTM A767 or epoxy-coated.

G. At the expansion joint locations shown on the Contract Drawings or as directed by the Engineer, reinforcing steel shall be sprayed, coating the entire circumference of the bar, with a zinc-rich formulation conforming to ASTM A767.

505.02.02 SAMPLES

A. One extra bar of each diameter shall be furnished for each 100 tons or fraction thereof.

1. This bar shall be selected from the longest bar of each size so that the bar, or a portion of it, can be used to replace any bar of that diameter that is selected to be used as a field sample.

2. Supplied field sample shall be of sufficient length to provide two 30-inch samples of each diameter.

3. The extra bars shall be indicated on the fabricator's details.

505.02.03 SPECIFICATIONS FOR COATING REINFORCING STEEL

A. Coating of reinforcing steel shall conform to AASHTO M284.

4. The coating fabricator for epoxy coated reinforcing steel shall be certified by the Concrete Reinforcing Steel Institute's Certification Program for Fusion Bonded Epoxy Coating Applicator Plants.

5. A copy of the Epoxy Coating Certification along with notification starting date of coating application shall be submitted.

H. Notification shall be given of the date and location of the coating operation, in writing, at least 10 days before the planned date for beginning the coating operation.

1. The Engineer shall be allowed free access to plant of the coating applicator for inspection.

2. If the representative so elects, preparation, coating, and curing of the bars shall be performed in the representative's presence.

I. Patching or repair material that is in compliance with AASHTO M284 shall be made available from the coating manufacturer.

CONSTRUCTION

505.03.01 REINFORCING STEEL LIST

A. In accordance with ACI 315, before placing reinforcing steel, the Contractor shall submit shop drawing details and furnish 2 copies of a list of all reinforcing steel showing sizes, lengths, and numbers of pieces and bends required to the Engineer at the site for Engineer's use in administering the contract.

1. Furnishing such lists to the Engineer shall not be construed to mean that the lists will be reviewed for accuracy.

2. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing all bar reinforcing steel in accordance with the details shown on the plans and as specified.

505.03.02 PROTECTION OF MATERIALS

A. Reinforcing steel shall be protected at all times from damage.

J. When placed in the work, the reinforcing steel shall be free from dirt, detrimental scale, paint, oil, or other foreign substance.

K. However, when steel has on its surface loose mill scale or dust that is easily removable, it may be cleaned by a satisfactory method, if approved by the Engineer.

505.03.03 BENDING

A. Bent bar reinforcement shall be cold bent to the shape shown on the plans.

L. Unless otherwise provided on the plans or by authorization, bends shall be made in accordance with the ACI Manual of Standard Practice for Detailing Reinforced Concrete Structures.

505.03.04 PLACING AND FASTENING

A. In accordance with ACI 315, all bar reinforcement shall be accurately placed in the positions shown on the plans and firmly held during the placing and setting of concrete.

M. When the spacing of bars exceeds 1 foot in either direction, all intersections shall be tied.

N. Distances from the vertical and horizontal forms shall be maintained by means of stays, blocks, ties, hangers, or other approved supports.

1. Blocks used for holding reinforcing bars from contact with the forms or between layers of bars shall be precast mortar blocks of approved shape and dimensions and shall have a compressive strength of not less than 3,000 psi.

2. Metal chairs that are in contact with the exterior surface of the concrete shall be fabricated of galvanized steel, or have the steel tips plastic coated to at least 3/4 inch into the concrete, or be of stainless steel conforming to the requirements of ASTM A493, Type 430.

3. The use of pebbles, pieces of broken stone or brick, metal pipe, and wooden blocks will not be permitted.

O. Reinforcement in any member shall be placed, and then inspected and approved by the Engineer, before the placing of concrete begins. Concrete placed in violation of this provision may be rejected and its removal required.

P. If mesh reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.

505.03.05 SPLICING

A. In accordance with ACI 315, all reinforcement bars shall be furnished in the full lengths indicated on the plans.

Q. Splicing of bars, except where shown on the plans, will not be permitted without the written approval of the Engineer.

1. Splices shall be staggered as far as possible.

2. Unless otherwise shown on the plans, bars near the top of beams and girders having more than 12 inches of concrete under the bar shall be lapped 35 diameters and all other bars shall be lapped 20 diameters to make the splice.

3. In lapped splices, the bars shall be placed in contact and wired together.

R. Welding of reinforcing steel shall be done only if detailed on the plans or authorized by the Engineer in writing. Welding shall conform to the specifications for Welded Highway and Railway Bridges of the American Welding Society.

S. Lapped splices in reinforcement shall not be used for sizes larger than No. 11.

T. Tensile reinforcement shall preferably not be spliced at points of maximum stress. The length of lap for deformed bars shall not be less than 24 and 36 bar diameters for Grade 40 and Grade 60, respectively, nor less than 12 inches.

U. Where lapped splices are used in reinforcement in which the critical design stress is compressive and with concrete having a strength of 3,000 psi or more, the length of lap for deformed bars shall be 20 bar and 24 bar diameters for Grade 40 and Grade 60,

respectively, but not less than 12 inches. When the specified concrete strengths are less than 3,000 psi, the amount of lap shall be 1/3 greater than the values given above.

V. Splices in spiral steel shall be made by welding or a lap of 1-1/2 turns.

W. Sheets of mesh reinforcement shall overlap each other sufficiently to maintain a uniform strength and shall be securely fastened at the ends and edges. The edge lap shall not be less than 1 mesh in width.

505.03.06 SUBSTITUTIONS

A. Substitution of different size bars will be permitted only with specific authorization by the Engineer.

X. The bars substituted shall have an area equivalent to the design area or larger.

END OF SECTION 505

SECTION 506 – STEEL STRUCTURES

DESCRIPTION

506.01.01 GENERAL

A. This work shall consist of furnishing, fabricating, casting, machining, or otherwise preparing, transporting, erecting, and painting structural steel, rivet and eye bar steel, steel forgings, casting, and any other metal of the type, shape, dimensions, and quality, required by these specifications or as shown on the plans.

MATERIALS

506.02.01 GENERAL

A. Materials shall meet the pertinent requirements of the following sections:

Materials	Section
Structural and Eyebar Steel	***710***
Aluminum for Bridge Rail	***711***
Miscellaneous Metal	***712***
Paint and Pavement Markings	***714***
Galvanizing	***715***
Elastomeric Bearing Pads	***725***

B. Turned bolts shall meet the material specifications set forth for Structural Rivet Steel. Anchor bolts, nuts, and washers shall be of structural steel, galvanized in accordance with ASTM A153. Bolts for fastening tubes to the rail posts sockets shall be stainless steel.

C. Steel bridge and pedestrian railing shall be primed and painted in accordance with ***Subsection 714.03.01, "Iron and Steel Use Items Classifications."***

D. Bridge or pedestrian rail and posts made of aluminum shall not be painted.

E. Shims shall be either aluminum alloy or asbestos sheet packing, at the Contractor's option.

1. Aluminum Alloy Shims shall conform to ASTM B209, Alloy 1100-0.
2. Asbestos sheet packing shall be composed essentially of asbestos fibers bonded together with a cementing medium rendering it tough and pliable.
3. The deformation of the packing under a load of 10,000 pounds per square inch shall be less than 16 percent of the thickness and the loss on ignition shall not be more than 25 percent.

F. Insulating material for insulating the base of aluminum rail posts from concrete and from steel anchor bolts shall be an aluminum impregnated light colored caulking compound of the consistency of putty.

G. Shims for steel railing shall be galvanized steel plates.

H. All bolts, nuts, and washers shall be either steel galvanized in accordance with ASTM A153; stainless steel conforming to ASTM A276; or steel cadmium plated in accordance with ASTM B766, Type TS.

CONSTRUCTION

506.03.01 SHOP DRAWINGS

A. Shop drawings shall consist of shop detail, erection, and other working drawings showing dimensions, size of material, details, and other information necessary for the complete fabrication and erection of the metal work.

1. The drawings shall be prepared on sheets 24 inches by 36 inches.
2. Eetails shall be drawn so that the prints will be clear and legible.

B. Unless otherwise requested, the Contractor shall submit to the Engineer, for approval, 3 sets of drawings.

1. The Engineer reserves the right to refuse prints of shop drawings which are not clear and legible.
2. Upon approval, the Contractor shall furnish the Engineer with the number of sets of shop drawings requested.
3. All shop plans shall be submitted for approval at least 15 days before fabrication is started and no material shall be fabricated until the plans have been finally approved by the Engineer.

C. After approval, there shall be no deviation from the shop drawings or changes made thereon without the prior approval of the Engineer.

D. Approval of shop drawings shall be understood to be an acceptance of the character and sufficiency of the details and not a check of any dimensions. Checking shop drawings is intended as a means of facilitating the work and avoiding errors, but it is expressly understood that it will not relieve the Contractor from the responsibility for errors or omissions on the shop drawings.

E. The contract price shall include the cost of furnishing all shop drawings and the Contractor will be allowed no extra compensation for shop drawings.

506.03.02 NOTICE OF BEGINNING WORK

A. The Contractor shall give the Engineer ample notice of manufacturing of material at the mill so that inspection may be provided. "Mill" means any rolling mill or foundry where material for the work is to be manufactured.

B. No material shall be manufactured or fabrication begun without authorization by the Engineer.

C. The Engineer may inspect the material, as provided for in ASTM A6, at Engineer's option.

D. Material not inspected at the place of manufacture shall be subject to inspection as provided for in ***Subsection 506.03.03, "Inspection and Testing."***

E. Prior to the beginning of fabrication, a 15-day written notice shall be provided by the Contractor to the Engineer.

F. Any purchase of material prior to inspection at the mill or fabrication of any work without authorization from the Engineer shall be at the Contractor's risk.

506.03.03 INSPECTION AND TESTING

A. The Engineer will examine and test as necessary all material before fabrication.

1. Adequate facilities and free access to the necessary work areas will be provided to the Engineer by the manufacturer and fabricator.
2. Required test samples will be furnished free of charge.
3. Material not inspected at the place of manufacture shall be subject to all chemical, physical, and workmanship requirements established for the material supplied.
4. Materials or workmanship not in conformity with the specified product may be rejected.

B. The Engineer may inspect and test all material by any visual, destructive, or non-destructive method to evaluate the material for its specified properties.

1. Mill orders and certificates, showing test values obtained, shall be furnished in triplicate to the Engineer.
2. All certified test values shall include physical and chemical results and steel making process used.
3. Test samples will be obtained from all steel not identified by mill heat numbers.
4. Acceptance of any material at the mill or fabrication shop prior to incorporation shall not prevent the rejection of the material or finished member if defects are discovered during the fabrication process.

C. Inspection in the fabrication shop is intended as a means of facilitating the work and avoiding errors as far as possible.

1. It is expressly understood that shop inspection does not relieve the Contractor from responsibility for material or fabrication defects or errors and the necessity for replacement or correction of rejected materials and workmanship.

D. Shop inspection of rail pipe and tubes will, in most cases, be waived and the Contractor permitted to ship subject to inspection at the project site.

1. The field inspection will cover the general appearance, size, thickness, etc., of the pipe and tubing.
2. Conformance of chemical and mechanical properties to requirements of the specifications will also be considered before the material is approved.
3. Shop inspection of rail posts will be made on the first few rail post castings furnished for each project in order to establish a satisfactory class of finish and workmanship.
4. When shop inspection is waived on a portion of the handrail posts for a project, a careful inspection will be made in the field to determine the acceptability of these posts on the basis of the finish and workmanship as compared to that of the other posts previously inspected and approved.

E. Fabrication of aluminum alloy material shall, in general, conform to or be equivalent to fabrication methods and practices recommended in the handbook of the major producers of aluminum materials and specifically the following requirements:

1. Material shall be sawed, routed, or milled.

2. Flame cutting is not permissible.

3. Tubing may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 15 minutes to facilitate bending.

4. Holes in pipe tubing shall be drilled. Holes in castings shall be cored and reamed, or drilled from the solid. Seats for pipe shall be finished smooth.

F. The fabrication and handling of aluminum materials in the shop and field shall be performed in a manner to prevent scoring or marring of the surfaces.

1. An objectionable appearance resulting from such scoring or marring shall be cause for rejection of the material.

2. Sleeves and rails shall be fabricated in lengths indicated on the plans.

G. The finishing of rail posts shall be performed after fabrication is completed. All fins, pipes, and other casting irregularities and all drilling, reaming, and other fabrication marks shall be removed.

506.03.04 STORAGE

A. The loading, transporting, unloading, storing, and handling of structural steel shall be conducted so that the metal will be kept clean and free from injury.

1. When unloaded, the material shall be placed on skids above the ground.

2. All material for the project shall be stored separate from "in stock" materials.

3. Girders and beams shall be placed upright and shored.

4. Long members, such as columns and chords, shall be supported on skids placed near enough together to prevent injury from deflections.

B. Different grades and classifications of material shall be color coded, as provided for in ASTM A6. This color code shall be transferred throughout fabrication.

C. If the contract covering the erection of the steel does not include the fabrication, the Contractor shall check the material received by Contractor and report promptly, in writing to the Engineer, any shortage or injury discovered.

506.03.05 STRAIGHTENING

A. Rolled material before being laid out or worked shall be straight. Subassemblies and completed members shall be straight before being incorporated into the work.

B. If straightening is necessary, it shall be done by methods acceptable to the Engineer. Details of methods proposed for straightening shall be submitted in writing to the Engineer prior to their use.

C. After straightening, evidence of fracture or other damage will be cause for rejection of the material.

D. Dimensional tolerances and repairs of surface irregularities described in ASTM A6 shall govern for the acceptance of repaired material.

506.03.06 SUBPUNCHING, DRILLING, AND REAMING

A. Unless otherwise specified, rivet holes and connections and splices (shop and field) of main truss or arch members, continuous beams, plate girders and rigid frames and rivet holes in plate girder flanges, and stiffeners, intermediate stiffeners intended as supports for concentrated loads, and web splices shall either be subpunched (or subdrilled) and reamed while shop assembled or drilled to full size from the solid while assembled at the shop.

B. The assembly, including camber, alignment, accuracy of holes and mill joints, shall be approved by the Engineer before reaming is commenced.

C. Unless otherwise specified, each individual (full length) truss, arch, continuous beam, or girder shall be assembled at the shop before reaming or drilling is commenced. During shop assembly, all members shall be supported at such intervals and in such manner as is necessary to avoid undesirable deflections.

D. All holes for floor beams and stringer field end connections shall be subpunched and reamed to a steel template.

506.03.07 BOLTS AND BOLTED CONNECTIONS

A. **Bolted Connections:**

1. Bolted connections shall not be used unless called for in the contract documents.
2. Where bolted connections are permitted, the bolts furnished shall be as hereinafter specified.
    a. Ribbed high-tensile strength bolts or high-tensile strength bolts may be substituted for field rivets in locations where, in the opinion of the Engineer, it is impractical to drive rivets.
    b. Bolts shall be of such length that they will extend entirely through the nut, but not more than 3/8 inch beyond.
    c. The Contractor shall furnish sufficient bolts of each type for each size and length to bolt such connections as called for with an ample surplus to replace bolts lost or rejected.
3. The holes, except holes in end diaphragms, shall be truly cylindrical.
    a. Holes shall be at right angles to the surface of the metal so that both head and nut will bear squarely against the metal.
    b. Bolts shall be driven accurately into the holes without damaging the thread.
    c. A snap shall be used to prevent damaging the heads.
4. Bolt holes in end diaphragms shall be slotted 1/2 inch in addition to the dimensions shown on the plans, in the direction to facilitate erection. At all locations where such slotted bolt holes are required, circular washers shall be placed on each side of the bolted connection, and the necessary bolt length adjusted accordingly.
5. Bolts in end diaphragms to girder connections shall not be tightened until the deck pour has been completed.

6. All bolted connections shall be fastened with high-tensile strength bolts or ribbed high-tensile strength bolts. The use of unfinished bolts or plain ribbed bolts will not be permitted.

B. **High-Tensile Strength Bolts.** The use of high strength bolts in structural connections shall comply with Article 2.10.20, "Construction Using High Strength Bolts," of the current AASHTO Standard Specifications for Highway Bridges.

506.03.08 SHOP ASSEMBLY

A. Shop assembly of trusses, arches, continuous beams, continuous plate girders, plate girders, and rigid frames shall be according to ***Subsection 506.03.06, "Subpunching, Drilling, and Reaming."*** All members shall be match marked before being disassembled.

B. Complete shop assembly of an entire structure, including floor system, which may be necessary in the case of complicated design or of skewed or super-elevated structure shall be done only if required by the Special Provisions.

1. The several component parts of a built-up member shall be straight and close fitting.
2. Surfaces of metal in contact shall be cleaned before assembling.
3. The parts of a member shall be assembled, well pinned, and firmly drawn together with bolts before drilling, reaming, or riveting is commenced.
4. Assembled pieces shall be taken apart, if necessary, for the removal of burrs and shavings produced by the operations.
5. The member shall be free from twists, bends, and other deformations.
6. End connections, angles, stiffener angles, and similar parts shall be carefully adjusted to correct positions and bolted, clamped, or otherwise firmly held in place until riveted.

C. The drifting done during assembling shall be such as to bring the parts into position, and not sufficient to enlarge the holes or distort the metal. If any holes must be enlarged to admit the rivets, they shall be reamed.

D. Parts not completely riveted in the shop shall be secured by bolts insofar as practicable to prevent damage in shipment and handling.

E. Connecting parts assembled in the shop for the purpose of reaming holes in field connections shall be match marked, and a diagram showing such marks shall be furnished to the Engineer.

506.03.09 EDGE PLANING

A. Sheared edges of plates more than 5/8 inch in thickness and carrying calculated stress shall be planed to a depth of 1/4 inch.

B. Re-entrant cuts shall be filleted to a radius of 3/4 inch.

506.03.10 FACING OF BEARING SURFACES

A. The surface finish of bearing and base plates and other bearing surfaces that are to come in contact with each other or with concrete shall meet the American Standards Association

surface roughness requirements as defined in ASA B46.1-55, Surface Roughness, Waviness and Lay, Part 1:

Steel Slabs	ASA 2,000
Heavy Plates in Contact in Shoes to be Welded	ASA 1,000
Milled Ends of Compression Members, Stiffeners, and Fillers	ASA 500
Bridge Rollers and Rockers	ASA 250
Pins and Pin Holes	ASA 125
Sliding Bearings	ASA 125

B. Surfaces of bronze bearing plates intended for sliding contact shall be planed parallel to the movement of the spans and polished.

506.03.11 ABUTTING JOINTS

A. Abutting joints in compression members of trusses and in columns shall be milled.

B. Opening and abutting joints in tension members shall not exceed 1/4 inch.

C. Abutting joints of continuous I-beam spans shall be square and tight-fitting.

D. Abutting joints in top and bottom flanges of plate girders shall be square and tight-fitting.

506.03.12 FLAME CUTTING

A. Preparation of material for flame cutting shall be in accordance with the provisions of AWS D2.0, Paragraph 302.

506.03.13 END CONNECTION ANGLES

A. Floor beams, stringers, and girders having end connection angles shall be built to exact length shown on the plans measured between the heels of the connection angles, with a permissible tolerance of minus 1/16 inch.

B. Where continuity is required, end connections shall be faced.

C. The thickness of the connection angles shall not be less than 3/8 inch, nor less than that shown on the detail drawings.

506.03.14 LACING BARS

A. The ends of lacing bars shall be neatly rounded unless another form is required.

506.03.15 WEB PLATES

A. In girders having no cover plates and not to be encased in concrete, the top edge of the web plate shall not extend above the backs of the flange angles and shall not be more than 1/8 inch below at any point.

1. Any portion of the plate projecting beyond the angles shall be chipped flush with the backs of the angles.

2. Web plates or girders having cover plates may be 1/2 inch less in width than the distance back to back of flange angles.

B. Splices in webs of girders without cover plates shall be sealed on top by welding.

C. At web splices, the clearance between the ends of the web plates shall not exceed 3/8 inch. The clearance at the top and bottom ends of web splice plates shall not exceed 1/4 inch.

506.03.16 STUD SHEAR CONNECTORS

A. Stud shear connectors shall be of a design suitable for end welding and shall be end welded to steel beams, girders, or plates with automatically timed stud welding equipment.

1. The type, size or diameter, placement pattern, and length of stud shall be as specified in the contract documents. (See Figure No. 1, below, for allowable tolerances or dimensions).
2. A maximum variation of 1 inch from the location shown will be accepted provided the adjacent studs are not closer than 2-1/2 inches center to center.
3. The clear distance between the edge of a girder flange and the edge of the shear connectors shall be not less than 1 inch.
4. Fillet welds varying in size from 3/16 inch to 5/16 inch are satisfactory provided the studs pass all other tests required.
5. Adequate provision shall be made in fabrication of structural members to compensate for loss of camber due to welding of the shear connectors.

B. Studs shall not be painted or galvanized.

1. The studs shall be free from rust, scale, rust pits, and oil at the time of welding and immediately before the concrete is placed.
2. The beam surface to which the studs are welded shall be free from excessive mill scale, rust, dirt, paint, grease, or any other material which might impair the quality of the weld.
3. When necessary to obtain satisfactory welds, the areas on the beam, girder, or plate to which the studs are to be welded shall be wire-brushed, peened, prick-punched, or ground free of scale or rust.

C. The Contractor shall submit to the Engineer for approval before installation, information on the studs to be furnished as follows:

1. The name of the manufacturer.
2. A detailed description of the stud and arc shield.
3. A certification from the manufacturer that the stud is qualified as specified in AWS D2.0. The certification must also indicate the heat from which the studs were manufactured.

D. Welding specifications and procedure requirements shall conform to AWS D2.0.

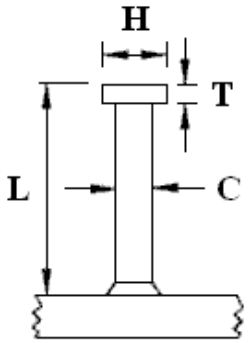
STEEL STRUCTURES	STANDARD DIMENSIONS			
	C	L*	H	T
	3/4" +0.000" –0.010"	4" +0.062" –0.125"	1-1/4" ±1/64"	3/8" minimum
	7/8" +0.000" –0.010"	4" +0.062" –0.125"	1-3/8" ±1/64"	3/8" minimum
	*NOTE: 4" length is standard. Other lengths may be obtained by special order.			

Figure 1. DIMENSIONS AND TOLERANCES

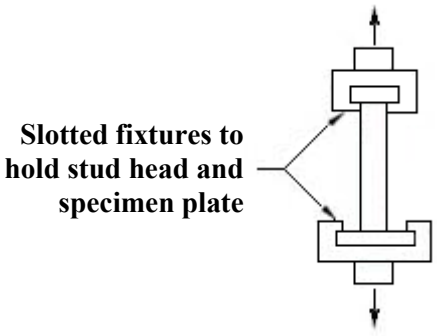


Figure 2. TYPICAL TENSILE TEST FIXTURE

506.03.17 WELDING

A. Welding of steel structures when authorized in accordance with the provisions contained herein, called for in the contract documents, or upon written permission from the Engineer shall conform to the most recent edition of the American Welding Society's *Bridge Welding Code*, except as modified in this subsection.

B. All welding shall be performed in the fabrication shop, except as otherwise noted on the plans or permitted by the Engineer.

C. **Inspection and Testing of Shop Welds:**

1. **Radiographic Inspection:**

   a. The procedure, techniques, and standards of acceptance shall be in conformance with the current AWS D2.0 Specifications.

   b. The Engineer will make all final interpretations of weld defects and film quality.

   c. All radiographs will be the property of the Contracting Agency during and after completion of the project.

2. **Ultrasonic Inspection.** The procedure, techniques, and standards of acceptance shall be in conformance with the current AWS D2.0 Specifications except as modified in this subsection.

3. **Magnetic Particle Inspection.** This procedure and technique shall be in conformance with ASTM E709, "Standard Guide for Magnetic Particle Testing."

D. **Inspection and Testing of Field Welds:**

1. The Contracting Agency will make magnetic particle inspections, ultrasonic inspections, or radiographic inspections of field welds when so required by the plans or the Special Provisions.

2. The acceptability of welds will be judged in accordance with the Inspection and Testing of Shop Welds for the type of inspection employed.

E. Welds shall be painted according to the applicable provisions of ***Section 614, "Painting."***

F. All groove welds on primary members shall be finished smooth and flush with the base metal on all surfaces by grinding in the direction of applied stress, leaving surfaces free from depressions. Chipping may be used provided it is followed by such grinding.

506.03.18 FIT OF STIFFENERS

A. End stiffeners of girders and stiffeners intended as supports for concentrated loads shall be milled or ground to secure an even bearing against the flange.

1. Intermediate stiffeners shall fit sufficiently tight to exclude water after being painted.

2. Fillers under stiffeners shall fit within 1/4 inch at each end.

B. Welding will be permitted in lieu of milling or grinding if noted in the contract documents. Where stiffeners are required on 1 side of the web only, they shall be welded to the compression flange.

506.03.19 ANNEALING AND STRESS RELIEVING

A. Members such as bridges shoes, pedestals, or other parts which are built up by welding sections of plate together, and stress relieving is called for in the contract documents, stress relieving shall be in accordance with the provisions of the American Welding Society.

506.03.20 PINS AND PIN HOLES

A. Rollers shall be of structural carbon steel, and pins shall be carbon steel forgings meeting the requirements of ***Subsection 710.03.08, "Pins and Rollers."***

1. Pins and rollers shall be accurately turned to the dimensions shown on the drawings and shall be straight, smooth, and free from flaws.

2. Final surface shall be produced by a finishing cut.

B. In pins larger than 9 inches in diameter, a hole not less than 2 inches in diameter shall be bored full length along the axis after the forging has been cooled to a temperature below the critical range under suitable conditions to prevent injury by too rapid cooling, and before being annealed.

C. Pin holes shall be bored true to the specified diameter, smooth and straight, at right angles with the axis of the member, and parallel with each other unless otherwise specified.

D. The distance outside to outside of holes in tension members and inside to inside of holes in compression members shall not vary from that specified more than 1/32 inch. Boring of holes in built-up members shall be done after the assembly is completed.

E. The diameter of the pin hole shall not exceed that of the pin by more than 1/50 inch for pins 5 inches or less in diameter, or more than 1/32 inch for larger pins.

F. Screw threads for all bolts and pins for structural steel construction shall conform to the American National Coarse Thread Series, Class 2, free fit, except that pin ends having a diameter of 1-3/8 inches or more shall be threaded 6 threads to the inch.

G. Pilot and driving nuts shall be used in driving pins.

1. They shall be furnished by the Contractor without charge.
2. Two pilot nuts and 2 driving nuts for each size of pin shall be furnished, unless otherwise specified.
3. Pins shall be so driven that the members will take full bearing.
4. Pin nuts shall be screwed up tight and the threads burred at the face of the nut with a pointed tool.

506.03.21 SHOP PAINTING

A. Unless otherwise provided, the application of shop paints shall conform to the requirements of ***Section 614 "Painting."***

B. Surfaces to be in contact after shop riveting is completed shall be cleaned but shall not be painted.

506.03.22 MARKING AND SHIPPING

A. Each member shall be painted or marked with an erection mark for identification and an erection diagram shall be furnished with erection marks shown thereon.

B. Members weighing more than 3 tons shall have the weight marked thereon.

C. Structural members shall be loaded on trucks or cars in such a manner that they may be transported and unloaded at their destination without being excessively stressed, deformed, or otherwise damaged.

D. All girders shall be shipped with the web vertical, which position shall be maintained in subsequent operations.

506.03.23 ERECTION METHODS AND EQUIPMENT

A. Before starting work, the Contractor shall inform the Engineer fully as to the method of erection the Contractor proposes to follow and as to the amount and character of the equipment the Contractor proposes to use, the adequacy of which shall be subject to the approval of the Engineer.

1. The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety and adequacy of Contractor's methods or equipment or from carrying out the work in full accordance with the plans and specifications.
2. No work shall be done without the sanction of the Engineer.

B. Spot welding for the purpose of eliminating field erection bolts or for holding steel parts together while fastening will not be permitted.

C. All work of erection shall be subject to inspection.

1. The Contractor shall furnish facilities for inspection of material and workmanship.

2. Material and workmanship not previously inspected shall be inspected after delivery to the site of the work.

D. The Contractor shall provide the falsework and all tools, machinery, and appliances, including drift pins and fitting-up bolts necessary for the expeditious handling of the work.

E. Anchor bolts for rail posts shall be galvanized high-strength bolts set with suitable templates in exact position and securely fixed to prevent displacement during the concreting operations.

1. The areas of concrete upon which posts are to be set shall be dressed by grinding or rubbing to a true plane for the proper seating of the posts.

2. All surfaces of aluminum alloy posts and adjustment shims to be in contact with concrete or with the steel anchor bolts nuts and washers shall be coated with aluminum insulating compound.

F. Rail posts shall be erected in sections.

1. Erection of sections of rails and posts shall continue successively until all or an approved portion of the required rail is erected.

2. The rail shall then be aligned and the nuts on the anchor bolts tightened.

3. In final adjustment, no posts shall deviate more than 1/8 inch from true alignment and there shall be no abrupt break in alignment of any location.

4. Aluminum shims may be slotted for ease in placing if approved by the Engineer.

506.03.24 FALSEWORK

A. The falsework shall be designed and substantially constructed and maintained for the vertical and lateral loads that will be applied to the structure.

1. The Contractor shall prepare and submit to the Engineer for approval plans for falsework or for changes in an existing structure necessary for maintaining traffic.

2. Approval of the Contractor's plans shall not be considered as relieving the Contractor of any responsibility.

B. Upon completion of the erection and before final acceptance, the Contractor shall remove all falsework, excavated or useless materials, rubbish and temporary buildings, replace or renew any fences damaged, restore in an acceptable manner all property, both public and private, which may have been damaged during the prosecution of the work, and leave the structure site and adjacent highway in a neat and presentable condition satisfactory to the Engineer.

C. All excavated material or falsework placed in the stream channel before construction shall be removed by the Contractor before final acceptance.

506.03.25 BEARING AND ANCHORAGE

A. Masonry bearing plates shall not be placed upon bridge seat bearing areas which are improperly finished, deformed, or irregular.

1. Bearing plates shall be set level in exact position and shall have a full and even bearing upon the masonry.

2. Unless otherwise directed by the Engineer, the bearing plates shall be placed on a layer of canvas and red lead applied as follows:

a. Thoroughly swab the bridge seat bearing area with red lead paint and place upon it 3 layers of 12-ounce to 14-ounce duck, each layer being thoroughly swabbed on its top surface with red lead paint.

b. Place the superstructure shoes or pedestals in position while the paint is plastic.

c. As an alternate to canvas and red lead, sheet lead may be used if called for on the plans.

B. The milled and finished surfaces of castings or bearing plates shall have the shop coat of tallow, white lead, or oil removed immediately prior to placing in the structure. Surfaces designed for sliding movement, one upon the other, shall be given a field coat of graphite grease when placed in the structure.

C. The Contractor shall drill the holes and set the anchor bolts, except where the holes are formed or the bolts are built into the masonry.

1. The bolts shall be set accurately and fixed with Portland cement grout, completely filling the holes.

2. The location of the anchor bolts in relation to the slotted holes in the expansion shoes shall correspond with the temperature at the time of erection.

3. The nuts on anchor bolts at the expansion ends of spans shall be adjusted to permit free movement of the span.

D. Elastomeric bearing pads shall conform to ***Subsection 502.03.12, "Expansion, Fixed Joints and Bearings."***

506.03.26 FIELD ASSEMBLING

A. The parts shall be accurately assembled as shown on the plans and match-marks shall be followed.

1. The material shall be carefully handled so that no part will be bent, broken, or otherwise damaged.

2. Hammering which will injure or distort the members shall not be done.

3. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.

4. Unless erected by the cantilever method, truss spans shall be erected on blocking so placed as to give the trusses proper camber.

5. The blocking shall be left in place until the tension chord splices are fully fastened and all other truss connections pinned and bolted.

6. Splices of butt joints of compression members, in railings, and in other field splice connections shall have 1/2 of the connection holes filled with bolts and cylindrical erection pins (half bolts and half pins) before fastening.

7. Splices and connections carrying traffic during erection shall have 3/4 of the holes so filled.

B. Cylindrical erection pins shall be 1/32 inch larger than the fitting up bolts.

506.03.27 MISFITS

A. The correction of minor misfits involving nonharmful amounts of reaming, cutting, and chipping shall be considered a legitimate part of the erection.

B. However, any error in the shop fabrication, or deformation resulting from handling and transportation, which prevents the proper assembling and fitting up of the parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be reported immediately to the Engineer and Engineer's approval of the method of correction obtained.

C. The correction shall be made in the Engineer's presence.

D. The Contractor shall be responsible for all misfits, errors, and injuries and shall make the necessary corrections and replacements.

506.03.28 FIELD PAINTING

A. Structural steel, unless otherwise specified, shall be painted as specified in ***Section 614, "Painting."***

END OF SECTION 506

SECTION 601 – PIPE CULVERTS-GENERAL

DESCRIPTION

601.01.01 GENERAL

A. This section includes general requirements that are applicable to all types of culvert pipes regardless of the material or culvert use with the following exceptions:

1. Structural plate pipe,
2. Water distribution systems and sanitary sewer system specifications will specify the pipe to be used in their respective installations.

B. This work shall consist of furnishing and installing pipe culverts, siphons, end sections, end walls, and so forth, as may be required to complete the work shown on the plans or established by the Engineer.

C. The pipe shall comply with AASHTO Design and Construction LRFD Specifications most current edition and these specifications. The more stringent requirements shall apply.

D. This work shall also consist of preparing utility final location information as described on the project drawings and in Section 622 of these Special Provisions.

MATERIALS

601.02.01 GENERAL

A. The materials used shall conform to the requirements in the following subsections:

Materials	Section/Subsection
Bituminous Coated Corrugated Metal Pipe and Pipe Arches	***709.03.02***
Clay Pipe	***708.03.04***
Corrugated Aluminum Pipe	***709.03.04***
Corrugated Metal Pipe and Pipe Arches	***709.03.01***
Grout and Mortar Sand	***706.03.04***
Nonreinforced Concrete Pipe	***708.03.02***
Hydraulic Cement	***701***
Reinforced Concrete Pipe	***708.03.01***
Rubber Gaskets	***707.03.06***
Thermoplastic Pipe	***709.03.10***

B. When the location of manufacturing plants allows, the plants will be inspected periodically for compliance with specified manufacturing methods.

1. Material samples will be obtained for laboratory testing for compliance with materials quality requirements as specified in the referenced specifications.
2. This can be the basis for acceptance of manufacturing lots.

C. All materials will be subject to inspection for acceptance as to condition at the latest practicable time the Engineer has the opportunity to check for compliance prior to or during incorporation of materials in the work.

D. The lengths shown on the plans are approximate.

E. BLANK

CONSTRUCTION

601.03.01 EARTHWORK

A. Excavation and backfill shall conform to the requirements of ***Section 206, "Structure Excavation,"*** and ***Section 207, "Structure Backfill,"*** or ***Section 208, "Trench Excavation and Backfill,"*** when the culvert is placed in a trench.

1. The pipe shall be bedded as shown in the plans and/or drawings appended to the plans or as specified in the Special Provisions.

2. When no bedding class is specified, the requirements for normal bedding as shown in the Uniform Standard Drawings shall apply.

3. The lines and grades will be established by the Engineer or as designated in the contract documents.

B. Where pipes are to be installed in new embankments on a steep slope or in a difficult location, the height of new embankments may be varied as directed by the Engineer before installing pipes.

C. When headwalls are not required and granular materials are used for backfilling, the fill at the ends of the structure shall be sealed against the infiltration of water by bedding the ends of the structure using Class II CLSM or concrete.

601.03.02 HEADWALLS

A. Where shown on the plans, inlet and outlet headwalls shall be constructed or installed in connection with culvert pipes.

B. Where headwalls are constructed or installed, the ends of pipes shall be placed flush or cut off flush with the headwall face, unless otherwise permitted by the Engineer.

C. Headwalls shall be constructed to conform ***to Section 501, "Portland Cement Concrete"*** and ***Section 502, "Concrete Structures."***

601.03.03 END SECTIONS

A. The bed for the end section shall be excavated to the required width and grade.

B. For metal end sections with toe plates, a trench shall be excavated for the toe plate in a manner to permit the toe plate from being against the inner face of the trench when the end section is in its final position. After end sections have been properly secured to the pipe, this trench shall be backfilled and firmly compacted.

C. Precast concrete end section shall be placed with its tongue (or groove) fully entered in the groove (or tongue) of the pipe.

D. Thermoplastic pipe greater than 30 inches shall not be used at the open-end sections.

601.03.04 JACKED PIPES

A. Culvert pipe to be jacked in place between the limits shown on the plans shall conform to the requirements of the respective section of pipe culverts.

B. The strength of pipe or gauge of pipe will be determined for vertical load only in embankment conditions. Any additional reinforcement or strength required to withstand jacking pressure shall be determined and furnished by the Contractor at no additional cost to the Contracting Agency.

C. Variation from theoretical alignment and grade at the time of completion of placing shall not exceed 0.2 foot for each 20 feet of pipe placed.

D. The diameter of the excavated hole shall not be more than 0.1 foot greater than the outside diameter of the pipe.

1. Sluicing and jetting with water will not be permitted.

2. When the material tends to cave in from outside these limits, a shield shall be used ahead of the first section of pipe or the face of excavation shall not extend beyond the end of the pipe greater than 1-1/2 feet unless permitted by the Engineer.

E. Areas resulting from caving or excavating outside the above limits shall be backfilled with sand or grout by a method that will fill the voids.

601.03.05 LAYING CULVERT PIPE

A. Laying of culvert pipe shall conform to the requirements of the respective sections of culvert pipe.

601.03.06 EXTENDING EXISTING CULVERTS

A. Where shown on the plans or directed by the Engineer, existing culverts shall be extended in accordance with the provisions for installing new culverts and the following additional provisions.

B. Existing headwalls shall be demolished and removed and disposed of or moved to the extended location as indicated on the plans or ordered by the Engineer. Comply with ***Section 202, "Removal of Structures and Obstructions."***

C. A headwall that is not to be reset shall be demolished without injury to the existing culvert and removed and disposed of in accordance with the provisions of ***Section 202, "Removal of Structures and Obstructions."*** If shown on the plans or ordered by the Engineer, a new concrete headwall shall be constructed in accordance with the provisions of ***Section 501, "Portland Cement Concrete,"*** of these specifications or a flared end section shall be attached thereto.

601.03.07 VIDEO INSPECTION

A. Unless otherwise approved by the Contracting Agency, all video inspection shall be completed by a National Association of Sewer Service Companies (NASSCO) certified operator, certified at the user level minimum.

1. The user shall have completed the Pipeline Assessment and Certificate Program (PACP).

2. Video inspection reports must follow the NASSCO format and use standard sewer defect codes.

B. The following paragraphs define the requirements for internal video inspection of storm drain facilities after installation.

1. The Contractor shall inspect the storm drain facility interior using a color closed circuit television (CCTV) camera and document the inspection on image with audio location and date information, image title information, and hard copy inspection logs. The CCTV inspection shall be performed after the installation has been completed.

2. Field operator(s) of inspection equipment must have current National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) Certification.

3. Television Inspection Camera. Equipment shall be operative in 100 percent humidity conditions. Lighting intensity shall be remote controlled and shall be adjusted to minimize reflective glare. Lighting and camera quality shall provide a clear, in-focus picture of the entire inside periphery of the storm drain facility.

4. Digital Storage Medium. The inspection shall be recorded, stored and submitted on CD's (or DVD's) in high quality MPG format on CD -R/+R disks formatted for use with PC systems. The audio portion of the composite CD shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report.

5. Footage Counter. A footage counter device, which measures the distance traveled by the camera in the storm drain facility, shall be accurate to plus or minus 2 feet in 1,000 feet.

6. Video Tilting. Pan and tilt unit, with adjustable supports specifically designed and constructed for operation in connection with storm drain facility inspection.

7. Flow in Storm Drain Facility. During internal video inspections the Contractor shall provide temporary dry conditions in the storm drain facility unless otherwise agreed upon by the Engineer.

C. Inspection Methods for Internal Video:

1. Verbal Commentary. None required except to note operational problems such as camera failure, or restart of inspection.

2. Access. The Engineer shall have access to observe the monitor and all other operations at all times. The system of cabling employed to transport the camera and transmit its signal shall not obstruct the camera's view.

3. Inspection Rate. The camera shall be pulled through the storm drain facility in either direction, but all inspections at each location shall be in the same direction. Rate of travel shall be such that a comprehensive inspection/analysis may be performed but at no time shall exceed 30 feet per minute when recording.

4. Image Perspective. The camera image shall be down the center axis of the storm drain facility when the camera is in motion. The Contractor is required to provide a

360-degree view of the interior. Points of interest shall also be shown on the video and shall include, but not be limited to, all joints, defects, encrustations, mineral deposits, debris, sediment, any location determined not to be clean or part of a proper installation or defects in the materials.

5. Storm Drain Facility Identification. All inspection documentation shall include the location referenced to the project survey control specifically the pipe stationing.

6. Defect Coding. National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) coding system, latest version, shall be used to document all defects visible on the image recordings.

7. Quality Control. The Engineer will review CD's or DVD's and logs to ensure compliance with the requirements listed in this specification and contract documents.

8. The Contractor shall be responsible for modifications to his equipment and/or inspection procedures to achieve report material of acceptable quality. No work shall commence prior to approval of the material by the Engineer. Once accepted, the report material shall serve as a standard for the remaining work.

9. Contractor shall maintain a copy of all inspection documentation (CDs, databases, and logs) for the duration of the work and warranty period.

601.03.70 MARKER BALLS

A. Marker balls shall be installed per local entity requirements.

END OF SECTION 601

SECTION 603 – REINFORCED CONCRETE PIPE

DESCRIPTION

603.01.01 GENERAL

A. This work shall consist of furnishing circular or elliptical, reinforced concrete pipe, siphons, and conduits of the size, classes, and dimensions and at locations shown on the plans or established by the Engineer and in accordance with ASTM C76, ASTM C655, or ASTM C507, with design basis in accordance with ***Section 708, "Concrete and Clay Pipe and Drains,"*** and where indicated in these specifications.

B. The installation shall conform to the AASHTO LRFD Bridge Construction Specifications and these specifications.

C. This work shall also consist of providing storm drain connections for the storm drain and laterals as directed by the Engineer.

MATERIAL

603.02.01 GENERAL

A. Materials and their use shall conform to ***Subsection 601.02.01, "General,"*** and the requirements below.

B. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and ***Section 708, "Concrete and Clay Pipe and Drains,"*** from an authorized source approved by the Interagency Quality Assurance Committee (IQAC).

C. Flared end sections (precast) shall conform to the details and dimensions shown on the plans and, except for shape, shall conform to the material requirements of this section for reinforced concrete pipe.

D. Rubber gaskets are required for all circular pipes and elliptical pipes. Rubber gaskets shall conform to ***Subsection 707.03.06, "Rubber Gaskets."***

E. If joint mortar is required, it shall be as specified in ***Subsection 501.03.12, "Mortar," Class "C."***

1. Sand shall conform to ***Subsection 706.03.04, "Grout and Mortar Sand."***
2. The materials shall be mixed to a consistency suitable for the purpose intended.
3. All mortar shall be used within 30 minutes after the mixing water has been added.
4. Admixtures of hydrated lime, fire clay, diatomaceous earth, or other approved inert material may be used in the mortar to facilitate workability if the Contractor elects.
5. The amount of admixture to be added shall be the quantity determined by the Engineer.

CONSTRUCTION

603.03.01 GENERAL

A. Construction methods shall conform to ***Subsection 601.03.01, "Earthwork,"*** through ***Subsection 601.03.06, "Extending Existing Culverts,"*** and shall meet the requirements below. All pipe installations shall conform to the workmanship and inspection requirements of the AASHTO LRFD Bridge Construction Specifications and this specification as applicable.

B. No pipe shall be laid that is excessively cracked (in accordance with ***Subsection 603.03.07, "Inspection"***), checked, spalled, or damaged, and all such sections of pipe shall be permanently removed from the work. Pipes that show defects due to handling shall be rejected at the site of the installation regardless of prior acceptance.

603.03.02 EARTHWORK

A. Where pipes are to be installed in new embankment (projection), the embankment shall first be constructed to the required elevation as set forth below. The height of embankment to be constructed in advance of installing the pipe may be varied when permitted by the Engineer.

B. In the case of pipes 24 inches or less in diameter, the roadway embankment shall be constructed to an elevation of 6 inches above the grade proposed for the top of the pipe, after which the trench shall be excavated and the pipe installed.

C. In the case of pipes more than 24 inches in diameter, the roadway embankment shall be constructed to an elevation of 30 inches above the grade proposed for the bottom of the pipe, after which the trench shall be excavated and the pipe installed.

D. When pipe having bells or hubs is used, cross trenches shall be excavated for them to prevent non-uniform loading of the joints.

603.03.03 LAYING CULVERT PIPE

A. Construction installation shall comply with the AASHTO LRFD Bridge Construction Specifications; ***Section 208, "Trench Excavation and Backfill"***; and this subsection.

1. The installation shall be conducted by a certified supervisor/foreman at the crew level who is responsible for the work.
2. The certified person is the designated installation inspector for the Contractor and shall generate a daily report attesting to the workmanship for each of the installation components described below.
3. This does not relieve the Contractor of responsibility for other Quality Control aspects of this and other specifications.

B. Installation Components:

1. Bedding.
2. Pipe Condition.
3. Pipe Installation.
4. Haunch Compaction.
5. Complete Pipe Zone Compaction.

C. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe. Blocking shall not be used to bring the pipe to grade.

D. Pipe sections shall be checked for alignment and grade at the time of joining the sections.

1. Pipe laying shall begin at the downstream end of the pipeline except for extensions of existing pipes.

2. Place the bottom of the pipe in contact with the shaped bedding throughout its full length.

3. The first section of pipe to be laid shall be firmly placed to the designated line and grade at the outlet end with the groove end or bell end pointing in the direction to be followed by the pipe laying.

4. Maintain the manufacturer's recommended minimum and maximum cover at all times unless otherwise shown in the contract.

5. Pipe will be inspected before any backfill is placed.

6. Ensure that no rocks greater than 3 inches or other rigid or jagged material is present in the bedding material where pipe may be laid directly on the material.

7. Take up and relay or replace pipe that is out of alignment, unduly settled, or damaged.

E. The interior of the pipe shall be kept free of dirt, and other foreign material as the pipe laying progresses, and left clean at the completion of the work. Any pipe, which is not in true alignment or which shows any undue settlement after laying, or is damaged, shall be taken up and re-laid at the Contractor's expenses.

F. **Backfill:** Prior to placing backfill material, all lifting holes in concrete culverts shall be completely filled with grout.

603.03.04 RUBBER GASKETED JOINTS

A. Circular reinforced concrete culvert pipe shall use rubber or neoprene gasketed joints.

B. Rubber gaskets shall not be exposed to the direct rays of the sun for more than 72 hours.

C. The Contractor shall make every effort to provide a concrete-to-concrete connection and pull the pipe completely home.

1. Should gapping occur due to changes or corrections in horizontal or vertical alignment or radius turns, the gaps shall not exceed the gap tolerance indicated in Table 1.

2. If pipes are laid that exceed these tolerances, the inner annular space between the pipe sections shall be completely filled with cement mortar (where pipe diameters allow for entry).

3. If pipes are laid that exceed the tolerances in Column 2, the pipe will need to be removed and re-laid or an acceptable concrete collar will need to be installed.

Table 1 - Maximum Joint Gap Tolerances[1]

	Column 1	Column 2
Inner Diameter of Pipe	**Maximum Joint Gap Tolerance**	**Maximum Joint Gap Tolerance (with Grouting)**
12-inch to 36-inch	5/8 inch	3/4 inch
42-inch to 48-inch	7/8 inch	1-1/8 inch
54-inch to 90-inch	1 inch	1-1/4 inch
96-inch	1- 5/8 inch	1-3/4 inch
Above 96-inch up to 144-inch	As recommended by Manufacturer	As recommended by Manufacturer

D. Where reinforced concrete collars or bells with rubber gaskets are used at the pipe joints, mortar will not be required in the outer annular space.

E. Where pipes are used with exposed metal surfaces at the joint, both the inner and outer annular joint spaces between pipe sections must be completely filled with cement mortar, except that pipes less than 24 inches in diameter may be pointed inside by brushing smooth and removing all surplus mortar.

F. The rubber gasket shall be the sole element depended upon to make the joint watertight for the purposes intended.

603.03.05 SIPHONS AND PRESSURE PIPE

A. Reinforced concrete pipe used for siphons or pressure pipe shall be laid in accordance with the above provisions, be connected by flexible, watertight rubber gasket joint and, prior to backfilling, be subject to the following hydrostatic test:

1. The pipeline shall be filled with water at a hydrostatic head of that required to maintain the design pressure.
2. The pressure head shall be maintained for a period of not less than 24 hours and any visible leak or other defects that develop under test shall be corrected by the Contractor at no additional cost to the Contracting Agency.
3. Sweating that does not develop into a flow or drip will not be considered as leakage.
4. The test shall be repeated until all leaks or other defects are eliminated

603.03.06 JUNCTIONS

A. All junctions of laterals with a main line or junctions of 2 or more main lines, which are not made in a manhole or concrete junction structure, shall be in a manufactured wye or tee.

B. The wye or tee shall be of the same material as the conduits to which they are joined, and shall have the same or greater stiffness as the pipe.

603.03.07 INSPECTION

A. All pipe joints and lengths shall be 100 percent inspected.

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[1] In no case shall maximum joint gap tolerance exceed ½ of the length where the gasket seats within the pipe

1. Inspection and testing shall be performed by the Contractor during and after installation to ensure proper performance.
2. Installation, placement, and compaction of bedding and backfill materials shall comply with this section.
3. During the initial phases of the installation process, inspection shall concentrate on detecting improper practice and poor workmanship.
4. Errors in line and grade, improper assembly, and improper backfill techniques shall be corrected prior to placing significant backfill or trench fill.
5. Bell/spigot joints shall be properly assembled to prevent the infiltration of soil fines.
6. Gaskets shall be properly seated to prevent groundwater infiltration and shall appear uniformly oriented around the pipe.
7. Shallow cover installations shall be checked to ensure the minimum cover level is provided.

B. After the pipe has been bedded and backfilled to subgrade level, internal quality inspection shall be paid for and performed by the Contractor a minimum of 30 days after final backfill has been placed and prior to final acceptance by the Contracting Agency.

1. The line shall be cleaned and inspected for cracks and joint gaps using visual physical measurement or other devices, including but not limited to calibrated television or video cameras, subject to approval by the Engineer.
2. Cracks in pipes (both longitudinal and circumferential) that are less than 0.10 inch in width are generally considered non-structural flaws and need not be repaired.
3. Cracks that are equal to or exceed 0.10 inch in width shall require an evaluation by a Nevada licensed professional engineer.
4. The Contractor's engineer shall provide a recommendation regarding removal or repair subject to approval by the Contracting Agency.
5. Pipe joints and lengths that do not meet the specification shall be repaired or pipe replaced at no additional cost to the Contracting Agency.

C. All inspection results shall be submitted and approved by the Engineer before final payment.

1. Any replacement pipe shall also be subject to the same testing.
2. All inspection and testing results shall be submitted to the Engineer for approval.

D. The Engineer shall be allowed access to randomly inspect at least 10 percent of the total number of pipe runs.

E. Internal Video Inspection. Internal video inspection shall be performed by the Contractor a minimum of 30 days after final backfill has been placed and prior to final acceptance by the Contracting Agency. This inspection includes 360 degree taping of all storm drain lateral joints. The line shall be cleaned and inspected per ***Subsection 601.03.07 "Video Inspection."***

END OF SECTION 603

SECTION 609 – CATCH BASINS, MANHOLES AND INLETS

DESCRIPTION

609.01.01 GENERAL

A. This work shall consist of constructing or reconstructing catch basins, manholes, inlets, and similar structures, consisting of Portland cement concrete with necessary reinforcement, metal frames, grates, and lids, including required excavation and backfilling.

B. This work shall also consist of preparing utility final location information as described on the project drawings and in Section 622 of these Special Provisions.

MATERIALS

609.02.01 GENERAL

A. Materials shall conform to the following sections and subsections:

Materials	Section/Subsection
Portland Cement Concrete	***501***
Reinforcing Steel	***505***
Miscellaneous Metal	***712***
Gray Iron Castings	***712.03.02***

B. Casting shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting strength and value for the service intended.

1. Casting shall be boldly filleted at angles and the arises shall be sharp and perfect.
2. Casting shall be sand blasted or otherwise effectively cleaned of scale and sand so as to present a smooth, clean, and uniform surface.

C. The Contractor shall obtain from the fabricator of the structural steel grates, frames, and gray iron castings a Certificate of Compliance stating that the fabrications meet these specifications, and giving certified shop weights for the fabrications.

D. Mortar for setting grates shall be mixed in the proportions of 1 part cement to 3 parts of fine aggregate.

E. Pipe crossbars for drop inlets shall be unpainted standard weight black pipe conforming to ASTM A53. Straps shall be unpainted ASTM A36 steel.

F. Grout shall conform to ASTM C476 and shall have a minimum strength of 2000 psi. Fine grout shall be proportioned by volume of one part Portland cement and 2-1/4 to 3 parts sand. Coarse grout shall consist of one part Portland cement, 2-1/2 to 3 parts sand, and 1 to 2 parts course aggregate.

G. Laboratory design mixes for grout, approved by a Licensed Professional Engineer in the State of Nevada, are acceptable in lieu of the above proportions and are required if the maximum strength is more than 2000 psi. Grout shall be of a fluid consistency with proper proportions of sand to gravel for pouring and pumping.

H. All exposed steel shall be hot-dipped galvanized per section 715.

CONSTRUCTION

609.03.01 GENERAL

A. Catch basins, inlets, and manholes shall be constructed in accordance with ***Section 501, "Portland Cement Concrete."***

B. Inlet and outlet pipes shall be placed prior to pouring concrete.

C. Grates shall be set in full mortar beds or otherwise secured as shown on the plans. Grates shall be set accurately to the final elevations so that no subsequent adjustments will be necessary.

D. Concrete covers, when indicated on the plans, shall be constructed to fit snugly and be readily removable.

E. Structural steel grates shall be painted as specified in ***Section 614, "Painting."***

F. Pipe or tile placed in masonry for inlet or outlet connections shall extend through the walls and beyond the outside surfaces of the walls a sufficient distance to allow for connections with conduit, and the masonry shall be carefully constructed around the pipe or tile to prevent leakage around their outer surfaces.

G. Commercially prefabricated frames and grates of equal or greater capacity and strength may be substituted for the design shown on the plans for drop inlets provided prior approval is obtained in writing from the Engineer.

H. Frames and grates shall be matchmarked in pairs before delivery to the work and grates shall fit into the frames without rocking.

609.03.02 ADJUSTING CATCH BASIN, MANHOLE, AND INLET COVERS

A. Unless otherwise provided on the plans or by the contract, existing covers including frames, grates, lining, and lids shall be adjusted to the required elevation.

B. Remove the existing covers and adjust the top of the existing structures by removing or adding concrete, brick masonry, concrete block masonry, high density polyethylene adaptor rings, or steel or cast iron adaptor rings, as applicable.

C. Reinstall the fixtures by supporting them on a satisfactory collar of concrete constructed to hold the fixtures firmly in place.

D. Concrete collars for manholes shall be constructed in accordance with Uniform Standard Drawing No. 408.1 “Concrete Collar Around Manholes, 30 Inch Ring and Cover.”

609.03.03 CLEAN OUT

A. All catch basins, manholes, inlets, and similar structures shall be thoroughly cleaned of any accumulations of silt, debris, or foreign matter of any kind, and shall be clean of accumulations at the time of final inspection.

609.03.04 EARTHWORK

A. Structure excavation and structure backfill shall conform to ***Section 206, "Structure Excavation"*** and ***Section 207, "Structure Backfill."***

END OF SECTION 609

SECTION 610 – SLOPE AND CHANNEL PROTECTION

DESCRIPTION

610.01.01 GENERAL

A. This work shall consist of constructing slope and channel protection structures to the lines and grades established by the Engineer using riprap or wire mesh gabions in accordance with the design shown on the plans and these specifications.

B. Riprap construction shall consist of furnishing and placing riprap (with or without grout) or sacked Portland cement concrete riprap.

C. Wire mesh gabion construction shall consist of furnishing, assembling, tying, and filling open mesh wire baskets with stone.

MATERIALS

610.02.01 GENERAL

A. All materials shall conform to the following sections and subsections:

Materials	Section/Subsection
Water	***722***
Hydraulic Cement	***701***
Grout and Mortar Sand	***706.03.04***
Riprap Grout	***706.03.05***

B. When so provided and with prior approval of the Engineer, crushed concrete may be substituted for the above designated stone. In such a case, the concrete shall be sound and meet all requirements as specified for stone.

610.02.02 GROUT

A. Grout shall be composed of 1 part by volume of Portland cement and 3 parts by volume of sand and shall be of such consistency that it will fill all voids in the riprap.

B. Comply with ***Subsection 706.03.05, "Riprap Grout."***

610.02.03 SACKED CONCRETE

A. Sacked concrete shall be composed of sacks filled with Portland cement concrete.

1. The mixed concrete shall contain a minimum of 376 pounds (4 sacks) of Portland cement per cubic yard.

2. The amount of water added at the time of mixing shall be such as will produce a mixture with a slump of from 3 inches to 5 inches.

B. Unless otherwise provided in the Special Provisions, aggregate for use in sacked concrete riprap shall consist of river run material of a sandy, gravelly nature, clean and free from roots, vegetable matter, and other deleterious substances. When tested on laboratory sieves, river run material shall conform to the following gradation requirements.

1. Passing a 2-inch sieve: 80 to 100 percent.
2. Passing a No. 200 sieve: 0 to 4 percent

C. Sacks for concrete riprap shall be made of at least 10 ounce burlap, and shall be approximately 19-1/2 inches by 36 inches measured inside the seams when the sack is laid flat.

1. The capacity of each sack shall be approximately 1.25 cubic feet.
2. Sound reclaimed sacks may be used.

610.02.04 STONES FOR RIPRAP

A. Stones used for riprap shall be hard, durable, angular in shape, resistant to weathering and erosion, and free from spoils, cracks, and organic matter.

1. The stone for non-grouted riprap shall have a minimum of 2 fractured faces with neither width nor thickness of a single stone less than 1/3 its length.
2. The specific gravity of the riprap shall not be less than 2.45.
3. The nominal stone size shall be as follows:

RIPRAP GRADATIONS

Percent Passing By Mass	Riprap D50=12" (Inches)	Heavy Riprap D50=18" (Inches)
100	20	30
70-85	18	27
35-50	12	18
5-15	5	7
0	2	3

B. This stone shall conform to the following requirements:

Source Requirements Test	Test Method	Requirements
Percent of Wear (500 Rev.)	ASTM C131	45% Maximum
Bulk Specific Gravity	ASTM C127	2.5 Minimum

C. Control of gradation will be by visual inspection.

1. Upon request by the Engineer, the Contractor shall provide a sample of stone of at least 5 tons meeting the gradation for each location riprap is indicated.
2. Each sample shall be located at the construction site near the location where the riprap is to be placed.
3. The sample shall be used as a frequent reference for judging the gradation of the riprap supplied.
4. The sample riprap shall be in place and acceptable to the Engineer before riprap

placing work begins.

5. The Contractor shall maintain the placed riprap until the project is completed and any material displaced by any cause shall be repaired to the lines and grades indicated on the plans.

D. Caliche stone or cementitious materials meeting the requirements of this section may be used as riprap with prior approval of the Engineer.

1. The riprap shall be fully cemented material. Only materials designated as hard (scratches leave only dust, requires many hammer blows to break) or very hard (difficult to scratch or break) shall be utilized.

2. Moderately hard (crumbles with several hammer blows) or partially cemented materials are not acceptable.

E. The Contractor may be required to provide riprap test results from an approved testing laboratory and a Certificate of Compliance in accordance with ***Subsection 106.05, "Certificate of Compliance."***

610.02.05 STONES FOR GABIONS

A. Stones for filling the gabions shall be well graded, hard stones, conforming to the testing requirements specified in ***Subsection 610.02.04, "Stones for Riprap."***

B. Size and gradation shall be such that the predominant size is between 4 inches and 8 inches, 85 percent by weight.

1. Minimum stone dimensions shall be 3 inches and maximum stone dimension shall be 8 inches.

2. For gabion baskets less than 1 foot in height, the maximum stone dimension shall be 6 inches.

610.02.06 FILTER MATERIAL

A. When filter material is specified or shown on the plans, the material shall consist of mineral aggregate that is clean, hard, durable, and free of any deleterious matter or harmful adherent coatings.

B. Gradation of the filter material shall conform to the requirements specified by the Engineer or as shown in the Special Provisions.

610.02.07 FILTER FABRIC

A. When filter fabric is specified or shown on the plans, the fabric shall consist of a geotextile that is made from synthetic fibers.

B. The filter fabric shall be in accordance with AASHTO M288, Section A4, and shall conform to the requirements specified by the Engineer.

610.02.08 WIRE MESH GABIONS AND GABION MATTRESSES

A. Wire mesh gabions and gabion mattresses shall be fabricated from either twisted wire mesh or welded wire mesh.

1. All wires shall be galvanized prior to fabricating the mesh and in compliance with

ASTM A90.

2. Only 1 type of wire mesh may be used in any 1 structure.

B. Gabion and gabion mattress dimensions of width, height, and length shall be as shown on the plans.

1. Each gabion unit shall not vary more than 5 percent from the dimensions shown on the plans.

2. Gabions come 1 foot or greater in height, 3 feet in width, and are compartmentalized into cells not larger than 3 feet by 3 feet by attaching to the base single diaphragm panels made of the same type and size mesh as the gabion panels.

3. Gabion mattresses come 9 inches or less in height, 6 feet in width, and are compartmentalized into cells not larger than 6 feet by 3 feet by attaching to the base single diaphragm panels made of the same type and size mesh as the gabion mattress panels.

C. The baskets shall be assembled with the necessary panels and diaphragms secured to the base in accordance with ASTM A975-97, Table 2 requirements. Pleating the base panel to obtain the diaphragms is prohibited.

D. Fabrication of the wire mesh gabions and gabion mattresses shall be as follows:

1. Twisted Wire Mesh Gabions and Gabion Mattresses:

a. Gabion panels for the twisted mesh style shall be manufactured from galvanized steel wire, Class 3, soft temper, conforming to ASTM A641, or from aluminized steel wire, soft temper, conforming to ASTM A809.

1) The wire shall have a minimum tensile strength of 60,000 psi when tested in accordance with ASTM A370.

2) Twisted wire mesh gabions and gabion mattresses shall comply with ASTM A975-97 standards.

b. The mesh shall be formed with non-raveling double twists by twisting each pair of wires through two 360-degree turns. The mesh openings shall be hexagonal in shape and uniform in size and shall comply with the mesh dimensions and requirements shown on Table 1 and Table 2 below.

c. All perimeter edges of the mesh panels forming the gabion basket shall be securely tied to a selvedge wire so that the selvedge-to-mesh connection has at least the same strength as the body of the mesh. Selvedge wire shall be the same kind and type of material used for the mesh, except that wire diameters shall be as shown on the tables below.

d. When specified by the Engineer, the galvanized or aluminized wire shall be coated with a polyvinyl chloride (PVC) material. The coating shall be accomplished by using either extruded or extruded and bonded PVC material, and shall be applied before twisting the wire into mesh panels.

e. All wire used for twisted mesh gabions and gabion mattresses shall meet the following nominal requirements:

Table 1 - Nominal Requirements for Twisted Wire Mesh Gabions			
Type of Basket	**Mesh Size**	**Mesh Wire**	**Selvedge Wire**
Baskets 1 foot or greater in height	3.25-inch by 4.5-inch	0.120 inch	0.148 inch
Baskets 1 foot or greater in height with PVC coating	3.25-inch by 4.5 inch	0.106 inch, plus the PVC coating	0.134 inch, plus the PVC coating

Table 2 - Nominal Requirements for Twisted Wire Mesh Gabion Mattresses			
Type of Basket	**Mesh Size**	**Mesh Wire**	**Selvedge Wire**
Baskets 9 inches or less in height	2.5-inch by 3.25 inch	0.087 inch	0.106 inch
Baskets 9 inches or less in height with PVC coating	2.5-inch by 3.25 inch	0.087 inch, plus the PVC coating	0.106 inch, plus the PVC coating

2. Welded Wire Mesh Gabions and Gabion Mattresses:

   a. Gabion panels for the welded mesh style shall be manufactured from welded wire fabric conforming to ASTM A185 and ASTM A974-97, Type 1.

   b. Galvanized wire shall have a Class 3 coating as indicated in ASTM A641.

   c. Aluminized wire shall have a minimum coating as indicated in ASTM A809.

   d. The wire shall be soft tempered with a minimum tensile strength of 60,000 psi when tested in accordance with ASTM A370.

   e. Welded wire mesh gabions and gabion mattresses shall comply with ASTM A974-97 standards.

   f. The mesh shall form a square or rectangular grid pattern with the maximum diagonal dimension of any grid opening not to exceed 4.5 inches.

   g. The welded wire mesh shall be galvanized or aluminized prior to welding into mesh and shall comply with the dimensions and requirements shown on Table 3 and Table 4 below.

   h. When specified by the Engineer, the welded wire mesh shall be coated with a polyvinyl chloride material. The PVC coating shall be fusion bonded to the galvanized or aluminized wire after fabrication of the gabion mesh panels.

   i. All wire used for welded mesh gabions and gabion mattresses shall meet the following nominal requirements:

Table 3 - Nominal Requirements for Welded Wire Mesh Gabions		
Type of Basket	**Mesh Size**	**Mesh Wire**
Baskets 1 foot or greater in height	3-inch by 3-inch	0.120 inch
Baskets 1 foot or greater in height with PVC coating	3-inch by 3 inch, plus the PVC coating	0.106 inch, plus the PVC coating

Table 4 - Nominal Requirements for Welded Wire Mesh Gabion Mattresses		
Type of Basket	**Mesh Size**	**Mesh Wire**
Baskets 9 inches or less in height	1.5-inch by 3-inch	0.087 inch (2.21 mm)
Baskets 9 inches or less in height with PVC coating	1.5-inch by 3-inch, plus the PVC coating	0.087 inch, plus the PVC coating

j. For polyvinyl chloride coated either twisted or welded mesh gabions and gabion mattresses, the PVC coating shall have a nominal thickness of 0.020 inch and a minimum thickness of 0.015 inch. The coating shall be grey, silver, green, or black and conform to the following:

1) Specific Gravity: In the range of 1.20 to 1.40, ASTM D792.

2) Abrasion Resistance: The percentage of weight loss shall be less than 12 percent, when tested according to ASTM D1242, Method B at 200 cycles, CSI-A Abrader Tape, 80 Grit.

3) Brittleness Temperature: Not higher than 15 degrees F, ASTM D746.

4) Tensile Strength: Extruded Coating - Not less than 2,980 psi, ASTM D412. Fusion Bonded Coating - Not less than 2,275 psi, ASTM D638.

5) Modulus of Elasticity: Extruded Coating - Not less than 2,700 psi, at 100 percent strain, ASTM D412. Fusion Bonded Coating - Not less than 1,980 psi. at 100 percent strain, ASTM D638.

6) Ultraviolet Light Exposure: A test period of not less than 3,000 hours, using apparatus Type E at 145.4 degrees F, ASTM G23.

7) Salt Spray Test: A test period of not less than 3,000 hours, ASTM B117.

610.02.09 INTERNAL CONNECTING WIRES

A. Internal connecting wires to reinforce the side panels of individual gabion baskets shall meet the same specifications as the wire used in the gabion body, except wire nominal diameter shall be 0.087 inches or larger. Alternate preformed stiffeners acceptable to the gabion manufacturer and the Engineer may also be used.

610.02.10 LACING WIRE

A. Lacing wire to assemble, interconnect, and close the gabion baskets shall meet the same specifications, as the wire used in the gabion body except its nominal diameter shall be 0.087 inches.

610.02.11 WIRE FASTENERS

A. Machine formed spiral wire binders with a 3-inch pitch and 2.5-inch inside diameter maximum are the standard fastener for welded wire mesh gabions and gabion mattresses, and shall be formed from wire meeting the same quality and coating thickness requirements as specified above for the gabions and gabion mattresses.

B. As an alternative to lacing wire and spiral binders, wire fasteners including interim fasteners, interlocking ring fasteners, overlapping (hog) ring fasteners, and twist ties may be used, subject to the approval of the Engineer.

C. The Contractor shall demonstrate that:

1. The proposed fastener can consistently resist an opposed tension force of at least 600 pounds without pulling apart.

2. The proposed fastener system can consistently produce a joint with strength of at least 1,400 pounds per linear foot while encompassing the number of wires as intended for its use. When PVC coated wire is used, the joint strength shall be at least 1,200 pounds per linear foot.

3. The proposed fastener system does not cause damage to the protective coating on the wire.

4. The Contractor has the proper equipment and trained employees to correctly install the fasteners.

5. Proper installation can be readily verified by visual inspection.

D. The Contractor shall provide a complete description of the fastener system, including the number of fasteners required, the number and size of wires that the fastener is capable of properly joining, and a description of a properly installed fastener, including drawings or photographs, if necessary.

E. Properly formed fasteners shall meet the following requirements:

1. Each interlocking fastener shall be locked and closed.

2. Each overlapping ring fastener shall be closed and the free ends shall overlap a minimum of 1 inch.

3. Spiral binders shall be crimped to secure the spiral in place.

4. Twist ties shall have a minimum of 2 complete revolutions.

F. If gauges or other aids are needed to verify the proper installation of the fasteners, the Contractor shall furnish the Engineer the gauges or aids in numbers as may reasonably be required.

1. If more than 1 wire fastener is proposed, e.g. different gauge or length of wire, for different joints, the fasteners shall be readily distinguishable.

2. Wire fasteners shall not be used to join more wires, or larger wires, than for which they were tested and approved.

3. As a minimum, a fastener shall be installed at intervals of 4 inches to 6 inches at the location where mesh wire meets selvedge or edge wire.

G. Fastener Materials:

1. Galvanized wire fasteners shall be used with galvanized gabions.

2. Aluminized wire fasteners shall be used with aluminized gabions.

3. Stainless steel overlapping rings or interlocking rings shall be used for stainless steel gabions.

4. PVC coated wire spiral binders shall be used for PVC coated gabions.

H. Fastener Properties:

1. Galvanized wire fasteners shall conform to ASTM A764 with Type III coating.
2. Aluminized wire fasteners shall conform to ASTM A809 for wire diameter and coating, with tensile strength equal to ASTM A764, Table 2.
3. Stainless steel wire fasteners shall conform to ASTM A313, Grade 302.
4. Spiral binder fasteners shall be formed with wire having at least the same thickness and coating as the basket mesh wire.
5. Twist tie fasteners shall meet the requirements of lacing wire, as specified in Subsection 610.02.10, "Lacing Wire."

CONSTRUCTION

610.03.01 EARTHWORK

A. The areas where riprap or wire mesh gabions are to be placed shall be graded to the required lines and grades as shown on the plans or as directed by the Engineer.

B. Any excavations or backfill required to achieve such grade shall conform to the provisions of ***Section 206, "Structure Excavation,"*** and ***Section 207, "Structure Backfill."***

610.03.02 FILTER PLACEMENT

A. Filter material shall be spread uniformly on the prepared foundation surface in a manner satisfactory to the Engineer, and to the slopes, lines, and grades as shown on the plans or as specified by the Engineer.

1. Placing of a filter material by methods that will segregate particle sizes will not be permitted.
2. Any damage to the foundation surface during filter placement shall be repaired before proceeding with the work.
3. The filter materials shall be placed and placement shall be approved and accepted before proceeding with the work.
4. The filter materials shall be placed and finished to present a reasonably even surface free from mounds or windrows.
5. Compaction of the filter materials shall conform to the requirements shown on the plans or as outlined in the Special Provisions.

B. Filter fabric shall be installed in accordance with the manufacturer's recommendations and in manner that will not tear, puncture, or shift the fabric.

C. Joining edges of the filter fabric shall be overlapped a minimum of 18 inches.

D. Filter fabric placed behind and/or beneath gabion or gabion mattress structures shall have a minimum permeability of 0.15 inch/second and shall be designed to retain the fine particles of the subsoil while releasing any hydrostatic pressure buildup.

610.03.03 RIPRAP

A. Stone for riprap shall be placed in a manner that will produce a well-graded mass of stone with a minimum percentage of voids.

1. The entire mass of stone shall be placed in conformance with the lines, grades, and thicknesses shown on the plans.
2. Riprap shall be placed to its course thickness in 1 operation and in such a manner as to avoid displacing underlying material.
3. When filter fabric is used under the riprap, the height from which the stone is dropped shall be minimized to avoid fabric damage.
4. Placement of stones shall begin at the bottom of the slope and proceed upward to the top.

B. The large stones shall be well distributed and the entire mass of stone shall conform to the gradation specified.

1. All material placed as riprap protection shall be so placed and distributed that there is no large accumulation of either the larger or smaller sizes of stone.
2. Placing of riprap in layers, or by dumping into chutes, or by similar methods likely to cause segregation will not be permitted.

610.03.04 GROUTED RIPRAP

A. When grouted riprap is specified, the stone shall be laid as set forth above for riprap.

B. The spaces between the stones shall then be filled with grout as directed, and in accordance with ***Subsection 706.03.05, "Riprap Grout."***

C. Sufficient grout shall be used to completely fill all voids, except that the face surface of the stone shall be left exposed.

D. After grouting is completed, the surface shall be cured as specified in ***Section 502, "Concrete Structures"*** for a period of at least 3 days.

610.03.05 SACKED CONCRETE RIPRAP

A. The sacks shall be filled with concrete, loosely placed, with enough room left at the top to fold to retain the concrete at the time of placing.

1. Not more than 1 cubic foot of concrete shall be placed in each sack.
2. Immediately after being filled with concrete, the sacks shall be placed and lightly trampled to cause them to conform with the earth face and to adjacent sacks in place.

B. The slopes on which the sacked concrete riprap is to be placed shall be finished true to line and grade.

1. The first course shall consist of a double row of stretchers laid in a neatly trimmed trench.
2. The second course shall consist of a single row of headers.
3. The third and remaining courses shall consist of stretchers.

4. Courses shall be placed in such a manner that joints in succeeding courses are staggered.
5. All dirt and debris shall be removed from the top of the sacks before the next course is laid thereon.
6. Stretchers shall be placed so that the folded ends will not be adjacent.
7. Headers shall be placed with the folds toward the earth face.
8. Not more than 4 vertical courses of sacks shall be placed in any tier until initial set has taken place in the first course of any such tier.

C. When, in the opinion of the Engineer, there will not be proper bearing or bond for the concrete due to delays for any cause, a small trench shall be excavated back of the row of sacks already in place. The trench shall be filled with fresh concrete before the next layer of sacks is laid.

D. Sacked concrete riprap shall be cured in accordance with **Section 702, "Concrete Curing Materials and Admixtures."**

610.03.06 WIRE MESH GABIONS AND GABION MATTRESSES

A. Prior to the assembly and placement of the wire mesh gabions, a representative of the gabion manufacturer shall be present at the construction site for 1 day of placement or construction to demonstrate the method of assembling, interconnecting, stone filling, and closing the gabion, unless otherwise specified in the Special Provisions.

B. Construction of the gabion structure shall not proceed until the Engineer approves the Contractor's assembly and placement methods.

C. Gabion baskets shall first be assembled as empty units.

1. The panels and diaphragms shall be connected to the base panel, rotated into position, and joined along the edges with lacing wire, spiral binders, or approved wire fasteners.
2. When joined with lacing wire, the lacing wire shall be tightly looped at intervals of not more than 6 inches along the seams so that single and double loops are alternated.
3. When joined with preformed spiral binders, thread the spirals along the panels' edges through every mesh and crimp the spirals ends to secure them in place.
4. When joined with alternate fasteners, the fasteners shall be properly installed as specified in ***Subsection 610.02.11, "Wire Fasteners."***
5. For either method, there shall not be any opening greater than 2 inches (maximum line dimension) along the joined edges or at the corner of the gabion basket.

D. Empty gabion baskets shall be placed into position, over the filter fabric when required, on the prepared foundation.

1. Empty gabion baskets shall be joined successively to the next empty gabion basket before filling with stone.
2. Each row, tier, and layer of baskets shall be reasonably straight and shall conform to the line and grade shown on the plans or established by the Engineer.

3. The empty gabion baskets shall be fastened to the adjacent baskets along the top and vertical edges.

4. Each layer shall be fastened to the underlying layer along the front, back, and ends.

5. Unless otherwise shown on the plans, the vertical joints between basket units of adjacent tiers or layers shall be staggered by at least one cell along the length of the structure.

E. All fastening of adjacent baskets shall be done with lacing wire, spiral binders, or approved wire fasteners in order to obtain a monolithic structure. The method of fastening shall meet the same requirements as that specified for assembling individual gabion baskets.

F. Fastening shall be made through selvedge-to-selvedge or selvedge-to-edge wire connection. Mesh-to-mesh or selvedge-to-mesh wire connection is allowed along vertical edges or in the case where baskets are offset or stacked, and selvedge-to-mesh or mesh-to-mesh wire connection would be necessary.

G. Before filling each gabion basket with stone, tension may be applied to the empty baskets to achieve a uniform alignment and shall be accomplished to prevent any possible unraveling.

1. Welded wire mesh gabions do not require stretching.

2. The finished gabion structure shall have no gaps along the perimeter of the contact surfaces between adjoining gabion basket units.

H. The gabion cells shall be carefully filled with stone placed by hand and/or machine so that the alignment of the structure will be maintained to avoid bulges and minimize voids.

1. All exposed stone surfaces shall have a reasonable smooth and neat appearance.

2. No sharp stone edges shall project through the wire mesh.

I. The gabion baskets stone-fill may be either cobbles or crushed stone.

1. The stone shall be clean, hard, durable, and of suitable quality to ensure suitable performance in the gabions or gabion mattresses.

2. The stone shall be free from cracks, seams, and other defects that would tend to increase its deterioration in the gabion baskets.

3. The inclusion of dirt, sand, clay, debris, and rock fines will not be permitted.

4. Stone-fill used in the gabions and gabion mattresses shall be a well-graded mixture with sizes ranging between 4 inches and 8 inches in diameter for gabions 1 foot or greater in height, and between 3 inches and 6 inches in diameter for gabion mattresses 9 inches or less in height.

J. The gabion cells in any row or layer shall be filled in stages so that local deformations may be avoided.

1. At no time shall any cell be filled to a depth exceeding 12 inches more than any adjacent cell.

2. The maximum height from which the stone may be dropped into the basket units shall be 3 feet.

K. During filling operations, internal connecting wires shall be placed in all exposed front and side gabion units in the following manner:

1. For gabion cells with a 36-inch height:

a. Stone shall be placed to a depth of 1/3, 12 inches, after which a minimum of 2 equally spaced internal connecting wires shall be placed in each cell, connecting the front and back faces of the compartment.

b. For corner units, internal connecting wires shall be placed in both directions.

c. The connecting wires shall be looped around 2 twisted wire mesh openings, or a welded wire joint, at each basket face, and the wire terminals shall be securely wrapped to prevent their loosening.

1) This operation shall be repeated when the cell is 2/3 full.

2) In welded mesh gabions, these cross-ties or stiffeners are made from lacing wire and placed across the comers of the gabion cells at 12 inches from the comers, thus providing a diagonal bracing. Lacing wire or preformed hooked wire stiffeners may be used.

2. For thinner gabion cells:

a. Internal connecting wires are not required except when 18 inch baskets are used to build exposed vertical surfaces.

b. In this case, the procedures under Subparagraph 1. above shall be followed, except that the internal connecting wires shall be placed at 9 inches from the base.

610.03.07 PARTIALLY GROUTED RIPRAP

A. When grouted riprap is specified, the stone shall be laid as set forth above for riprap.

B. The spaces between the stones shall then be filled with grout as directed, and in accordance with ***Subsection 706.03.05, "Riprap Grout."***

C. Sufficient grout shall be used to fill 1/3 to 1/2 of the void spaces, and in accordance with Subsection 706.03.05, "Riprap Grout". The target distribution of grout within the riprap matrix is such that about two-thirds of the grout should reside in the upper half of the riprap layer, with one-third of the grout penetrating into the lower half.

D. No grout should penetrate deep enough to come in contact with any underlying filter.

E. The grout shall "glue" individual stones to neighboring stones at their contact points, but leaves relatively large voids between the stones.

F. Conglomerate-like elements should be present in the riprap after partial grouting.

G. After grouting is completed, the surface shall be cured as specified in Section 502, "Concrete Structures" for a period of at least 3 days.

END OF SECTION 610

SECTION 611 – CONCRETE SLOPE PAVING

DESCRIPTION

611.01.01 GENERAL

A. This work shall consist of constructing concrete slope paving and concrete mortar slope paving including aprons and cutoff walls in connection therewith, to the lines and grades established by the Engineer and in accordance with the design shown on the plans.

MATERIALS

611.02.01 GENERAL

A. Materials shall conform to the following sections:

Materials	Section
Portland Cement Concrete	***501***
Reinforcing Steel	***505***

B. Concrete mortar slope paving shall consist of a mixture of 1 part Portland cement to 4 parts sand, thoroughly mixed in a dry state prior to mixing with water.

1. Measurement may be either by volume or weight.
2. Before placing, all lumps 3/8 inch and over shall be removed by screening.
3. Sand shall conform to ***Subsection 706.03.03, "Fine Aggregate."***
4. An air-entraining admixture shall be added to the concrete mortar at a rate of 4 percent to 7 percent.

C. Reinforcing for the slope paving and cutoff walls shall be reinforcing steel in accordance with the Contract Drawings and ***Section 505, "Reinforcing Steel."***

D. Header boards consisting of 2-inch by 4-inch redwood lumber furnished and placed in the concrete or mortar slope paving shall be as shown on the plans. Lumber used in the construction of header boards shall be commercial grade heart redwood, S4S.

E. Nails used in construction of header boards shall be commercial quality galvanized nails.

F. Concrete for the concrete slope paving and cutoff walls shall be modified Class A or AA using Type V cement (6.0 sack minimum, 0.53 water/cement ratio), having a minimum twenty-eight (28) day compressive strength of 3000 psi having a slump not to exceed 4-inches.

CONSTRUCTION

611.03.01 EARTHWORK

A. The subgrade for paved ditches and slope paving shall be formed by excavating to the required depth below the prepared finish surface grade in accordance with dimensions and design indicated on the plans or as directed by the Engineer.

B. The subgrade shall be thoroughly compacted.

1. Any soft, spongy, or other unsuitable material shall be removed to the depth directed by the Engineer, backfilled with suitable material, and thoroughly compacted.

2. Water shall be sprinkled on the subgrade during compaction.

3. The subgrade shall be sufficiently moist prior to placing concrete or mortar to prevent absorption.

C. Excavations for trenches, footings, cutoff walls, and so forth shall conform to ***Section 206, "Structure Excavation."*** Gradation and compaction requirements on structure backfill will not apply.

611.03.02 GENERAL

A. Concrete, after placing, shall be tamped until it is thoroughly consolidated and mortar flushes to the surface.

1. If the slope is too steep to permit the use of concrete sufficiently wet to flush with tamping, the concrete may be tamped until consolidated and a mortar surface 1/4-inch thick troweled on immediately.

2. The mortar shall consist of 1 part Portland cement and 3 parts clean, sharp sand.

3. The mortar surface shall be considered as a part of the concrete and no additional allowance will be made therefor.

B. After striking off to grade, the concrete shall be hand floated with wooden floats not less than 4 inches in width and not less than 30 inches in length.

1. Care shall be taken to prevent rotary marks of the hand floats.

2. The entire surface shall be broomed with a fine texture hair push broom to produce a uniform surface and eliminate float marks.

3. Brooming shall be done when the surface is sufficiently set to prevent deep scarring and shall be accomplished by drawing the broom down the slope leaving the marks parallel to the edges of the panel.

4. Joints shall be edged with a 1/4 inch radius edger prior to the brooming.

C. Materials for mortar that have been mixed for more than 45 minutes and have not been incorporated in the work shall not be used unless otherwise permitted by the Engineer.

D. Concrete or mortar shall not be placed against frosted or frozen surface. If concrete or mortar is placed during cold weather, it shall be heated and protected during placing and curing as set forth in ***Section 501, "Portland Cement Concrete,"*** except concrete or mortar shall be maintained at a temperature of not less than 50 degrees F for 72 hours after placing and at not less than 40 degrees F for an additional 4 days.

E. The slope paving shall be constructed without expansion joints.

F. The mesh reinforcing shall be placed in the approximate center of the concrete mortar.

G. All joints shall be lapped 6 inches and run continuously throughout paving or between headers.

H. Concrete slope paving, aprons, and cutoff walls shall be cured as specified in **Section 502, "Concrete Structures."**

END OF SECTION 611

SECTION 614 – PAINTING

DESCRIPTION

614.01.01 GENERAL

A. This work shall consist of the preparation of surfaces to be painted and the application, protection, and drying of the required number of coats of paint of the kinds and at the points specified or ordered by the Engineer.

MATERIALS

614.02.01 GENERAL

A. Materials shall meet or exceed the minimum standards hereinafter set forth.

B. **Materials:**

1. The raw materials for use in the various paint formulas shall conform to the specifications designated by Federal or Military serial number or paint material code number under the various paint classifications hereinafter specified.
2. Subsequent amendments to the specifications quoted shall apply to all raw materials and finished products.
3. No "or equal" substitutions for any specified material shall be made without written consent of the Engineer.

C. **Manufacturing and Packaging:**

1. All manufactured paint shall be prepared at the factory ready for application.
2. The addition of thinner or other material to the paint after the paint has been shipped will not be permitted, unless so specified.
3. The finished paint shall be furnished in new, round steel containers of not more than 6-gallon capacity and of metal not thinner than 0.024-inch nominal thickness.
    a. The containers shall have lug type crimp lids with ring seals and be equipped with ears and bails.
    b. The containers shall meet U.S. Department of Transportation Hazardous Material Shipping Regulations.
    c. The containers shall be lined if necessary to prevent attack by the paint.
    d. The lining shall not come off the can as skins.
4. No finished paint shall be used until at least 7 days have elapsed from the date of its manufacture.
5. All containers of paint shall be labeled showing the exact title of the paint specification, California State specifications number, manufacturer's name, date of manufacture, and manufacturer's batch number.
6. Precautions concerning the handling and the application of paint shall be shown on the label of paint and solvent containers.

614.02.02 NUMBER OF COATS

A. Unless otherwise required in the contract documents, the number and kinds of coats of paint shall be as set forth in ***Section 714, "Paint and Pavement Markings."***

CONSTRUCTION

614.03.01 WEATHER CONDITIONS

A. Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather.

1. Except as provided below, painting will not be permitted when weather conditions during applications are such that the atmospheric temperature is at or below 40 degrees F or when freshly painted surfaces may become damaged by rain, wind, dust, or condensation, or when it can be anticipated that the atmospheric temperature will drop below 40 degrees F during the drying period.

2. If fresh paint is damaged by the elements, the paint shall be replaced by the Contractor at no additional cost to the Contracting Agency.

B. Subject to the approval of the Engineer in writing, the Contractor may provide suitable enclosures to permit painting during inclement weather.

1. Provisions shall be made to control atmospheric conditions artificially inside the enclosures within the limits suitable for painting throughout the painting operation.

2. The cost of providing and maintaining such enclosures shall be considered as included in the prices paid for the various contract items of work and no additional payment will be made therefore.

614.03.02 APPLICATION – GENERAL

A. Painting shall be done in a neat and workmanlike manner.

B. Unless otherwise specified, paint shall be applied by brush, roller, or spray methods.

1. Brushes shall have sufficient body and length of bristle to spread the paint in a uniform coat.

2. In general, the primary movement of the brush shall be such as to fill thoroughly all irregularities in the surface, after which the coating shall be smoothed by a series of parallel strokes.

3. Paint shall be evenly spread and thoroughly brushed out.

4. If a considerable amount of brush marks appear, it will be considered that the paint has been improperly applied.

5. Rollers shall be of a type that do not leave a stippled texture in the paint film.

C. Work that is defective shall be refinished or repainted as directed at no additional cost to the Contracting Agency.

D. On surfaces that are inaccessible for brushing, the paint shall be applied by sheepskin daubers or by other means approved by the Engineer.

E. If spray methods are used, the operator shall be experienced. Runs, sags, thin areas in the paint coat, or skips and holidays shall be considered as evidence that the work is unsatisfactory and the Contractor may be required to apply the remainder of the paint by brush.

F. Mechanical mixers shall be used to mix the paint.

1. The paint shall be mixed to thoroughly blend the pigment and vehicle together.

2. Paint shall be kept mixed while being applied.

G. Paint specified or formulated shall be ready for application and thinning will be allowed only on direction of the Engineer.

H. The Contractor shall protect all parts of the structure being painted against disfigurement by spots of paint or paint materials.

1. When paint is being applied on structures carrying public traffic, the Contractor shall be responsible for damage caused by Contractor's operations to passing vehicles or persons.

2. The Contractor shall use shields or other protective means to guard against such damage.

I. Paint stains that result in unsightly appearance shall immediately be removed by the Contractor at no additional cost to the Contracting Agency.

614.03.03 SURFACE PREPARATION OF STEEL

A. The following methods of surface preparation apply to steel surfaces. Unless otherwise specified, the sand blasting method shall be used.

B. **Sand Blasting:**

1. Dirt, mill scale, rust, stain, old paint, and other foreign material shall be removed from steel surfaces by an approved blast cleaning apparatus.

2. Blast cleaning shall be sufficient to give the surface the appearance of unpolished cast aluminum.

3. Abrasives used for blast cleaning shall be clean dry sand, mineral grit, steel shot, or steel grit, at the option of the Contractor, and shall be of a grading suitable to produce satisfactory results.

4. The use of abrasives other than those specified herein will not be permitted unless approved in writing by the Engineer.

5. When sand blasting is being performed on structures open to traffic, the Contractor shall provide suitable protective devices to prevent damage to traffic.

6. When sand blasting is being performed near machinery, all journals, bearings, motors, and moving parts shall be sealed against entry of sand dust before sand blasting begins.

7. Unless otherwise authorized by the Engineer, sand blasted surfaces shall be primed or treated the same day sand blasting is done.

8. If cleaned surfaces rust before painting is accomplished, the surfaces shall be recleaned by the Contractor.

C. **Washes:**

1. Rust-inhibitor chemical washes shall be applied to freshly sand blasted steel surfaces prior to the application of the first undercoat of paint, except when the first undercoat of paint is applied to the cleaned surfaces within a 4-hour period after cleaning, washes will not be required.
2. Washes shall be applied in not more than 4-hour intervals.
3. If, in the opinion of the Engineer, atmospheric conditions are such that corrosion forms on freshly sand blasted surfaces in less than 4 hours, treatment may be required at more frequent intervals.
4. Rust-inhibitor chemical washes may be applied by brush or spray, and the washes shall be applied in a careful manner to ensure that all surfaces are covered.
5. During the application of the rust-inhibitor chemical wash, no sand blasting will be permitted in the areas being treated.
6. No paint shall be applied until the treated surfaces have dried.
7. The first undercoat of paint shall be applied to the treated surfaces the same day that cleaning and washing have been done.

D. **Steam Cleaning:**

1. Dirt, grease, loose chalky paint, and other foreign material that has accumulated on the previously painted surfaces shall be removed with an approved steam cleaning apparatus which shall precede all other phases of cleaning.
2. It is not intended that sound paint be removed by this process.
3. Subsequent painting shall not be performed until the cleaned surfaces are thoroughly dry and in no case in less than 24 hours after cleaning.
4. A detergent soap consisting of 45 percent sodium metasilicate, 43 percent sodium sesquisilicate, 10 percent sodium tetraphosphate, and 2 percent Naccanol shall be added to the feed water of the steam generator at the approximate rate of 1 pound of detergent per 200 pounds of water.
5. Any residue that may accumulate on cleaned surfaces shall be removed by flushing with fresh water, but washing down the cleaned surfaces will not otherwise be required.

E. **Hand Cleaning:**

1. Dirt, loose rusts, mill scale, dead paint, or paint that is not firmly bonded to the metal surfaces shall be removed by hand or powered wire brushes, hand scraping tools, or sandpaper.
2. Pneumatic chipping hammers will not be allowed unless authorized in writing by the Engineer.
3. Hand cleaning shall be sufficient to remove all loose material that would prevent the bond of succeeding coats of paint.

F. If the amount of steel to be painted exceeds 100 tons, the surface shall be prepared by method B, "Sand Blasting"; however, if the amount to be painted is 100 tons or less, the surface may be prepared by method E, "Hand Cleaning."

614.03.04 PAINTING STRUCTURAL STEEL

A. **Paint:**

1. Unless otherwise required in the contract documents, the paints to be applied to steel surfaces shall conform to ***Section 714, "Paint and Pavement Markings."***
2. The undercoats shall consist of a minimum dry film thickness of 1 mil per coat.
3. The finish coat shall consist of a minimum dry film thickness of 1 mil.
4. The total thickness of all coats shall be not less than 3 mils.
5. Excessively thick coats of paint will not be permitted.
6. The thickness of each coat shall be limited to that which will result in uniform drying throughout the paint film.

B. **Field Cleaning:**

1. Unless otherwise specified in the contract documents, after erection and riveting or welding, all surfaces of unpainted structural steel that will be exposed to air shall be sand blasted in accordance with ***Subsection 614.03.03, "Surface Preparation of Steel."***
2. Any damage to sound paint, on areas not designated for treatment, resulting from the Contractor's operations shall be repaired to the satisfaction of the Engineer.

C. **Painting:**

1. Painting of structural steel prior to erection will be limited to surface preparation and one undercoat of paint.
2. Any deficiencies in the first coat of paint shall be corrected to the satisfaction of the Engineer, prior to the application of succeeding coats of paint.
3. Surfaces exposed to the atmosphere that would be inaccessible for painting after erection shall be painted the full number of coats prior to erection.
4. The surface of the paint coat being covered shall be free from moisture, dust, grease, or any other deleterious material that would prevent the bond of the succeeding paint coats.
5. In spot painting, any old paint that lifts after application of the first spot coat shall be removed by scraping and the area repainted before application of the next coat.
6. The application of the finish coat will be permitted until the required total film thickness of the undercoats of paint, as described in A, above, is obtained.
7. Open seams at contact surfaces of built-up members that would retain moisture shall be caulked with red lead paste before applying the second undercoat of paint.
8. Metal surfaces embedded in concrete need not be painted.

D. **Machine Finished Surfaces:**

1. With the exception of abutting chord and column splices and column and truss shoe bases, machine finished surfaces shall be coated with a rust inhibitor that can be easily removed.

2. Surfaces of iron and steel castings that have been machine finished shall be painted with a coat of shop paint.

E. **Frames and Grates:**

1. Prior to installation, all surfaces of frames and grates exposed to the atmosphere shall be painted with 2 coats of paint.

2. Unless otherwise specified in the contract documents, the exposed surfaces shall be painted after installation with 1 finish coat as specified for structural steel.

614.03.05 PAINTING TIMBER

A. **Paint:**

1. New timber requiring painting shall be painted with 3 coats of paint.

2. The paint used for various coats will be as specified in these specifications or in the contract documents.

B. **Preparation of Surfaces:**

1. Cracked or peeled paint, loose chalky paint, dirt, and other foreign matter shall be removed by wire brushing, scraping, or other approved means immediately prior to painting.

2. Unpainted timber shall be thoroughly dry before paint is applied.

C. **Painting:**

1. When permitted in writing by the Engineer, the first coat of paint may be applied prior to erection.

2. After the first coat has dried and the timber is in place, cracks, checks, nail holes, and so forth shall be puttied flush with the surface and allowed to dry before the second coat is applied.

3. Skips, holidays, thin areas, or other deficiencies in any coat of paint shall be corrected to the satisfaction of the Engineer before the succeeding coat is applied.

4. The surface of the paint coat being covered shall be free of any deleterious material before any additional paint is applied.

END OF SECTION 614

SECTION 619 – OBJECT MARKERS AND GUIDE POSTS

DESCRIPTION

619.01.01 GENERAL

A. This work shall consist of furnishing and installing object markers and guide posts of the design and at locations shown on the plans or established by the Engineer.

MATERIALS

619.02.01 GENERAL

A. Materials shall conform to ***Section 721, "Object Markers and Guide Posts."***

CONSTRUCTION

619.03.01 GENERAL

A. Target members, object markers, and reflectors appropriate to the color involved shall be assembled, fastened, set, and aligned in accordance with the details and dimensions shown on the plans.

B. All fastenings shall be tight.

619.03.02 RESET

A. Reset object markers and guide posts shall be erected, using salvaged materials, and shall be similar in type to the original construction.

B. Any new materials necessary to rebuild the markers shall be furnished by the Contractor, shall be the same as those in the original, if available, and the cost thereof shall be included in the contract price for the work.

C. The Contracting Agency reserves the right to furnish the Contractor with such new materials as the Contracting Agency deems advisable, and these materials shall be used in the resetting of the markers in lieu of salvage materials which the materials replaced.

END OF SECTION 619

SECTION 621 – MONUMENTS

DESCRIPTION

621.01.01 GENERAL

A. This work shall consist of furnishing and installing permanent survey monuments, constructed in accordance with the design and drawings shown on the plans or ordered by the Engineer.

B. All monuments destroyed and/or damaged shall be installed by the Contractor in accordance with the Uniform Standard Drawings, and under the direct supervision of the Engineer. The Contractor shall coordinate his work with the Engineer.

C. The Contractor shall coordinate Contractor's work with the Registered Land Surveyor.

MATERIALS

621.02.01 GENERAL

A. Monuments shall be constructed of Portland cement concrete, and shall be of Type I, Type II, Type III, or Type IV as shown in the Standard Drawings.

CONSTRUCTION

621.03.01 INSTALLATION

A. The monuments shall be set to assist in reestablishment of the center line for future use and shall be set at the beginning and end of each project, at the beginning and end of each curve, at any angle point, at street intersections, and to replace or reference Section Corners or other Government Land Corners.

B. The monuments may perpetuate a point or reference a point.

C. An as-built set of plans for the project, showing the exact location of all monuments set, shall be prepared by a Registered Land Surveyor and filed with the County Surveyor prior to acceptance of the project.

END OF SECTION 621

SECTION 622 – CONSTRUCTION SURVEYING BY THE CONTRACTOR

DESCRIPTION

622.01.01 GENERAL

A. The Contractor shall, under supervision of a Professional Land Surveyor, registered in the state of Nevada, furnish and set construction stakes establishing locations, lines, and slope stakes for roadway, storm drain, drainage structures, sewer, laterals, and for all other improvements for project necessary to ensure conformance of work to lines, elevations, locations, and grades as shown on the Plans and in these Special Provisions. Any horizontal or vertical discrepancies shall be reported to Engineer prior to commencement of construction. Any revisions or changes approved by Engineer that affect lines, grades, elevations or locations of any improvement shall be indicated on As-Built (Record) Drawings.

B. If necessary, the Contractor shall also perform and provide to the Engineer those items described in subsection 203.04.01 of the USS. Any revisions or changes approved by the Engineer that affect the lines, grades, elevations or locations of any improvement shall be indicated on the As-Built (Record) Drawings.

C. Contractor shall preserve property line and corner survey points. If their destruction is determined by Engineer to be unavoidable, and their replacement is not called for on the plans, Owner shall replace or pay for their replacement under this contract as determined by Engineer. Markers that are disturbed or destroyed by Contractor's operations without prior approval by the Engineer shall be replaced by Contractor at no additional cost to the Owner. Replacement shall be done only by a Nevada Professional Land Surveyor and in accordance with the USS. A monument tie sheet for replacement of permanent survey monuments shall be submitted to Engineer for approval.

D. When a permanent survey marker and/or monument is located within the construction area of any roadway, storm drain, drainage structures, sewer line or channel improvement, the Contractor shall adjust the cover or replace the monument as noted on the plans. The cost of replacement or adjustment of said monuments shall be included in the lump sum bid for Construction Survey. If monuments are to be installed as part of the work, they shall be placed in accordance with the USD numbers 239 through 243 and Section 621 of the USS.

E. The Contractor shall, under the supervision of a Professional Land Surveyor, prepare and provide GPS location and mapping of as-built conditions for all proposed sanitary sewer and storm drainage facilities as described on the Project Drawings and in this Section.

MATERIALS

622.02.01 BLANK

CONSTRUCTION

622.03.01 GENERAL

A. Prior to all work in this section, the Contractor shall carefully inspect all installed work and verify that all such work is complete to a point where this installation may properly commence.

B. The Contractor shall verify that all work can be installed in accordance with all pertinent codes and regulations, Contract Drawings and referenced standards.

C. The Contractor shall verify that there are no conflicts with existing utilities prior to the start of work.

D. In event of a discrepancy, the Contractor shall immediately notify the Engineer in writing.

E. Installation of work in areas of discrepancy shall not proceed until all such discrepancies have been fully resolved.

F. After stakes and marks have been set, it shall be the responsibility of the Contractor to protect the stakes and marks. Should any of the stakes or marks be destroyed or disturbed by the Contractor's operations or otherwise, the costs of replacing said stakes or marks shall be paid by the Contractor.

G. The Engineer, at his discretion, may periodically have survey work performed to verify conformance to the construction plans. Any nonconformity found to be the fault of the Contractor, or the Professional Land Surveyor, shall be corrected at no additional cost to the Owner.

H. Upon completion of the project and as a condition for final payment authorization, the Contractor shall furnish to the Engineer a Record of Survey/monument tie map and a certification attested to by the Professional Land Surveyor that the work performed for this contract has been constructed to the lines and grades as described in the As-built (Record) Drawings. When requested, the Contractor shall also provide the Engineer with copies of all field notes, computations, and other related work performed by the Professional Land Surveyor.

622.03.02 FINAL ACCURACY

A. Surface Drainage Structures (including all concrete or asphalt gutters and drains) shall be installed within 0.05 feet horizontally and 0.05 feet vertically from the location taken from the project plans, and shall not vary more than 10 percent of the gradient shown on the plans.

B. Monument Cases and Brass Caps shall be centered to within 0.01 feet horizontally of the position as called for on the plans, and the ties to that monument.

C. Sanitary and Storm Drainage Sewer Systems shall be installed within 0.05 feet horizontally and 0.05 feet vertically of the exact location taken from the project plans. In

addition, the gradient of any 10-foot section of pipe shall not vary by more than 10 percent of the gradient shown the project plans

622.03.03 INSTALLED/EXPOSED UTILITY SURVEYING

A. All measurements are to be made by the Surveyor who will be certifying the project as constructed.

B. The contractor is responsible for coordinating with the Surveyor during construction and shall provide access to all utilities prior to being buried; allowing accurate horizontal and vertical measurements to be acquired by the Surveyor. In the event of any discrepancies identified by CLV and at no cost to CLV, the Contractor shall verify the location and measurements of any buried utilities.

C. After construction of the approved plans and before backfilling, survey shall be conducted indicating the size, horizontal and vertical location, and configuration of any utility constructed with this project or utility exposed during construction, and utility encasement if applicable. Utility final location information shall be described by coordinates which shall be based on the official horizontal and vertical control networks of the City of Las Vegas and be certified by a Nevada professional land surveyor to have positional certainties within +/- 0.3-ft.

D. Survey measurements for utilities constructed or exposed during the course of construction including but not limited to pipes, manholes, drop inlets, conduits, cables, encasements, boxes, vaults and appurtenances shall be located to the extent possible within the excavation area. Measurements shall be taken at a minimum of 100-ft intervals, at all exposed angle points, deflections of the utility exceeding +/- 0.5-ft, at all exposed points that enter/exit the excavation or the public right-of-way, and sufficient measurements to accurately define curving layout.

E. Potholes performed by the contractor prior to or during construction shall be surveyed indicating the size, location, burial depth, and configuration of the utility. Pothole location information shall be tied to the official horizontal and vertical control networks of the City of Las Vegas and be certified by a Nevada professional land surveyor.

F. Utility final location information shall be submitted on paper and in electronic form, on a form specified by the City Surveyor. Submittal requirements and examples are included in Appendix E.

G. Interim and final survey progress reports shall be submitted to the Engineer certifying sufficient survey measurements have been performed prior to backfilling as required by this section on a weekly basis or as directed.

END OF SECTION 622

SECTION 624 - ACCOMMODATIONS FOR PUBLIC TRAFFIC

DESCRIPTION

624.01.01 GENERAL

A. The work shall consist of providing safe and effective work areas and to warn, control, protect and expedite vehicular and pedestrian traffic through the construction zone. It shall be the sole responsibility of the Contractor to provide for the safety of the traveling public within the limits of the project.

B. The work shall be performed in accordance with the MUTCD Latest Edition and as specified in these Special Provisions.

624.01.70 SPECIAL TRAFFIC CONTROL, LANE RESTRICTIONS OR ACCESS ISSUES:

A. Refer to ***Section 107.07, "Traffic and Access"*** for traffic and access requirements.

MATERIALS

624.02.01 GENERAL

A. The materials used for the construction and maintenance of facilities required for the free flow of public traffic and for protection of the work shall be those prescribed for the several items which constitute the finished work and shall conform to all the requirements for such materials as set forth herein.

CONSTRUCTION

624.03.01 SPECIAL DETOURS

A. Special detours shall be constructed as shown on the Traffic Control Plan prepared by the Contractor. Detour locations indicated on the Traffic Control Plan may be approximate only; the exact location shall be staked by the Contractor's surveyor.

B. Grading for special detours shall consist of motor grader work, supplemented where necessary by other mechanical equipment, to provide the specified roadbed width and a grade line free from breaks or rolls of sufficient magnitude to be hazardous to traffic. This work shall conform to ***Subsection 107.21, "Dust Control."***

C. When grading of special detours has been completed and approved by the Engineer and, if required on the plans or in the Special Provisions, the special detours shall receive surfacing materials of the kind and type specified, and the detours shall be placed and constructed in accordance with the requirements for the particular materials used.

D. Water shall be applied to detours in amounts necessary to attain the compaction of graded sections and of surfacing materials.

E. Maintenance on special detours shall consist of performing any work necessary to maintain the detour satisfactorily, as ordered by the Engineer.

F. Eradication of special detours shall consist of blade grader and scraper work supplemented by other equipment if needed. Eradication shall be performed to the extent

that the ground will be restored as nearly as feasible to the original, and material disposed of, all as directed by the Engineer.

G. It is the City of Las Vegas's policy that under no circumstances will travel on a temporary gravel surface be permitted for longer than fifteen (15) calendar days. Temporary gravel surfaces shall be graded, watered and maintained at all times to provide a smooth dust free traveled surface.

H. All temporary detours and/or bypasses that are expected to be in service for more than fifteen (15) calendar days shall be hard surfaced with a minimum of 1-1/2 inches of AC pavement and maintained in a smooth and usable condition at all times for the duration of the detour and/or bypass.

624.03.02 FLAGGERS

A. If, in the opinion of the Engineer, controlled traffic is necessary for protection of the work or for safety of public traffic, flaggers shall be employed by the Contractor.

B. Flaggers shall have completed an approved instructional course in flagging procedures.

C. A prospective flagger shall possess a valid flagger card attesting satisfactory completion of said instructional course conducted by the Nevada Department of Transportation or some other approved course given by another governmental agency.

D. Proper advance warning signs shall be in place when flaggers are working and removed when work requiring flaggers is completed.

E. Flaggers shall be used to assist trucks for safe ingress and egress whenever truck movements may interfere with safe passage through the work zone. The flaggers' first priority shall be to maintain the safe and efficient movement of the public traffic. In the event that a flagger is to flag at an intersection controlled by a stop sign they must bag the sign(s) prior to taking control of traffic. If a flagger is to flag at an intersection controlled by a traffic signal the traffic signal must be turned off prior to taking control of traffic. Any changes to regulatory signs or changes to a traffic signal shall be reversed at the end of every workday, unless approved by the traffic engineer. Failure to do so could result in an order to stop work.

F. The "Flagger Method" as outlined in Part VI of the MUTCD shall be used for all one lane, two-way traffic control.

624.03.03 PILOT CARS

A. If, in the opinion of the Engineer, it is necessary to afford additional protection to the work, workers, or public traffic, a pilot car and driver shall be used as the Engineer directs. This provision shall be in effect even though the pilot car and driver are not indicated on the plans or provided for in these specifications.

B. Pilot cars shall be suitable vehicles in good mechanical condition and shall carry a sign which shall comply with the design and mountings as shown on the standard drawings appended to the Special Provisions, or shown on the plans.

624.03.04 MAINTAIN BASE

A. When the proposal contains an item of "Maintain Base," the provisions of ***Subsection 109.03, "Extra and Force Account Work,"*** shall apply.

624.03.05 EQUIPMENT RENTAL

A. When the proposal contains an item of equipment rental, the use of such equipment shall be as directed by the Engineer or as indicated on the plans.

624.03.70 TEMPORARY STRIPING

A. The temporary traffic striping tape material shall conform to subsection 635.02.01 of the NDOT Standards. Placement of temporary pavement striping shall be by pilot line method and its use limited to fourteen (14) calendar days. The tape shall be four (4) inches wide and four (4) feet long and spaced every forty- (40) feet. The color of the tape shall match the color of the existing line. The double yellow line shall have two pieces of tape side by side with a four (4) inch space between, and spaced to the above increments.

B. Painted temporary striping shall be 4-inches wide and shall be continuous or intermittent in accordance with the MUTCD. Painted temporary striping shall not be used on the final wearing course of the pavement.

C. Existing pavement markings, either painted or raised pavement markers, which are not applicable and are within the transverse limits of the temporary travel lanes shall be removed to the satisfaction of the Engineer. Painting over existing markings will not be allowed.

624.03.71 TEMPORARY BRIDGES FOR VEHICULAR ACCESS

A. Where necessary or required for the convenience of the traveling public or individual residents, businesses or schools, The Contractor shall provide temporary bridges over all unfilled excavations at all street, driveway and alleyway, crossings unless otherwise directed by the Engineer. The bridges shall remain in place until the excavations have been properly backfilled to the satisfaction of the Engineer.

D. Temporary bridges for street crossings shall conform to the requirements of the authority having jurisdiction in each case, and the Contractor shall adopt designs furnished by said authority for such bridges or shall submit designs for approval by said authority as may be required. If plates are used, they must be capable of carrying the heaviest anticipated loads using the roadway, be properly anchored so as to prevent any transverse and/or any longitudinal shifting of the plate and must be certified by a structural engineer registered in the State of Nevada. Refer to the City of Las Vegas Trench Plate Requirements detail in Appendix “B”.

624.03.72 PIPE LAYING OPERATIONS

A. Pipe stored in the street rights of way within a barricaded work zone, with the approval of or at the direction of the Engineer, which is to remain one night or more shall be protected by Barrier Rail. Type B high intensity warning lights will be installed on the barrier rail at intervals not exceeding 25 feet.

E. During working hours, the Contractor shall have no more than three hundred (300) feet of open trench and/or structure excavation nor more than one half (1/2) of an intersection closed to vehicular traffic, except with specific written permission by the Engineer. During non-working hours, the Contractor shall have no more than one hundred (100) feet of open trench and/or structure excavation barricaded in accordance with these supplemental specifications. Pedestrian access crossings suitably equipped with handrails shall be

provided as directed by the Engineer. The cost of such crossings shall be included as a part of the traffic control bid item.

624.03.73 TRAFFIC CONTROL DEVICES

A. Trained and knowledgeable traffic control personnel shall be utilized to insure proper set-up and maintenance of traffic control devices and to assist in the safe movement of vehicles through the traffic control zone.

F. The Contractor from the public right-of-way shall remove all traffic control devices that are not in use or will not be used for a period greater than 24 hours. All traffic control devices that are determined by the Engineer to be unnecessary, confusing, or causing an unsafe condition, shall be removed by the Contractor from the public right-of-way immediately upon written notification by the Engineer. The Contractor shall not, at any time, use the sidewalk area to store unused barricades unless the sidewalk is closed and an approved barricade plan is provided for rerouting the pedestrians.

G. The Contractor shall maintain all barricades and other traffic control devices in clean and effective condition. The Contractor shall replace poorly maintained devices immediately upon notification by the Engineer.

H. The Contractor shall begin placing the barricades in the direction of traffic. The Contractor shall remove the barricades in a direction opposing traffic.

I. **Temporary Stop Signs**: All temporary stop signs shall be installed in a semi-permanent manner in the ground or pavement surface in accordance with Standard Drawing Number 249 of the USD.

624.03.74 TRAFFIC CONTROL SUPERVISOR

A. The Contractor shall designate a Traffic Control Supervisor who shall be responsible for initiating, installing and maintaining all traffic control devices as shown on the traffic and plans, as specified in the MUTCD, and revisions thereto, the USS, these supplemental specifications or as directed by the Engineer. When traffic control devices are on the project site the designated Traffic Control Supervisor shall be available to the Engineer twenty-four (24) hours a day for the duration of the contract. The Traffic Control Supervisor shall be an employee of the Contractor and under the supervision of the Superintendent. The person so designated shall be certified as a worksite traffic control supervisor by the ATSSA.

J. The Traffic Control Supervisor shall be capable of being on-site within thirty- (30) minutes of notification.

K. The traffic control supervisor shall make at least four (4) inspections of all traffic control devices each calendar day as follows:

1. Before beginning work
2. At mid shift
3. Half an hour after the end of the shift
4. Once during the period of non working hours

L. The Traffic Control Supervisor shall make a daily record of traffic control activities including a reference to the barricading in effect that day. The Project superintendent

shall sign the daily record each day attesting to its accuracy. The Contractor shall submit these records to the Engineer on a weekly basis.

624.03.75 REQUIRED PROTECTION FOR OPEN EXCAVATION DURING WORKING AND NON-WORKING HOURS

A. The following requirements apply to any open excavations where the difference in elevation between the pavement and the excavated area is greater than 6":

1. Any open excavations, in the roadway or within eighteen (18) feet of the roadway, which does not provide a 4:1 (horizontal: vertical) slope between the edge of pavement and the bottom of the excavation, shall be protected with portable precast concrete traffic barrier rails and six (6) feet high non-climb fence. All portable precast concrete traffic barrier rails shall be butted tight and pinned in accordance with the requirements of the Nevada Department of Transportation's Standard Drawing R-8.3.3, entitled "Portable Precast Concrete Barrier Rail", which is hereby incorporated into the plans.

2. Any open excavation further than eighteen (18) feet and less than three hundred (300) feet from any building or roadway, shall be, as a minimum, completely fenced with a six (6) foot high non-climb fence.

3. Any open excavation beyond three hundred (300) feet of any building or roadway shall be protected with a three (3) foot high earth berm completely around the excavation. Type II Barricades with Type B high intensity warning lights shall be spotted around the top of the berm after daylight hours.

4. Barrier rails and fencing may be required, during working hours, when determined by the Engineer, to be in the interest of public safety.

M. The following requirements apply to any open excavations adjacent to a sidewalk where the difference in elevation between the back of the sidewalk and the excavated area is greater than 6 inches:

1. The open excavation shall be protected, as a minimum, with a six (6) foot high non-climb fence.

END OF SECTION 624

SECTION 625 – CONSTRUCTION SIGNS

DESCRIPTION

625.01.01 GENERAL

A. This work shall consist of furnishing, erecting, maintaining, relocating, and removing work zone traffic control devices, including signs, channelizing devices, and lighting devices at locations set forth in the contract documents, or as directed by the Engineer, for the protection of the work, workers, and guidance and safety of the motoring and pedestrian public.

B. All work zone traffic control devices shall remain the property of the Contractor upon completion of the contract and shall be removed from the project by the Contractor.

C. All work zone traffic control devices shall conform to the latest edition of the *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD), published by the U.S. Department of Transportation, Federal Highway Administration, as well as the current edition of the Traffic Control Plans for Highway Work Zones for the Clark County Area, unless otherwise indicated on the plans or by the Special Provisions.

D. Regulatory signs shall be mounted so that the bottom of the sign will be a minimum of 5 feet above the ground surface or the pavement.

MATERIALS

625.02.01 GENERAL

A. It is expressly intended that a broad selection of material be granted the Contractor since work zone traffic control devices are in temporary use and new products become commercially available regularly.

1. Sign panels may be constructed of steel, aluminum, wood, or other approved material and be of a sound, durable nature.

2. The materials shall be of such quality to do the job for which they are intended and are subject to approval by the Engineer.

3. Signs and channelizing devices that have become dull, have flaking or peeling paint, are dirty or discolored, or are otherwise marred shall be repaired or replaced with acceptable units.

B. Reflective sheeting for all signs and channelizing devices shall conform to ***Subsection 716.03.01, "Reflective Sheeting."***

C. Reflective sheeting shall be used on all work zone signs and channelizing devices.

625.02.02 SIGN DIMENSIONS

A. Sign dimensions shown in the MUTCD are minimum standard.

1. Increases above this minimum are permissible and desirable where investigation has shown a larger sign is needed for adequate emphasis.

2. In the enlarging of signs, standard shapes and colors shall be used, and standard proportions shall be retained so far as practicable.

CONSTRUCTION

625.03.01 GENERAL

A. Before any detour, temporary route, or work zone is opened to traffic or imposed upon existing traffic, all necessary signs shall be in place.

B. Signs required by road conditions or restrictions shall be removed immediately when those conditions cease to exist or the restrictions are withdrawn.

C. Guide signs directing traffic to and on temporary routes or detours shall be removed when no longer applicable.

D. Signs and barricades shall be maintained in operable condition.

1. Care shall be exercised to keep the sign faces free of dust and splashed mud.

2. Any signs and barricades that become scarred, damaged, or destroyed shall be repaired immediately or replaced, at no additional cost to Contracting Agency and as directed by the Engineer.

E. The responsibility for the protection of the work, workmen, and public traffic will rest with the Contractor and the Contractor shall be liable for damages and injury suffered by reason of the Contractor's operations or any circumstances, conditions, actions, or negligence in connection therewith.

625.03.02 SIGN PLACEMENT

A. Signs shall be placed in conformance with the MUTCD.

B. All temporary stop signs shall be mounted on a post that is embedded in the ground a minimum of 18 inches or to a depth sufficient to prevent overturning by wind loadings and easy removal by vandals as approved by the Engineer with the following possible exceptions:

1. A flagger is used to supplement temporary stop signs. The temporary stop signs shall be post-mounted and embedded in the ground when no flagger is present.

2. Temporary stop signs may be used with a moving construction operation with frequent lane shifts only when construction is in progress and the flagger is present. When no construction is in progress and no flagger is present, the temporary stop signs shall be post-mounted and embedded in the ground.

625.03.03 SIGN SUPPORTS

A. Signs, posts, pole mountings, and sign foundations shall be constructed to hold signs rigidly in a proper and permanent position, and prevent the signs from swaying in the wind, or from being turned or otherwise displaced.

B. A portable or removable type of mounting may be used for signs required intermittently or that are frequently moved. Such a mounting shall be heavy enough not to turn over in the wind, and the base shall not be appreciably wider than the sign.

C. A portable or removable type of mounting for temporary stop signs may only be used in a moving operation during the time when construction personnel are present.

1. Such a mounting shall be heavy enough not to turn over in the wind.

2. Temporary stop signs shall be post-mounted and embedded in the ground after working hours when no flagger is present.

625.03.04 CHANNELIZING DEVICES

A. Projects closed to traffic shall be protected by appropriate channelizing devices, as approved by the Engineer, in conjunction with appropriate work zone warning signs.

B. If weighting of channelizing devices is necessary, sand bags may be used as long as a low center of gravity is maintained as approved by the Engineer.

625.03.05 PORTABLE CHANGEABLE MESSAGE SIGN

A. Portable Changeable Message Signs (PCMS) conforming to the MUTCD, Part 6, Section 6F.60 shall be used to advise the driver of road closures on streets with an 80-foot or greater right-of-way.

B. The PCMS shall be placed far enough in advance of the closed street to allow traffic ample opportunity to detour around the disrupted area.

C. The location and number of PCMS will be determined by the Engineer.

D. Solar powered panels shall be used in residential areas**.**

625.03.06 ARROW DISPLAYS

A. Arrow Displays conforming to the MUTCD, Part 6, Section 6F.61, Type B, shall be used to advise the driver of lane closures when so directed by the Engineer.

B. The Arrow Displays shall be required at the beginning of the taper and placed behind the barricades in the closed lanes, as required by the approved traffic control plan and as directed by the Engineer.

C. Solar powered panels shall be used in residential areas.

END OF SECTION 625

SECTION 626 – FINAL CLEANUP

DESCRIPTION

626.01.01 GENERAL

A. Before final acceptance, the Contractor shall remove or obliterate, insofar as feasible, all objects or disturbances of the ground which mar the landscape and were caused by Contractor's operations, whether or not part of the improvement.

B. This shall be required on all areas used or occupied by the Contractor within or outside the right-of-way limits.

CONSTRUCTION

626.03.01 FINAL CLEANUP

A. Rubbish, excess material, temporary structures, and discarded equipment shall be collected and disposed of as directed by the Engineer.

1. Burning is prohibited.
2. Pits or trenches for equipment setups or camp sites shall be filled and the ground restored, insofar as feasible, to its original conditions, within or outside of the right-of-way limits.
3. Temporary haul roads within the right-of-way limits shall be scarified and bladed to blend with surroundings.
4. Pits from which materials have been obtained shall be dressed and shaped to conform with the surrounding ground.
5. Waste shall be removed from the tops of banks and placed in the bottom of pit.
6. Unless otherwise specified or directed by the Engineer, banks of pits shall be cut to not steeper than 2:1 slopes to blend with the natural contours.
7. Bottoms of pits shall be reasonably smooth.
8. All other disturbances shall be removed or corrected as directed by the Engineer with particular attention to the abatement of any dust hazard.

B. Working areas and backslopes pertaining to the improvement shall be hand raked and loose objects including rocks and clods in excess of 2 inches in any dimension shall be removed from the site.

C. Pavement, curb and gutter, sidewalks, and driveways shall be swept or flushed and presented to the Contracting Agency in condition for maintenance without further work.

END OF SECTION 626

SECTION 627 – PERMANENT SIGNS

DESCRIPTION

627.01.01 GENERAL

A. This work shall consist of furnishing, erecting, relocating, and installing signs, sign supports, and other materials required for highway signs in accordance with the current edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) and these specifications, as shown on the plans, and as directed by the Engineer.

B. This item does not include street name signs or construction signs used for traffic control during construction.

C. The work shall generally consist of:

1. Overhead signs, including concrete foundations, steel sign posts and frames, and aluminum sign panels with reflective sheeting.

2. Ground mounted signs consisting of concrete foundations, steel sign posts, pole mounted signs, aluminum sign panels with reflective sheeting, and appurtenances.

D. This work does not include sign illumination systems.

627.01.02 SHOP DRAWINGS

A. When overhead sign structures are to be furnished, the Contractor shall submit to the Engineer 5 sets of shop drawings for each overhead sign structure for approval.

B. Fabrication of the overhead sign structures shall not commence until the shop drawings have been approved by the Contracting Agency.

C. Shop drawings for other than overhead signs will not be required; however, all signs shall conform to the plans and the MUTCD.

1. For signs which are shown on the Sign Summary Sheets and are not included in the MUTCD, special sign design sheets shall be furnished by the Contracting Agency to the bidders of the project.

2. The special design sheets shall include such information as letter heights, spacing between letters and words, borders, sign radii, and so forth.

3. These signs shall conform to the special design sheets as well as the drawings noted in the plans.

MATERIALS

627.02.01 GENERAL

A. Materials shall conform to ***Section 716, "Sign Materials."***

627.02.02 REFLECTORIZATION

A. All signs shall utilize Type XI retroreflective sheeting for sign background, letters, numerals, symbols, borders, and accessories.

B. All letters, numerals, symbols, borders, and accessories shall be directly applied to the sign background.

627.02.03 LETTERS, NUMERALS, SYMBOLS, AND ACCESSORIES FOR GUIDE SIGNS

A. All names of places and highways on guide signs shall be composed of lower case letters with initial capital letters.

1. The initial capital letters shall be 1-1/3 times the loop height of the lower case letters.

2. Other legends on guide signs shall be in capital letters.

B. The initial capital letters and numerals used shall be Series E, modified by widening the stroke-width to approximately 1/5 the letter or numeral height.

C. Tables of recommended letter spacing can be obtained from the FHWA.

D. Arrows that are used for large directional guides shall be in direct proportion to the arrows shown in the MUTCD.

CONSTRUCTION

627.03.01 PANEL FASTINGS

A. The panel sections shall be provided with suitable fastenings, as shown on the plans, to permit easy attachment to the supporting frames.

1. The fastenings shall be so designed as to carry the full design load with a factor of safety of not less than 1.5.

2. Panel sections shall be provided with closure strips at the joints.

B. Panel fastenings for use on sign panels covered with sign sheeting shall utilize nylon washers for contact between the sheeting and the metal washer.

627.03.02 CLOSURE STRIPS

A. Closure strip shall be anchored by aluminum rivets as shown on the plans.

B. Rivets shall be the same color as the sign face.

C. Closure strips are required only on aluminum sign panels.

627.03.03 INSTALLATION

A. Sign locations indicated on the plans are approximate only. Final determination of sign locations will be made in the field by the Engineer.

B. Signs and sign islands shall be constructed to the lines and grades given by the Engineer and in accordance with the design and locations shown on the plans.

C. All signs shall be erected as specified before, during, or immediately after the completion of bituminous plantmix surface operations.

D. The date of installation, consisting of month and year, shall be permanently stamped on the back of each sign with metal dies and shall be visible only on close inspection. The stamp shall be placed on the lower right hand corner when facing the rear of the sign.

E. Each sign face shall be thoroughly cleaned according to the reflective material manufacturer's recommendations.

1. All undesirable material that is visible on the face of the sign shall be removed.

2. The use of abrasives or other cleaning material that will scratch or otherwise deface the sign shall not be permitted.

F. Sign islands shall be constructed as roadway embankment in conformity with ***Section 203, "Excavation and Embankment."***

1. Structure excavation and backfill shall conform to ***Section 206, "Structure Excavation,"*** and ***Section 207, "Structure Backfill."***

2. Anchor bolts shall be set true to line and grade.

3. Posts shall be plumb.

G. Sign faces of all directional signs facing public traffic and directing such traffic to a portion of the project not yet open to public traffic shall have the message covered.

H. Care shall be exercised at all times in the handling, storing, transporting, and erecting of the signs. Signs that are damaged shall be repaired or replaced at no additional cost to the Contracting Agency.

I. Pipe sign posts may be field cut and drilled to adjust for local conditions when approved by the Engineer.

1. Flame cutting will not be permitted.

2. All field cuts and abraded areas on steel posts shall be thoroughly cleaned and given 2 coats of paint having a high-zinc dust content conforming to Federal Specification MIL-P-21035.

J. Extending the lengths of sign posts to adjust for local conditions by splicing or welding will not be permitted.

627.03.04 TESTS

A. The Contractor shall verify that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency.

B. The Contractor shall furnish the Contracting Agency with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

627.03.05 RELOCATION

A. This work shall consist of temporary or permanent relocation of existing permanent sign panels, posts, and footings as shown on the plans and as directed by the Engineer.

B. Existing sign panels and posts that are removed for relocation shall be stockpiled on the jobsite at locations determined by the Engineer and shall remain the property of the Contracting Agency.

C. The Contractor shall remove and dispose of all concrete from sign posts prior to stockpiling as directed by the Engineer.

D. Temporary relocation of permanent sign panels for public bus or transit stops shall be as indicated on the plans or as directed by the Engineer. Temporary locations for public bus or transit stops shall conform to ***Subsection 107.07, "Traffic and Access."***

E. The Contractor shall exercise care when removing and stockpiling signs for relocation. Signs that are damaged shall be repaired or replaced at no additional cost to the Contracting Agency.

END OF SECTION 627

SECTION 637 - POLLUTION CONTROL

DESCRIPTION

637.01.01 GENERAL

A. This work shall consist of temporary pollution control measures that may be shown on the plans, specified in the Special Provisions, or ordered by the Engineer during the life of the contract.

1. The work shall meet the applicable requirements of the Clark County Department of Air Quality and Environmental Management (DAQEM).

2. The work is intended to provide prevention, control, and abatement of water and air pollution within the limits of the project and to minimize damage to the work, adjacent property, and streams or other bodies of water.

B. The Contractor shall, 7 days prior to the preconstruction conference, submit for acceptance the Contractor's proposed plans and schedules, in duplicate, for accomplishing the prevention of erosion and pollution that may occur due to the Contractor's operations. No work shall be started until the schedules and methods of operations have been accepted by the Engineer.

C. The work shall include furnishing and applying a dust palliative to all completed excavation and embankment grading planes and other disturbed areas within the right-of-way except those areas that are to be paved under the terms of the contract and as directed by the Engineer. The dust palliative item does not include dust control measures required due to construction operations or carrying public traffic through construction or on detours.

D. Dust control work includes creating a Dust Control Mitigation Plan (DCMP), obtaining all necessary approvals for the DCMP, obtaining a Dust Control Permit for Construction Activities, payment of all fees associated with the project dust control, all work necessary to comply with the DCMP, Dust Control Permit, and the requirements of Section 94 of the Clark County Department of Air Quality Regulations, most recently adopted.

E. Any fines or penalties levied by the Clark County Department of Air Quality and Environmental Management due to violations of the project Dust Control Permit requirements are the sole responsibility of the Contractor and shall be paid by the Contactor.

F. The Contractor shall use all necessary Stormwater Runoff Best Management Practices (BMPs) performing the Work so as to not discharge stormwater runoff containing pollutants or sediment into the waters of the United States, including municipal separate storm sewer systems (MS4s) in violation of federal and state laws, rules, and regulations and the City’s water pollution requirements.

G. The Contractor shall:

1. Comply with the provisions of Nevada Revised Statutes, Chapter 445A: Water Pollution Control and City of Las Vegas Municipal Code 14.18; and

2. Adhere to all Federal regulations under 40 CFR 122.26(b)(14).

3. Submit SWPPP Submittal Checklist found in Appendix A of these Specifications to the Owner's Representative. This checklist must be on file prior to the issuance of the Notice to Proceed for construction.

H. All information and forms pertaining to Nevada's Stormwater NPDES Permitting Program can be found on the following website:

http://ndep.nv.gov/bwpc/storm01.htm

I. The City, state and federal regulations identified above are hereby incorporated by reference as preconditions of this Contract. The Contractor shall familiarize itself with these regulations and practices, and is advised that prior to engaging in any construction activities, the Contractor shall submit a Notice Of Intent (NOI) to the Nevada Division of Environmental Protection. A Storm Water Pollution Prevention Plan (SWPPP) must be completed prior to submission of the NOI and must remain on the project site and be updated as necessary for the duration of the project. As applicant, the Contractor is responsible for insuring that all persons on the project site, including contractor and subcontractor personnel, abide by the conditions of the permit. As the applicant, the Contractor is responsible for supplying complete copies of the NOI and SWPPP to all project subcontractors.

J. Upon completion of the project, the Contractor will need to permanently stabilize the construction area and file a Notice Of Termination (NOT) with NDEP to terminate the permit. The Contractor shall provide a copy of the approval letter of termination from NDEP to the Owner. Receipt of this letter will be required prior to acceptance of Contractor's final payment request.

K. Contractor shall apply for, pay for, and gain approval of the required permit from NDEP in a timely manner so as not to affect the project schedule. Contractor shall comply with the requirements of the permit and shall bear all associated costs. If the Owner suffers damages including but not limited to delays and fines as a result of the Contractor's failure to obtain a required permit or for non-compliance with the requirements of the permit, the Contractor shall reimburse the Owner for such damages and the Owner may withhold amounts equal to the damages from the Contractor's payments. Failure of the Contractor to obtain required permits in a timely manner shall not be justification for delay of the issuance of the Notice to Proceed by the Owner.

L. Any fines or penalties levied by the City of Las Vegas, Nevada Division of Environmental Protection, U.S. EPA, or any local, state, or federal agency to violations of the project Stormwater Runoff Management requirements are the sole responsibility of the Contractor and shall be paid by the Contactor.

MATERIALS

637.02.01 GENERAL

A. The binder for dust palliative shall be a resin emulsion that is miscible in water in the proportions hereinafter provided, is noncorrosive, and is effective as a dust palliative.

B. Resin emulsion shall be composed of from 57 percent to 63 percent of semi-liquid petroleum resin and the remainder water to which a suitable emulsifying agent has been added.

1. The binder shall be mixed with additional water at the job site and at the appropriate rate of 4 parts of water to 1 part of binder.
2. The exact rate of mixture shall be determined by the Engineer.
3. The resin emulsion shall be readily miscible with water and when diluted with any hard water in proportions of 1 part emulsion to 10 parts water shall show no signs of breakdown or separation of the petroleum resin base.
4. Resin emulsion that has been stored in closed containers at temperatures above freezing for a period of up to 3 months shall show no signs of separation.
5. Any resin emulsion that has been stored for more than 3 months shall not be used until tested and approved.

CONSTRUCTION

637.03.01 GENERAL

A. The temporary pollution control measures shall be as directed from time to time by the Engineer for the duration of the contract. The Engineer may revise and bring up to date any temporary control measures or instigate any new temporary pollution control measures found necessary as the work progresses.

B. The temporary control measures to prevent pollution of streams or other bodies of water or of the air, and to minimize damage to the work, to adjacent property, and to streams or other bodies of water, as directed by the Engineer and paid for on a force account basis, are in addition to any other measures provided for within the contract that are to be paid for as separate bid items.

C. It is expected that compliance with the requirements will necessitate performance of certain items of work at a different time or in a different manner than originally planned, causing revisions in scheduling of work that may interfere with normal construction practices.

D. Unless otherwise approved by the Engineer, the total area of erodible earth material exposed by the Contractor's operation shall not exceed 750,000 square feet before either temporary pollution control or temporary or permanent erosion control measures are accomplished.

E. Where erosion damage is probably due to the nature of the material or to the season of the year, the Contractor's operations shall be scheduled so that pollution control features will be installed concurrently with or immediately following grading operations.

F. Compliance with this section shall not relieve the Contractor from Contractor's responsibility to comply with the other provisions of the contract, except that the Contractor will be required to replace, at no additional cost to the Contracting Agency, any of the temporary pollution control work that is damaged by action of the elements.

G. All erosion control work required elsewhere in the specifications or on the plans will be paid for under the provisions for the applicable contract items of work therefor.

H. The Contractor shall coordinate temporary pollution control work, as required by the Engineer, with erosion control work specified elsewhere in the contract to ensure that

effective and continuous pollution control is maintained during the construction of the project.

I. The Contractor shall conduct operations to minimize the effects of erosion and air pollution due to the Contractor's operations upon areas within the limits of the project, haul roads, material sites, disposal sites, and upon adjacent properties, streams, and other bodies of water.

J. Mixing of the dust palliative material shall be accomplished by simultaneously placing the binder and water in the spreading equipment or by other mixing methods that will produce equivalent results.

1. The resulting mixture shall be applied with pressure type water distributor trucks equipped with a spray system, or pressure type asphalt distributors.

2. The mixture shall be applied at a total rate of approximately 1/2 gallon per square yard in 2 applications of 1/4 gallon per square yard.

3. The exact rate of application will be determined by the Engineer.

637.03.70 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) PERMIT FOR CONTRACTOR'S STAGING AREAS

A. The following applies to the Contractor's staging areas:

NDEP, Bureau of Water Pollution Control, has issued general permit NVR100000 that covers construction activities within the state of Nevada. The Contractor shall comply with the requirements of the general permit at no extra cost to the Owner. In order to be covered by the permit, the Contractor shall submit, at no extra cost to Owner, a Notice of Intent (NOI) and the required filing fee on the Internet at http://www.ndep.nv.gov/bwpc/storm_cont03.htm.

B. Upon the completion of the construction, Contractor is responsible for permanently stabilizing the staging area, filing Notice of Termination (NOT), and obtaining approval of NOT with NDEP to terminate the permit.

637.03.71 ROCK MULCH

A. Rock mulch, granite based non-organic ground cover, shall be placed 4 inches thick on all disturbed areas [outside of the detention basin] as required by NDEP final stabilization requirements for the purpose of dust control. Unless otherwise specified, rock mulch shall be one inch (1") minus from a local quarry. The Contractor shall provide with a sample of the proposed rock mulch a minimum of forty-eight (48) hours prior to start of work with any relative manufacturer's comprehensive product description, including specifications and installation instructions.

B. Final approval of product samples shall be made by the Owner and Engineer. No work shall proceed until Contractor has coordinated and received approval of the material from NDEP and provided a copy of the written approval to the Owner. Contractor shall then receive written approval from the Owner prior to proceeding with work.

C. All areas to receive rock mulch [outside of the detention basin] shall be treated with pre-emergent herbicide in accordance with the manufacturer's recommendations and approved by the Engineer.

END OF SECTION 637

DIVISION III

MATERIALS DETAILS

NOTE: Where pertinent, a "Manufacturer's Certificate of Compliance" covering materials as specified in this Division may be required and shall be furnished by the Contractor, when requested by the Engineer, at no cost to the Contracting Agency.

SECTION 701 – HYDRAULIC CEMENT

SCOPE

701.01.01 MATERIALS COVERED

A. This specification covers the types of Hydraulic cement as defined by ASTM C150, ASTM C595, and ASTM C1157. Unless otherwise provided, the cement will be used for all Hydraulic cement concrete, mortar, cement treated base, and cement treated subgrade. The type of cement used shall be as listed in Table 1 with the minimum sack requirements in ***Section 501, "Portland Cement Concrete."***

Table 6 - Types of Cement

Type of Cement Permitted
Type II & Fly Ash
Type MS & Fly Ash
Type IP (MS)
Type V
Type HS
Type V & Fly Ash
Type HS & Fly Ash

MATERIALS

701.02.01 GENERAL

A. Unless otherwise specified, the type of cement used shall be at the Contractor's option based on availability, and no additional compensation will be allowed for substitution of any type of cement for another.

B. Cement to be removed and replaced with fly ash shall be a minimum of 20 percent of the weight of cement. Fly ash added at the mixer shall be in an equal proportion to the weight of cement removed.

C. Class F fly ash conforming to the requirements of ***Section 729, "Fly Ash,"*** shall be used.

PHYSICAL PROPERTIES AND TESTS

701.03.01 REQUIREMENTS

D. Type II and Type V Portland cements shall conform to ASTM C150 except as hereinafter provided.

E. Type IP blended hydraulic cement shall conform to ASTM C595 except as hereinafter provided.

F. Pozzolan shall conform to ***Subsection 702.03.04, "Pozzolans (Fly Ash)."***

G. Additionally, Type II, Type V, and Type IP cements shall conform to ASTM C150 with the following requirements:

1. The cement shall not contain more than 0.60 percent by mass of alkalis calculated as Na20 plus 0.658 K20.

2. Type IP, MS, and HS cements that exceed the allowable alkali content may be used if mortar bars made and tested according to Subparagraph 1 above, using the proposed cement and a selected highly alkali-reactive aggregate, show no more than 0.05 percent expansion at 6 months.

END OF SECTION 701

SECTION 702 – CONCRETE CURING MATERIALS AND MIXTURES

SCOPE

702.01.01 MATERIALS COVERED

A. This specification covers concrete curing materials, air-entraining admixtures, water retardants, pozzolans, and hydrated lime. Comply with ***Section 722, "Water"*** for mixing and curing. The Contractor shall submit a request to use any one of the following for approval by the Engineer as prescribed in ***Subsection 702.03.06 "Submittal."***

PHYSICAL PROPERTIES AND TESTS

702.03.01 CURING MATERIALS

A. Curing materials shall conform to the requirements of the following tests, except the curing compound shall not react harmfully with the components of concrete or contain oils, waxes, or other materials which would prevent bonding of traffic marking paints. The film of curing compound shall be continuous, uniform, and free from pinholes, bubbles, or blisters.:

1. Burlap Cloth made from Jute or Kenaf: AASHTO M182.
2. Waterproof Paper for Curing Concrete: AASHTO M171.
3. Liquid Membrane-Forming Compounds for Curing Concrete: ASTM C309.
4. Pigmented Curing Compound for Portland Cement Concrete pavement: ASTM C309, except the loss of water from the surface in the water retention test shall not exceed 1.50 ounces per square foot in 72 hours.
5. White Pigmented Curing Compound for Bridge Decks: ASTM C309. Type 2 Class B resin type and shall be poly-alpha-methyl-styrene with the loss of water from the surface in the water retention test shall not exceed 0.50 ounce per square foot in 24 hours or more nor 1.50 ounces per square foot in 72 hours.
6. Plastic Sheeting: ASTM C171.
7. White Polyethylene Sheeting (film) for Curing Concrete: ASTM C171.

702.03.02 AIR-ENTRAINING ADMIXTURES

A. Air-entraining admixtures shall conform to ASTM C260.

702.03.03 ADMIXTURES OTHER THAN AIR-ENTRAINING

A. These admixtures shall comply with ASTM C494 and shall be clearly marked as to Type A, B, C, D, E, F, or G.

702.03.04 POZZOLANS (FLY ASH)

A. Fly Ash admixture shall conform to ***Section 729, "Fly Ash."***

702.03.05 HYDRATED LIME

A. Hydrated lime shall conform to ASTM C207, Type N.

702.03.06 SUBMITTAL

A. Curing compounds and admixtures shall be tested and certified in accordance with the Table 1 frequency.

1. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and requirements.

2. A test certificate shall be included with the certifying document.

B. The material supplier for Portland cement concrete materials, plantmix bituminous materials, or any material production that requires the use of admixtures shall attach the certificate to the mix design submittal as indicated in Table 1. All subsequent certificates shall be on file and accessible to the Engineer for audit purposes.

C. The Statute of Limitations duration for the record storage shall be as required by the Nevada Revised Statutes.

Table 1 - Quality Control Testing

Material	Certificate	Frequency
All curing materials	Sample and certification	1 per project
All admixture material	Certificate with copy of test for lot used	1 per lot

END OF SECTION 702

SECTION 704 – BASE AGGREGATES

SCOPE

704.01.01 MATERIALS COVERED

A. This specification covers the quality and size of mineral materials used in base courses, trench backfill, or other construction locations.

B. The term Source shall mean any of the following:

1. A permanent commercial location.
2. Contractor manufactured material either commercial or on-site.

704.01.02 REFERENCE CODES AND STANDARDS:

A. Related Interagency Quality Assurance Committee (IQAC) procedures at:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

(IQAC website)

REQUIREMENTS

704.02.01 GENERAL

A. The mineral aggregate shall be the crushed and screened product from approved aggregate deposits, except that Type I aggregate base need not be crushed. The Engineer reserves the right to prohibit the use of aggregates from any source when:

1. The character of the material is such, in the opinion of the Engineer, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.
2. The character of the material is such, in the opinion of the Engineer, that undue additional costs may be accrued by the Contracting Agency.

B. The mineral aggregate shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful adherent coatings. Crushed Portland cement concrete and asphaltic concrete pavement will be permitted, subject to the requirements of these specifications. No materials subject to regulation as hazardous wastes as defined in the Nevada Administrative Code 444.8565 shall be allowed.

704.02.02 IQAC SOURCE QUALIFICATION

A. For expediting of material source and type approvals, a listing of qualified materials has been provided on the IQAC website.

B. Any listed material is considered qualified for use without a material testing submittal. However, this does not relieve the Contractor of project testing of the material as required in these specifications.

C. The IQAC posted materials indicated in Table 1 are subject to reapproval annually for continued posting on the IQAC website. The procedure is annotated in ***Subsection 704.04.02, "IQAC Annual Material Prequalification."***

Table 1 – IQAC Materials that Require Annual Qualification

Type II Aggregate Base
Type II Controlled Low Strength Material (CLSM)

Table 2 – Materials that Require 6-Month Qualification

Type II blended with recycled Portland Cement Concrete

704.02.03 DEFICIENCIES

A. If the product of a deposit is deficient in material passing the No. 16 sieve, filler from other approved deposits may be added at the crushing and screening plants. This is not to be construed as a waiver of any of the requirements contained herein.

PHYSICAL PROPERTIES AND TESTS

704.03.01 PLASTIC LIMITS

A. When specified, aggregates shall conform to the applicable requirements of the following table:

Table 3 – Plastic Limits

Percentage by Weight Passing 200 Sieve	Plasticity Index Maximum
0.1 to 3.0	15
3.1 to 4.0	12
4.1 to 5.0	9
5.1 to 8.0	6
8.1 to 11.0	4
11.1 to 15.0	3

704.03.02 DRAIN BACKFILL

A. This aggregate shall conform to the following requirements:

Table 4 – Drain Rock Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve		
	3-Inch Size	2-Inch Size	3/4-Inch Size
3-Inch	100	--	--
2-Inch	90-100	100	--
1-1/2-Inch	70-100	95-100	--
3/4-Inch	0-50	50-100	100
1/2-Inch	--	--	95-100
3/8-Inch	0-10	0-55	70-100
No. 4	--	0-25	0-70
No. 8	0-5	0-15	--
No. 200	0-3	0-3	0-3

B. Unless otherwise specified in the contract documents, the Contractor may use any of the sizes.

Table 5 – Drain Backfill Durability Acceptance Limits

Source Requirement Test	3-Inch Size	2-Inch Size	3/4-Inch Size
Percentage of Wear (500 Rev.)	45% Maximum	45% Maximum	45% Maximum

704.03.03 TYPE I AGGREGATE BASE

A. This aggregate shall conform to the following requirements:

Table 6 – Type I Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve	
	3-Inch Size	2-Inch Size
3-Inch	100	--
2-Inch	90-100	100
1-1/2-Inch	--	95-100
1-Inch	--	70-90
No. 4	30-65	30-65
No. 16	15-40	15-40
No. 200	2-12	2-12

Table 7 – Type I Acceptance Limits

Project Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 6
Sampling Aggregate from Calibrated Conveyor stream or belt cut[1]	AASHTO T2	--
Plasticity Index	AASHTO T90[2]	Table 3
Liquid Limit	AASHTO T89	35 Maximum
Resistance (R Value)	ASTM D2844	60 Minimum
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum

704.03.04 TYPE II AGGREGATE BASE

A. This aggregate shall conform to the following requirements:

Table 8 – Type II Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	90-100
No. 4	35-65

[1] Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.

[2] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

Table 8 – Type II Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
No. 16	15-40
No. 200	2-10

Table 9 – Type II Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream or belt cut[3]	AASHTO T2	--
Fractured Faces	Nev. T230	70% Minimum
Plasticity Index	AASHTO T90[4]	Table 3
Liquid Limit	AASHTO T89	35 Maximum
Resistance (R Value) or Resilient Modulus	ASTM D2844	78 Minimum for road base
	AASHTO T307	35,000 psi minimum for road base
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum
Total Available Water Soluble Sulfates[5]	ASTM D2791 AWWA 4550 E	Less than 0.3% by dry weight of soil.

B. BLANK

704.03.05 TYPE III AGGREGATE

A. The soluble sulfate content shall not exceed 0.3 percent by dry weight of soil. The mineral shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful coatings. In addition thereto, the material shall conform to the gradation requirements of Type II aggregate base in accordance with ***Subsection 704.03.04, "Type II Aggregate Base,"*** with the following property testing:

Table 10 – Type III Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream of belt cut[6]	AASHTO T2	--
Plasticity Index	AASHTO T 90[7]	Table 3
Liquid Limit	AASHTO T 89	35 Maximum

[3] Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.
[4] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.
[5] Required only for placement around waterline pipe.
[6] Sampling from a stockpile permitted only after approval of the Engineer.
[7] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

Table 10 – Type III Acceptance Limits

Quality Control Test	Test Method	Requirements
No. 200 Sieve	AASHTO T 27	2-15%
Total Available Water Soluble Sulfates[8]	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

704.03.06 CRUSHED ROCK

A. Crushed rock shall be the product from approved aggregate deposits and shall only be used as directed by the Contracting Agency. The mineral aggregate shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful coatings. In addition thereto, the material shall conform to the following gradation requirements:

Table 11 – Crushed Rock Gradation Acceptance Limits

Sieve Sizes	Percentage of Weight Passing
3/8-Inch	100
No. 4	20-80
No. 200	0-15

Table 12 – Crushed Rock Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T 27	Table 11
Sampling Aggregate From Calibrated Conveyor stream of belt cut[9]	AASHTO T 2	----------
Fractured Faces	Nev. T 230	90% Minimum
Plasticity Index	AASHTO T 90[10]	Table 3
Liquid Limit	AASHTO T 89	35 Maximum
Percentage of Wear (500 Rev.)	AASHTO T 96	45% Maximum
Total Available Water Soluble Sulfates[11]	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

704.03.07 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. CLSM shall consist of a low-strength, self-leveling concrete material composed of various combinations of cement, fly ash, aggregate, water, and chemical admixtures. CLSM shall have a design compressive strength at an age of 28 days within the ranges required below for the specified class:

1. Class I - (20 to 150 psi): Specified where the maximum strength is of primary concern due to the desire to have material that can be excavated in the future with relative ease.

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[8] Required only for placement around waterline pipe.
[9] Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.
[10] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.
[11] Required only for placement around waterline pipe.

2. Class II – (100 to 300 psi): Specified where the minimum strength is of primary concern for pipe support.

3. Class Special (as shown in project specifications or drawings): Specified where project unique criteria, such as erosion control, are the primary concern.

4. Class I and Class II CLSM:

   a. The mix shall result in a product having a slump in the range of 6 to 10 inches at the time of placement in the pipe zone. Above the pipe zone, a lesser slump is acceptable.

   b. The Source of Contractor shall submit a mix design for approval by the Engineer prior to placement.

   c. The mix design shall be supported by laboratory test data verifying the potential of the mix to comply with the requirements for these specifications.

5. Class III – Bonded Aggregate Fill (BAF) (20 to 150 psi): Specified where the maximum strength is of primary concern due to the desire to have material that can be excavated in the future with relative ease, and where reduced concrete cure time is desired.

B. CLSM Class I and Class II shall be proportioned in general compliance with the methods outlined in ACI 211.1-91, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete." The product shall be proportioned and mixed in a central plant or mobile mixer. The following materials shall be used:

1. Cement shall meet the requirements of ***Section 701, "Hydraulic Cement."*** Type V cement shall be used unless otherwise specified.

2. Fly ash shall meet the requirements of ***Section 729, "Fly Ash."*** Fly ash not meeting the requirements of **Section 729, "Fly Ash,"** may be used if prior testing indicates to the satisfaction of the Engineer the ability of the CLSM with this fly ash to meet these specifications.

3. Water shall meet the requirements of ***Section 722, "Water."***

4. Aggregates shall be well graded, having 100 percent by total weight passing the 1 inch screen and no less than 6 percent passing the No. 200 sieve. The aggregate shall meet the plastic limits requirements of ***Subsection 704.03.01, "Plastic Limits."***

5. Chemical admixtures shall meet the requirements of ***Subsection 702.03.02, "Air-Entraining Admixtures,"*** and ***Subsection 702.03.03, "Admixtures Other Than Air-Entraining."***

   a. Other admixtures specifically approved for CLSM may be used.

   b. All materials proportions shall be measured and the CLSM mixed in accordance with ***Section 501, "Portland Cement Concrete."***

   c. Other proportion measuring and CLSM mixing systems are acceptable, if control can be demonstrated to be satisfactory to the Engineer.

   d. These other methods include continuous feed, volumetric measurement of proportions, and pug mill and continuous mixing plants.

C. If the CLSM Class I and Class II mixes do not produce a flowable consistency or exhibits excessive bleeding, the mix shall be adjusted.

1. Excessive bleeding is considered to occur when water flows from the CLSM in a manner that causes disturbance or displacement of the exposed surface of the CLSM.

2. Mix adjustments shall include, but not be limited to: aggregate gradation, cementitious material content, admixtures, water content, or a combination of adjustments.

D. The testing procedures of CLSM Class I and Class II for acceptance testing and mix design approval by the IQAC, or if required in the contract special provisions shall be as follows:

1. The material Source, which may be the Contractor, shall cast specimen molds using ASTM D4832 “Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM Test Cylinders.” The type of molds shall be as stated below.

a. Section 6.1 other sizes and type

1) Grout Sample Box must meet ASTM C1019, Note 6 and the following:

a) A Grout Sample Box that has a minimum absorption rate of 1.30% or that both the QA and QC laboratories have the same absorption with a tolerance of 0.2.

b) Creates four specimens with nominal dimension of 3”x3”x6”.

2) The QA and QC must agree in a pre-activity meeting which vendor of grout sample box will be used for the casting mold to comply with Note 6 in ASTM C1019 for proper comparisons.

2. Sampling shall be in accordance with ASTM D4832.

3. The cast specimens shall not be laboratory-cured in a concrete cure room (cure tanks shall not be used). The samples must be cured at the ambient temperature of the laboratory at a range between 65º and 85º degrees F.

4. Compressive strength testing shall be performed in accordance with AASHTO T22 and T23 with samples from each set at the ages of 14and 28 days.

5. A report of the results shall be submitted to the Engineer.

E. Class Special: The compressive strength testing procedures shall be as specified in the project specifications or on the project drawings.

F. **Class III - Bonded Aggregate Fill (BAF):**

1. The material Source shall have it designed under the responsible charge of a Nevada PE, and the mix shall consist of a gap-graded 1/2-inch maximum nominal size crushed gravel. The cementitious material shall be Type V cement and/or fly ash and water for a flowable type consistency.

2. The material shall be plant mixed and placed from a truck or may be placed directly from a continuous feed mobile mixer approved by the Engineer.

3. Due to the gap-graded nature of the material, it shall not be used where water drainage is an issue unless wrapped in an approved geotechnical filter fabric, and in all trench installations shall conform to ***Subsection 208.03.16, "Drain Backfill."***

4. This material does not require concrete cylinder break testing; however, it does require a visual inspection and shall be documented in a report to the Engineer summarizing the inspection to be performed as follows:

   a. After the first batch is placed and initially cured, excavate to the bottom of the pipe or structure.

   b. If a self-supporting vertical face is maintained, the material is functioning properly.

704.03.08 AGGREGATE FOR PORTLAND CEMENT TREATED BASE

A. This aggregate shall conform to the following requirements:

Table 13 – Portland Cement Treated Base Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
3-Inch	100
2-Inch	90-100
No. 4	35-75
No. 200	20

Table 14 – Portland Cement Treated Base Acceptance Limits

Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 13
Sampling Aggregate from Calibrated Conveyor stream or belt cut[12]	AASHTO T2	1/1000 Tons per day or portion thereof
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum

B. Aggregate for cement or lime treated bases will be sampled as follows:

1. Where the material is being mixed at a stationary plant, samples will be taken from the conveyors just prior to delivery to the mixer and prior to adding lime or cement.

2. Where material is being mixed on the roadbed, samples will be taken after the material has been placed on the roadbed and processed and prior to adding cement or lime.

704.03.09 SHOULDERING MATERIAL

A. This aggregate shall conform to the following requirements:

Table 15 – Shouldering Material Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	90-100

[12] Sampling from a stockpile permitted only after approval of the Engineer. The conveyor device shall be calibrated every 3 months and record attached to sample document.

No. 4	35-65
No. 16	15-40
No. 200	2-6

704.03.10 AGGREGATE BASE MATERIAL WITH RECYCLED ASPHALT PAVEMENT (RAP) AND CONCRETE

A. The use of recycled asphalt pavement or recycled concrete for Type II Aggregate Base is permitted with the following requirements:

1. The material must conform to the requirements of ***Subsection 704.03.04 "Type II Aggregate Base***

2. The maximum ratio of crushed concrete to Type II Aggregate Base is 50%. Recycled materials must be substantially free of foreign matter including but not limited to asphalt, base, dirt, reinforcing steel, and have at most 1.5% deleterious material.

3. The maximum ratio of the crushed recycled asphalt concrete pavement (RAP) to Type II Aggregate Base is 30%. The mean oil content shall be 1.2% with a +0.3% tolerance. The Total Oil Content of the blended material (virgin aggregate and RAP) shall not exceed 1.5%.

B. The maximum qualification period is six (6) months for aggregate base materials blended with recycled aggregates. The entire qualification process must be completed prior to the first day of April and the first day of October of each calendar year. The report format, as outlined in ***Subsection 704.04.05 "Report Format"*** shall include the sieve analysis for RAP or recycled concrete stockpile, Blended aggregated, the RAP binder content and blended binder content.

SOURCE QUALITY CONTROL TESTING

704.04.01 GENERAL

A. There are 2 testing aspects to Source material acceptance.

1. Testing by the Source for annual posting on the IQAC website of qualified materials.

2. Contractor project quality control Source testing for non-qualified materials.

B. The acceptance of the Source material shall be at the production plant while the acceptance of the Contractor-placed material is at the project site.

C. Any laboratory submitting to an agency shall be R-18 AASHTO accredited in the appropriate test method in accordance with Table 16, "Source Quality Control Testing Requirements," where applicable and testing reviewed and stamped by a Nevada professional engineer who has responsible charge of the work. The use of a professional engineer by the Source could be the Source staff engineer or third party, but the professional engineer must have responsible charge of the testing and/or inspection.

704.04.02 IQAC ANNUAL MATERIAL PREQUALIFICATION

A. Each individual location or "pit" shall be referred to as a "Source." The responsibility for testing and inspection is the material Source. Material shall be tested, inspected, and

certified in accordance with Table 16 "Source Quality Control Testing Requirements." The Source shall submit to the IQAC agency engineer assigned for that Source. The reviewing agency is listed on the IQAC website page next to the Source material.

B. Test data shall be included with the certifying document.

C. The maximum qualification period is 1 year, or 6 months for aggregate blended with crushed concrete. The entire qualification process shall be completed, in accordance with the sections above, prior to the first day of April, or for aggregates blended with crushed concrete, the first day of April and the first day of October of each year. This includes, but is not limited to, submittal, agency review, all required retesting, and qualification from the IQAC member.

704.04.03 NON-PREQUALIFIED MATERIALS

A. If the material is not posted on the IQAC web page, the Source may elect to submit non-prequalified material to the Engineer for approval prior to use that complies with the above noted specification and shall have been tested within 60 days of the intended use.

704.04.04 SUBMITTAL

A. All tests specified in this section shall be performed.

1. The report(s) shall include any graphical representation of plotted data such as the R-value or the Proctor value(s) along with the pit name and location.

2. The most current ASTM, AASHTO, NDOT, and AWWA methods shall be used when performing the tests.

B. All samples shall be "cut" from the "belt." When circumstances do not allow for sampling during production, the Source shall coordinate with the Engineer to identify an alternative plan for sampling.

C. <u>IQAC Annual Submittal</u>

1. For the purposes of IQAC submittal, the Engineer is the IQAC reviewing agency as noted on the IQAC web page.

2. For the annual submittal by the supplier, the material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.

3. The Engineer shall be notified a minimum of 48 hours prior to obtaining the sample.

4. If the Engineer is not present during the sampling of the material, the results for that sample will not be accepted.

5. Sampling shall be performed during normal working hours for the Engineer.

6. If the Source laboratory results are in compliance with the above noted specifications, Source shall submit the test report to the Engineer within 21 days of sampling requesting the review and approval of the materials for the proposed use of the material.

7. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required. Samples without notification or a

qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.

8. The agency Engineer for a particular pit may accommodate minor adjustments for "tuning" of an operation. This courtesy shall not be extended during the qualification process.

D. Non-prequalified materials (materials not posted on the IQAC list)

1. The material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.

a. The Engineer shall be notified a minimum of 48 hours prior to obtaining the sample.

b. If the Engineer is not present during the sampling of the material, the results for that sample will not be accepted.

c. Sampling shall be performed during normal working hours for the Engineer.

d. If the Source laboratory results are in compliance with the above noted specifications, the Source shall submit the test report to the Engineer within 21 days of sampling with a letter requesting the review and approval of the materials report for the proposed use of the material.

2. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required.

a. Samples without notification or a qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.

b. The Source shall submit the material test report to the Engineer no earlier than 60 days and no later than 14 days prior to use.

3. The qualification is for one project only.

704.04.05 REPORT FORMAT

A. The report shall be prepared and stamped by, or under the direction of, a professional engineer registered in the state of Nevada. The report shall be on the standard IQAC[13] form and shall include the pit name and location. The report shall include the following:

1. Recommendation by the Source Professional Engineer.

2. The testing results in accordance with the appropriate Table 16, "Source Quality Control Testing Requirements," test methods and reporting requirements, along with any graphs and charts.

B. When "no exceptions" are taken, a conditional posting on the web site will be provided by the IQAC within 10 days of the receipt of the submittal.

[13] The form is on the IQAC website, or use an Agency approved form.

C. Discrepancies between test results will be reviewed on a case-by-case basis. The Engineer will notify the aggregate producer of substantial test variations within 10 days of receipt of the qualification submittal.

704.04.06 SAMPLING AND TESTING

A. When the Contractor/Material Source or Engineer acquires aggregate samples at an aggregate production plant, the plant shall provide a calibrated mechanical means for obtaining samples.

1. If a mechanical means is not provided, a belt cut from a stopped conveyor will be required.
2. Any mechanical sampling device shall be approved by the Engineer prior to starting the respective phase of the project, or shall have been approved as part of a prior plant inspection by the Engineer or the Engineer's representative.
3. The sampling device shall be so constructed to provide for simultaneous "cutting" of the entire section of material being discharged or conveyed, and so constructed that small representative samples may be taken frequently and these samples combined to form the complete sample.
4. The reference method for the mechanical procedure shall be a "belt cut" sample taken from a stopped conveyor belt.
5. Samples of the finished product of the plant shall be obtained prior to or as the material leaves the conveyor belt for the bin or stockpile.

B. Test results run from samples taken will be furnished to the Engineer by the Contractor or the Contractor's representative. The results of such tests shall not be the basis for final acceptance of the material.

C. Sampling for final acceptance of materials will be as required in the appropriate USS sections and in general shall comply with the AASHTO requirements, where applicable, and with any exception to the method(s) listed on the IQAC website.

Table 16 – Source Quality Control Testing Requirements[14]

Spec Section	Description	Item	Reference Specification and/or Test Procedure	Frequency
704.03.02, 704.03.03, 704.03.04, 704.03.08	Drain Rock	Submittal	IQAC and/or Agency Requirements	Annually for IQAC Source Approval OR per project
	Type I, Type II Aggregate	Sampling from calibrated conveyor stream or belt cut	AASHTO T2	1/day at plant
	Cement treated base	Sieve Analysis	AASHTO T11 & T27	1/day at plant
		Percentage of Wear (500 Rev.)	AASHTO T96	Annually for Source Approval OR per project

[14] Review the IQAC website for any exceptions to the listed test methods.

Table 16 – Source Quality Control Testing Requirements[14]

Spec Section	Description	Item	Reference Specification and/or Test Procedure	Frequency
704.03.04*, *704.03.05*, *704.03.06	Drain rock, Type II, and Type III aggregate around water pipe	Total Available Water Soluble Sulfates[15]	AWWA 3500-NaD AWWA 4550 E	1/month at plant
704.03.03*, *704.03.04	Type I and Type II Aggregate	Plasticity Index	AASHTO T90[16]	1/day at plant
		Liquid Limit	AASHTO T89	1/day at plant
		Resistance (R Value) or Resilient Modulus	ASTM D2844	Annually for IQAC Source Qualification OR per project
			AASHTO T307	Annually for IQAC Source Qualification OR per project
704.03.07	CLSM Class I & II	Mix Design	***USS* *704.03.07***	Annually for IQAC Source Qualification OR per project
		Compressive Strength	***USS* *208.02.07*** & AASHTO T22, T23	Annually for IQAC Source Qualification OR per project
	CLSM Class III-BAF	Visual Inspection Report	**USS 208.02.07 Split cylinders**	Annually for IQAC Source Qualification OR per project

END OF SECTION 704

[15] Required only for placement around waterline pipe.
[16] Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

SECTION 706 – AGGREGATES FOR PORTLAND CEMENT PRODUCTS

SCOPE

706.01.01 MATERIALS COVERED

A. This specification covers the quality and size of aggregates used in Portland cement products.

REQUIREMENTS

706.02.01 GENERAL

A. The mineral aggregate shall be the product of approved deposits. The Engineer reserves the right to prohibit the use of aggregates from any source when:

1. The character of the material is such, in the opinion of the Engineer, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.
2. The character of the material is such that, in the opinion of the Engineer, undue additional costs may be accrued by the Contracting Agency.
3. The mobile mixer shall use aggregate from an approved source. Each mixer shall not change source product without a new mix design. The certificate of the source shall include the appropriate test data.
4. The testing type and frequency shall conform to the tables on the Clark County IQAC website page: http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

B. For mix design approval, the proposed proportions of coarse, intermediate, and fine aggregate, combined mathematically by volume or mass, shall produce a mixture within the grading limits for combined aggregates as shown in Table 1 (not applicable to lightweight concrete):

Table 7 - Grading Limits of Combined Aggregates

Sieve Size	Percentage Passing				
	1-1/2-inch Max.	1-inch Max	3/4-inch Max.	1/2-inch Max	3/8-inch Max.
2-inch	100	--	--	-	-
1-1/2-inch	87-100	100	--	-	-
1-inch	65-90	97-100	100	-	-
3/4-inch	48-82	70-100	80-100	100	-
1/2-inch	--	--	--	90-100	100
3/8-inch	39-57	43-70	46-70	70-90	70-100
No. 4	30-45	32-48	34-50	45-60	47-70
No. 8	23-38	23-42	24-42	38-56	34-55
No. 16	15-33	15-34	17-34	24-38	23-43
No. 30	8-24	8-25	10-25	13-27	15-33
No. 50	4-13	4-15	5-15	7-17	7-20

Table 7 - Grading Limits of Combined Aggregates

Sieve Size	Percentage Passing				
	1-1/2-inch Max.	1-inch Max	3/4-inch Max.	1/2-inch Max	3/8-inch Max.
No. 100	1-5	2-7	2-7	0-6	2-8
No. 200	0-5	0-5	0-5	0-5	0-5

C. If the Contractor prefers a finer gradation for the purpose of slip-form operations, the following gradation is permitted with approval of the Engineer.

Table 8 - Gradation for Slip-Form Operations

Sieve Size	Percentage Passing	
	1-1/2-inch Max.	3/4-inch Max.
2-inch	100	--
1 1/2-inch	87-100	--
1-inch	65-97	100
3/4-inch	48-91	80-100
1/2-inch	--	--
3/8-inch	39-70	46-74
No. 4	30-54	34-54
No. 8	23-38	24-50
No. 16	15-33	17-38
No. 30	8-24	10-29
No. 50	4-13	5-19
No. 100	1-5	2-9
No. 200	0-5	0-5

D. If the Contractor proposes to use an admixture other than an air-entraining agent, Contractor shall state the complete brand name and the quantity proposed to be used per sack of cement.

E. Should the Contractor change Contractor's source of supply, Contractor shall submit in writing to the Engineer the new gradation before their intended use.

F. In addition to the coarse, intermediate, and fine aggregates meeting the individual source requirements, the combined gradation shall meet the following source requirement:

Table 9 - Alkali-Silica Reaction

Source Requirement Test, Combined Aggregates	Test Method	Requirement
Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction	AASHTO T303	0.10% Max. Expansion[1]

G. Previous AASHTO T303 qualified aggregates for concrete mix designs will not automatically qualify for approval. Submit new AASHTO T303 test results with concrete mix design.

[1] This requirement applies to all aggregate used in the concrete bridge structures, including approach slabs, reinforced concrete boxes, walkways, or sidewalks on the bridge structure itself, and all concrete bridge rail.

H. Perform this test on the coarse, intermediate, and fine aggregates together, combined in the same proportions as the proposed mix design.

1. The test may be performed on each size separately and the results combined mathematically.

2. Perform the test using the proposed sources together with proposed job cement and job pozzolan or other admixture, if used.

3. The pozzolan and silica fume quantities will be considered as cement in meeting the requirements of cement in Table 2 of ***Subsection 501.03.04, "Classification and Proportions."***

I. Prior to mix design approval, the Contracting Agency reserves the right to verify the AASHTO T303 test results, using the sources and proportions of materials as indicated by the mix design.

J. Conduct another test upon changes in source of cementitious materials, including fly ash, or changes in cement type or mitigating admixture suppliers.

PHYSICAL PROPERTIES AND TESTS

706.03.01 COARSE AGGREGATE

A. The aggregate shall conform to the following table requirements:

Table 4 - Percentage by Weight Passing Sieve

Sieve Size	Size No. 3 2-inch to 1-inch	Size No. 4 1-1/2-inch to 3/4-inch	Size No. 7 1/2-inch to No. 4	Size No. 57 1-inch to No. 4	Size No. 67 3/4-inch to No. 4	Size No. 357 2-inch to No. 4	Size No. 467 1-1/2-inch to No. 4
2-1/2-inch	100	--	--	--	--	100	--
2-inch	95-100	100	--	--	--	95-100	100
1-1/2-inch	35-70	90-100	--	100	--	--	95-100
1-inch	0-15	20-55	--	95-100	100	35-70	--
3/4-inch	--	0-15	100	--	90-100	--	35-70
1/2-inch	0-5	--	90-100	25-60	--	10-30	--
3/8-inch	--	0-5	40-70	--	20-55	--	10-30
No. 4	--	--	0-15*	0-10*	0-10*	0-5	0-5

*Not more than 5 percent shall pass No. 8 Sieve.

NOTE: Sizes No. 357 and No. 467 shall each be split into 2 sizes. Size No. 357 shall be furnished in stockpile or bunker in Sizes No. 3 (2-inch to 1-inch) and Size No. 57 (1-inch to No. 4.) Size No. 467 shall be furnished in stockpile or bunker in Size No. 4 (1-1/2-inch to 3/4-inch) and Size No. 67 (3/4-inch to No. 4). The two sizes shall be uniformly combined at the mixing plant to comply with the grading requirements of Sizes No. 357 and No. 467 respectively.

Table 5 - Coarse Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	--
Material Passing 200 Sieve	AASHTO T27	1% Maximum

Table 5 - Coarse Aggregate Properties

Tests	Test Method	Requirements
Percentage of Wear (100 Rev.)	ASTM C131	10% Maximum
Percentage of Wear (500 Rev.)	ASTM C131	50% Maximum
Soundness (5 Alternations) (sodium sulfate)	AASHTO T104	9% Maximum Loss
Cleanness Value min.	CALIF 227	71 ***706.03.01.B.1***
Clay Lumps	AASHTO T112	1% Maximum
Potential Reactivity	AASHTO T303	Innocuous ***706.03.01.B.2***

B. Thin or elongated pieces (length greater than 5 times maximum thickness) shall not exceed 15 percent by weight.

1. When 2 or more stockpiles are to be combined, each stockpile shall have a cleanness value of at least 65 with a minimum combined cleanness value of 71 calculated by the percent of material used from each stockpile.

2. If the material from a proposed source fails this test requirement, the material may still be used for concrete aggregate provided that it is incorporated in an approved mix design with an approved Type F or Type N Pozzolan, or with a Type IP cement.

C. If a pozzolan is used for this purpose, use 1 part pozzolan to 4 parts of cement by mass. The pozzolan quantity shall be considered as cement in meeting the required minimum cement content. If a Type IP cement is used for this purpose, the use of pozzolan is not required.

706.03.02 LIGHTWEIGHT AGGREGATES

A. These aggregates shall conform to the following requirements:

Table 6 - Lightweight Aggregate Gradation

	Percentage of Weight Passing Sieve			
Sieve Size	**Fine Natural**	**Fine Lightweight**	**1-inch Size Coarse**	**3/4-inch Size Coarse**
1-inch	--	--	95-100	100
3/4-inch	--	--	--	90-100
1/2-inch	--	--	25-60	--
3/8-inch	100	100	--	20-60
No. 4	95-100	85-100	0-10	0-10
No. 16	45-80	40-80	--	--
No. 50	10-35	10-35	--	--
No. 100	2-12	5-25	--	--
No. 200	0-5	--	--	--

Table 7 - Lightweight Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above ***706.03.02.A.1*** below
Sampling	ASTM D75	--
Unit Weight (loose oven dry) Fine Aggregate 70 lb/ft^3	Nev. T487	Maximum ***706.03.02.A.2*** below
Unit Weight (loose oven dry) Coarse Aggregate 55 lb/ft^3		
Unit Weight (loose oven dry) Combined Fine and Coarse Aggregate 65 lb/ft^3		
Organic Impurities	ASTM C40	Satisfactory ***706.03.02.A.3*** below
Clay Lumps	AASHTO T112	2.0% Maximum
Test for Staining Materials	ASTM D330	Satisfactory ***706.03.02.A.4*** below
Mortar Making Properties of Sand	ASTM C87	95% Minimum ***706.03.02.A.5*** below

1. With the following exceptions: The weight of the test sample for the fine lightweight aggregate shall be in accordance with Table 8, and the aggregate when mechanically sieved shall be sieved for only 5 minutes. The test sample for coarse aggregate shall consist of no less than 0.1 cubic foot of the material used for the determination of unit weight.

Table 8 - Weight of Sieve Test Sample for Fine Lightweight Aggregates

Nominal Weight of Aggregate		Weight of Test Sample	
(lbs/ft^3)	kg/m^3	Grams	Oz.
25-35	401-561	150	5.3
35-45	561-721	200	7.0
45-55	721-881	250	8.8
55-65	881-1042	300	10.6
65-70	1042-1122	350	12.3

2. The unit weight of successive shipments of lightweight aggregate shall not differ by more than 10 percent from that of the sample submitted for acceptance tests.

3. Aggregates tested and showing color darker than the standard shall be rejected unless it can be demonstrated that the discoloration is due to small quantities of materials not harmful to the concrete.

4. Aggregates tested and showing stain darker than "heavy stain" (stain index of 80) shall be tested by chemical procedure, and aggregates that contain 1.5 mg or more of ferric oxide (Fe_2O_3) per 200 gram sample shall be rejected for use.

5. Fine Aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

706.03.03 FINE AGGREGATE

A. This aggregate shall conform to the following requirements:

Table 9 - Fine Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
3/8-inch	100
No. 4	95-100
No. 16	45-80
No. 50	10-35
No. 100	2-12
No. 200	0-5

Table 10 - Fine Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	--
Soundness (5 alternations) (sodium sulfate)	AASHTO T104	10% Maximum Loss
Clay Lumps	AASHTO T112	1.0% Maximum
Lightweight Pieces in Aggregate (less than 2.0 sp. gr.)	AASHTO T113	1.0% Maximum
Organic Impurities	ASTM C40	Satisfactory ***706.03.03.A.2*** below
Mortar Making Properties	ASTM C87	95% Minimum ***706.03.03.A.1*** below

1. Aggregates tested and showing color darker than the standard shall be rejected unless they pass the mortar making properties test in accordance with ASTM C87.

2. Fine aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength of 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

3. If the material from a proposed source fails this test requirement, the material may still be used for concrete aggregate provided that it is incorporated in an approved mix design with an approved Type F or Type N Pozzolan, or with a Type IP cement.

    a. If a pozzolan is used for this purpose, use 1 part pozzolan to 4 parts of cement by mass.

    b. The pozzolan quantity shall be considered as cement in meeting the required minimum cement content.

    c. The limitation on replacement of cement with pozzolans at a minimum of 20 percent in ***Subsection 501.02.03, "Admixtures,"*** is hereby waived to meet this requirement.

    d. If a Type IP cement is used for this purpose, the use of pozzolan is not required.

706.03.04 GROUT AND MORTAR SAND

A. This aggregate shall conform to the following requirements:

B. Sand for grout and mortar shall conform to the size requirements of ***Subsection 706.03.03, "Fine Aggregate,"*** except if the Contractor elects, Contractor may screen the sand over a No. 8 screen to produce the following:

Table 11 - Grout Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
No. 8	100
No. 50	15-40
No. 100	0-10
No. 200	0-5

Table 12 - Grout Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	-----
Organic Impurities	ASTM C40	Satisfactory ***706.03.04.B.2***
Mortar Making Properties	ASTM C87	95% Minimum ***706.03.04.B.1***

1. Aggregates tested and showing color darker than the standard shall be rejected unless they pass the mortar making properties test in accordance with ASTM C87.

2. Fine aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

706.03.05 RIPRAP GROUT

A. The mix design for the placing requirements addresses 2 placement methods:

1. Direct discharge from the transit mixer.

2. Placement by small diameter line pumping methods.

B. Two typical mixtures that would meet the above minimum requirements are as follows:

Table 13 - Proportions for 1.0 Cubic Yard of Grout

	Pump Method Approx. Volume (Cu. Ft.)	Transit Mixer Discharge Approx. Volume (Cu. Ft.)
Pea Gravel	3.5	7.6
Washed Concrete Sand	10.6	7.6
Water	6.5	5.9
Type V cement	3.5	3.1

Table 13 - Proportions for 1.0 Cubic Yard of Grout

	Pump Method Approx. Volume (Cu. Ft.)	Transit Mixer Discharge Approx. Volume (Cu. Ft.)
Fly Ash class F	1.6	1.4
Balance Air	1.3	1.4

C. Factors which shall be considered for a given grout mix are:

1. Fine and coarse aggregates.
2. Consistency.
3. Elapse time between placement and initial set.
4. Length of time between batching and placement during which continuous or intermittent mixing is required.

D. Materials used in the production of riprap grout shall meet the minimum following material standards:

1. Fine and Coarse Aggregate: ASTM C33; ***Section 206, "Structure Excavation."***
2. Portland Cement: ASTM C150, Type V; ***Section 701, "Hydraulic Cement."***
3. Fly Ash: ASTM C618; ***Section 729, "Fly Ash."***
4. Water: ***Section 722, "Water."***
5. Air Entraining Admixture: ASTM C260; ***Section 702, "Concrete Curing Materials and Admixtures."***

E. A trial batch shall be placed for review by the Engineer for final approval for the project.

F. The Engineer shall be provided with a legible ticket with each load of grout delivered to the project site which shall contain the following information:

1. Name of Vendor.
2. Name of Contractor.
3. Number of Cubic Yards in the Load.
4. Actual Weights of Cement and of each Size of Aggregate.
5. Amount of Water Added at the Plant.
6. Amount of Water in the Aggregate.
7. Brand and Type of Cement.
8. Brand and Amount of Admixture.
9. Time and Date of Batching.

END OF SECTION 706

SECTION 707 – JOINT MATERIAL

SCOPE

707.01.01 MATERIALS COVERED

A. This specification covers the quality requirements for poured filler, preformed fillers, and resilient and rubber type gaskets used in the construction of bridges, culverts, sidewalks, and so forth.

PHYSICAL PROPERTIES AND TESTS

707.03.01 JOINTS

A. Materials for joints in concrete structures shall comply with provisions specified below.

707.03.02 POURABLE JOINT SEALER

A. The materials specified in this subsection shall be supplied and installed in weakened plane joints, contraction joints, and construction joints when required by the Engineer and as shown on the drawings.

B. Joint Sealant:

1. 2-component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV).
2. Sealant shall be able to expand and compress plus or minus 25 percent movement as the joint opens and closes.
3. Sealant shall be self-leveling for flat surfaces and non-sagging for sloped and vertical joints.
4. Sealant shall meet or exceed requirements of Table 1 below.

Table 1 - Minimum Requirements for Pourable Joint Sealer

Material Characteristics	Self-Leveling	Non-Sagging
Application Temperature	40 to 100 degrees F	40 to 100 degrees F
Service Range	-40 to 170 degrees F	-40 to 170 degrees F
Curing Rate	Tack-free Time: 1-2 hours Final Cure: 3-5 days	Tack-free Time: 6-8 hours Final Cure: 3 days
Tear Strength (ASTM D624)	--	45 lbs/in
Shore A Hardness (ASTM D2240)	45 ±5 (21-day)	25 ±5
Tensile Properties (ASTM D412):		
Tensile Strength	550 psi (21-day)	120 psi (at break)
Elongation	700% (at break)	500%
Modulus of Elasticity (100%)	150 psi	70 psi
Adhesion in Peel, Concrete Substrate (Fed Spec TT-00227E):		
Peel Strength	>30 pounds	25 pounds
% Adhesion Loss	0%	0%

C. No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

D. Each container shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use.

E. The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the 2 components and extrudes the mixed material into the joint.

1. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed.

2. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

F. Primer:

1. Special material furnished by the manufacturer of the sealant to improve bond of polyurethane sealant to concrete.

2. Primer shall be applied to the sides of the groove and to all exposed vertical surfaces in the joint prior to placing the polyurethane sealant.

3. The primer shall be dry prior to placing the sealant.

4. Contaminated primer shall be removed and replaced.

707.03.03 CHANNEL EXPANSION JOINT (1-INCH OR LESS)

A. The materials specified in this subsection shall be supplied and installed in expansion joints with widths 1-inch or less designed for channels included in Clark County Regional Flood Control District's Master Plan.

B. Joint Sealant:

1. 2-component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV).

2. Sealant shall be able to withstand up to plus or minus 25 percent movement.

3. Sealant shall be self-leveling for flat surfaces and non-sagging for slopes.

4. The sealant shall meet or exceed requirements of Table 1 in ***Subsection 707.03.02, "Pourable Joint Sealer."***

C. No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

D. Each container shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use.

E. The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the 2 components and extrudes the mixed material into the joint.

1. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed.

2. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

F. Joint Filler: Preformed, ASTM D1752, Type I (sponge rubber) or inert, preformed, closed cell, polypropylene material.

G. Bond Breaker Tape:

1. Adhesive backed polyethylene tape meeting or exceeding the following:

a. Adhesive Strength: 35 ounces/inch width.

b. Tensile Strength: 20 pounds./inch width.

c. Mil thickness: 14.

2. Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs.

3. In joints that have considerable width variation, 1 tape may be lapped over another to accomplish total backside coverage.

4. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

H. Backer Rod:

1. Non-absorbent expanded, closed cell polyethylene foam.

2. The backer rod shall be approximately 25 percent larger in diameter than the width of the joint to be sealed.

3. Other back-up materials (paper, rope and open cell foam) are unacceptable.

4. The backer rod shall be compatible with the sealant, and no bond or reaction shall occur between the backer rod and sealant.

707.03.04 EXPANSION JOINT (1-INCH OR LESS)

A. The materials specified in this subsection shall be supplied and installed in expansion joints with widths 1-inch or less designed for structures other than those listed in ***Subsection 707.03.03, "Channel Expansion Joint (1-Inch or Less)."***

B. Joint Sealant:

1. 2-component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV).

2. Sealant shall be able to withstand up to plus or minus 25 percent movement.

3. Sealant shall be self-leveling for flat surfaces and non-sagging for slopes.

4. The sealant shall meet or exceed requirements of Table 1 above.

C. No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

D. Each container shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use

E. The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the 2 components and extrudes the mixed material into the joint.

1. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed.

2. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

F. Joint Filler:

1. Preformed filler conforming to AASHTO M213 or ASTM D1751 (fiber type).

2. Filler material shall be punched or drilled to admit dowels where called for on the plans.

3. Filler for each joint shall be furnished in a single piece for the full depth and width required for the joint unless otherwise specified by the Engineer.

4. When the use of more than 1 piece is authorized for a joint, the abutting ends shall be fastened securely and held in place, by stapling or other positive fastening satisfactory to the Engineer.

G. Bond Breaker Tape:

1. Adhesive backed polyethylene tape meeting or exceeding the following:

a. Adhesive Strength: 35 ounces/inch width.

b. Tensile Strength: 20 pounds./inch width.

c. Mil thickness: 14.

2. Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs.

3. In joints that have considerable width variation, 1 tape may be lapped over another to accomplish total backside coverage

4. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

H. Backer rod:

1. Non-absorbent expanded, closed cell polyethylene foam.

2. The backer rod shall be approximately 25 percent larger in diameter than the width of the joint to be sealed.

3. Other backer materials (paper, rope and open cell foam) are unacceptable.

4. The backer rod shall be compatible with the sealant and no bond or reaction shall occur between the backer rod and sealant.

707.03.05 EXPANSION JOINT (GREATER THAN 1-INCH)

A. The materials specified in this subsection shall be supplied and installed in expansion joints with widths greater than 1-inch.

B. Joint Sealant:

1. Impermeable closed-cell, cross-linked, ethylene vinyl acetate, low density polyethylene copolymer, nitrogen blown foam material.
2. Joint sealant shall have a minimum working movement range of 60 percent compression and 30 percent tension.
3. The sealant shall meet or exceed the requirements listed in Table 2 below.
4. Joint sealant shall have 1/8-inch" deep by 1/8-inch wide grooves spaced at 1/4 inch to 1/2 inch along both sides of the joint and running the entire length of the joint to increase bond surface area.
5. Joint sealant material shall be resistant to degradation due to ultraviolet radiation or shall be coated with a material that provides adequate protection.
6. The joint sealant shall be installed with a width 25 percent greater than width of joint opening at a near neutral condition.
7. All direction changes in joint sealant shall be done using heat welding method.
8. Joint sealant shall be installed using all of manufacturer's recommendations.
9. Joint sealant shall be installed prior to significant joint movement after concrete placement.

C. Contractor shall prevent construction equipment from traversing joint after sealant has been placed or adequate steps shall be taken to protect sealant from construction traffic.

Table 2 - Minimum Requirements for Preformed Joint Sealer

Material Characteristics	Physical Requirements
Service Range	-94 degrees F to 160 degrees F
Tensile Strength	115 lb/in^2
Elongation at break	255%
Tear Resistance (ASTM D624)	16 lb/in^2
Water Absorption (ASTM D3575, Suffix L)	0.2 lb/ft^2
Density	2.8–3.4 lb/ft^3

D. Joint Filler: Inert, preformed, closed cell, polypropylene material.

E. Bond Breaker Tape:

1. Adhesive backed polyethylene tape meeting or exceeding the following:
   a. Adhesive Strength: 35 ounces/inch width.
   b. Tensile Strength: 20 pounds./inch width.
   c. Mil thickness: 14.
2. Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs.
3. In joints that have considerable width variation, 1 tape may be lapped over another to accomplish total backside coverage.
4. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

F. Bonder: 2-component, 100 percent solid epoxy adhesive designed to bond joint material to steel, cured concrete, or wood.

707.03.06 RUBBER GASKETS

A. The ring gaskets shall conform to AASHTO M198.

707.03.07 WATERSTOPS

A. Waterstops shall conform to the following requirements:

1. Natural rubber waterstops shall be manufactured from a stock composed of a high grade compound made exclusively from new plantation rubber, reinforced carbon black, zinc oxide, accelerators, antioxidants, and softeners.

2. This compound shall contain not less than 72 percent by volume of new plantation rubber.

NATURAL RUBBER

Test	Test Method	Requirements
Tension Testing of Vulcanized Rubber	ASTM D412	Tensile strength: 3,500 psi minimum Elongation at breaking: 550 percent Unit stress (300 percent): 1,100 psi minimum Unit stress (500 percent): 2,800 psi minimum
Test for Accelerated aging of Vulcanized Rubber by the Oxygen Pressure Method	ASTM D572	After 7 days in air at 158 degrees F (±2 degrees F) or after 48 hours in oxygen at 158 degrees F (±2 degrees F) and 300 psi, the tensile strength and elongation shall not be less than 65 percent of the original.
Test for Indentation of Rubber by Means of a Durometer	ASTM D2240	55 to 65 hardness

SYNTHETIC RUBBER

Test	Test Method	Requirements
Tension Testing of Vulcanized Rubber	ASTM D412	Tensile strength 2,500 psi minimum Elongation at breaking of 425 percent.
Test for Accelerated aging of Vulcanized Rubber by the Oxygen Pressure Method	ASTM D572	After 7 days in air at 158 degrees F (±2 degrees F) or after 48 hours in oxygen at 158 degrees F (±1 degree F) and 300 psi, the tensile strength and elongation shall not be less than 65 percent of the original.
Test for Indentation of Rubber By Means of a Durometer	ASTM D2240	50 to 70 hardness

POLYVINYL CHLORIDE

Test	Test Method	Requirements
Polyvinyl Chloride Waterstops	Corps of Engr CRD-C 572	Compliance with paragraph 6

707.03.08 ASPHALT PLANK

A. Asphalt plank shall conform to ASTM D517 for Plain Asphalt Plank.

707.03.09 PREFORMED ELASTIC JOINT SEALER

A. Preformed elastic joint sealer and lubricant adhesive shall conform to AASHTO M220.

B. The lubricant adhesive shall be homogeneous and shall remain workable from 5 degrees F to 120 degrees F.

1. Each lot of the adhesive shall be in containers with the manufacturer's name or trademark and the date of manufacture plainly marked.

2. Adhesive shall be stored at a temperature of 50 degrees F to 80 degrees F and shall be used within 270 days after the date of its manufacture.

C. The lubricant adhesive shall conform to the following requirements:

1. Average new weight per gallon, pounds: 7.84 ±5%.

2. Solids content by weight, percent: 22 - 28.

D. Each lot of the preformed elastic joint sealer and lubricant adhesive furnished under these specifications shall be identified as specified herein and shall be products that have been tested by a reputable testing laboratory, recognized by the Contracting Agency.

1. The testing laboratory shall certify that the materials meet these specifications and requirements.

2. The Contractor shall furnish the Contracting Agency with these certifications prior to using the material.

707.03.10 SUBMITTAL

A. Material shall be tested and certified in accordance with the Table 3 frequencies.

1. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and requirements.

2. The test shall be performed in an accredited laboratory such as the American Association for Laboratory Accreditation (A2LA) or other as approved by the Engineer.

3. A test certificate shall be included with the certifying document.

4. Subsequent submittals shall be reviewed by the Contractor for compliance then transmitted to the Engineer.

B. The Statute of Limitations duration for the record storage shall be as required by the Nevada Revised Statutes.

Table 3 - Quality Control Inspection and Testing

Product	Subsection	Reference	Submittal	Frequency
Joint Sealant	***707.03.02*** ***707.03.03***	Table 1 requirements	Certification with copy of tests	1 per lot
	707.03.04	ACI 504R, Table 1, Type IV		
	707.03.05	Table 2 requirements		
Joint Filler	***707.03.03***	Tested per ASTM D1752 Type I	Certification	1 per lot

	707.03.04	AASHTO M213	with copy of tests	
	707.03.05	Inert, preformed, closed cell, polypropylene material	Certification	1 per lot
Backer Rod	707.03.03 707.03.04	Non-absorbent expanded, closed cell polyethylene	Certification	1 per lot
Bond Breaker Tape	707.03.03 707.03.04 707.03.05	Adhesive strength 35 ounces/in width Tensile Strength 20 lb/in width Thickness 14 mil minimum	Certification with copy of tests	1 per lot
Rubber Gaskets	707.03.06	AASTHO M198		
Waterstops Natural and Rubber	707.03.07	ASTM D412 ASTM D572 ASTM D2240		
Waterstops Polyvinyl Chloride	707.03.07	Corps of Engr CRD-C 572		
Asphalt Plank	707.03.08	ASTM D517		
Preformed Elastic Joint Sealer	707.03.09	AASHTO M220		

END OF SECTION 707

SECTION 708 – CONCRETE AND CLAY PIPE AND DRAINS

SCOPE

708.01.01 MATERIALS COVERED

A. This specification covers the quality of clay pipe, nonreinforced concrete pipe, and reinforced concrete pipe used for culverts, siphons, pressure conduits, and storm drains and also the quality of perforated pipe used in underdrains.

1. BLANK

2. Quality control testing and inspection requirements are in ***Subsection 708.04.01, "Production Quality Control Inspection and Testing."***

B. Concrete pipe that is precast shall be manufactured in an annually certified plant.

1. Certification shall be by the American Concrete Pipe Association (ACPA).

2. The quality program from the certification process and this specification shall be initially submitted to the Regional Transportation Commission Specification Subcommittee for approval.

3. Once approved, the facility is considered "Authorized" and submittals of the QC program will not be required on a per-project basis unless required in the project specifications.

C. Design in accordance with AASHTO LRFD Bridge Design Specifications, Section 12, and to withstand a backfill dead load of 120 pounds per cubic foot and an HS-20 live load, unless otherwise shown in the contract or approved by the Engineer. The minimum cover over a pipe shall be placed on the plans and/or specifications being submitted for plan review.

D. The design shall consider any flotation effects with the use of controlled low strength material for backfill.

E. For storm drain application, the design shall consider the abrasion effects of parameters outlined in the Clark County Regional Flood Control District design manual or Federal Highway Administration (FHWA) publication FHWA-DF-88-003, "Federal Lands Highway Project Development and Design Manual."

F. The trench section installation configuration as demonstrated in Figure 1 in ***Section 208, "Trench Excavation and Backfill,"*** shall only be permitted when approved by the Engineer.

G. The designing engineer shall comply with the intent of the pipe material as defined as either rigid or flexible in conformance with the AASHTO LRFD Bridge Design and Construction Specifications and this section.

1. Special attention shall be given to the sidewall material properties as this section assumes a minimum AASHTO A1 or A3 material.

2. Other sidewall material type shall be given special consideration for minimum trench widths, the use of CLSM, or other critical processes that would affect the pipe ability to withstand the load and shall also be noted on the plans and specifications for the project.

H. The type of pipe and applicable installation requirement (trench and embankment) to be used as demonstrated by the design and approved by the Engineer shall be clearly noted on the drawings and specifications along with installation procedures that may differ from this section.

I. The design shall include definition of either rigid or flexible pipe as defined by the South African Standard SABS 0102 as outlined on the Clark County QAQC web page:

http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

J. The minimum design life before first maintenance on all pipes shall be 50 years. The definition of first maintenance is as follows:

1. **Rigid Pipe or Box - Reinforced Concrete:** Point of exposed reinforcement from normal designed use

2. **Rigid Pipe – Nonreinforced:** The least value of the thickness from designed use by a reduction of 25 percent or 1 inch.

K. Joints shall be specified in accordance with the following:

Table 10- Joint Types

Pipe Type	Joint Type	Description	Test Pressure	Application
Non-pressure	Silt Tight	Mastic or Rubber Gasketed	2.0 psi	Storm
Pressure	Water Tight (pressure)	Rubber Gasketed	10.8 psi	Storm

708.01.02 BASIS OF MANUFACTURED LOT ACCEPTANCE

A. Unless otherwise specified or designated by the Engineer, pipe shall be accepted based on manufacture's tests and inspection as indicated in ***Subsection 708.04.01, "Production Quality Control Inspection and Testing,"*** Table 1.

B. The Contractor shall submit to Engineer manufacturer's Certificate of Compliance for each type of pipe furnished, in accordance with the provisions of ***Subsection 106.05, "Certificate of Compliance,"*** and these specifications.

1. The certificate shall certify that the pipe complies with the specifications and shall include the pipe classification, diameter, and the date of manufacture.

2. The batch test results of each material lot delivered to the project shall be attached to the certificate.

PHYSICAL PROPERTIES AND TESTS

708.03.01 REINFORCED CONCRETE PIPE

A. Reinforced concrete pipe shall conform to the following requirements:

1. **Circular Pipe:** ASTM C76, ASTM C1417.

2. **Elliptical Pipe:** ASTM C507.

B. The above ASTM specifications are clarified and amended as follows:

1. Reinforced Concrete Pipe (RCP) ASTM C76, Basis of Manufactured Lot Acceptance. Unless otherwise specified or designated by the Engineer, pipe shall be accepted based on the authorized status of the facility and visual defects or imperfections as delivered to the site.

2. Reinforced Concrete Arch Pipe (RCAP) ASTM C507, Reinforced Concrete Elliptical Pipe (RCEP) Basis of Manufactured Lot Acceptance. Unless otherwise specified or designated by the Engineer, pipe shall be accepted based on the authorized status of the facility and visual defects or imperfections as delivered to the site.

C. **Materials:**

1. Cement and Fly Ash:

a. Unless otherwise specified, cement shall be Type V, Type IP, or Type V and fly ash, and shall conform to ***Section 701, "Hydraulic Cement."***

b. Fly ash shall be Class F and conform to ***Section 729, "Fly Ash."***

2. Concrete: Unless otherwise specified, Portland cement concrete shall be as specified in ***Section 501, "Portland Cement Concrete."***

3. Synthetic Fibers**:**

a. Polypropylene fibers may be used, with the approval of the Engineer, as a nonstructural manufacturing material.

b. Only Type III synthetic fibers designed and manufactured specifically for use in concrete and conforming to ASTM C1116 shall be accepted.

4. Admixtures: Unless otherwise specified or approved by the Engineer, admixtures conforming to ***Section 702, "Concrete Curing Materials and Admixtures,"*** shall be acceptable for use.

D. All D-load and/or compressive strength requirements shall be met prior to shipment.

708.03.02 NONREINFORCED CONCRETE PIPE

A. This pipe shall conform to ASTM C14 for the specified diameters and strength classes.

708.03.03 PERFORATED CONCRETE PIPE

A. This pipe shall conform to ASTM C444 for the specified diameters and strength classes.

708.03.04 CLAY PIPE

A. This pipe shall conform to AASHTO M65 for pipe with full circular cross section, for the specified diameter and strength class.

B. When specified, the bell shall have integral spacer lugs to provide for an annular opening and self-centering feature.

708.03.09 REINFORCED CONCRETE PRESSURE PIPE

A. This pipe shall conform to AWWA C300, AWWA C301, AWWA C302, and ASTM C361.

TESTING AND INSPECTION

708.04.01 PRODUCTION QUALITY CONTROL INSPECTION AND TESTING

A. Material shall be tested, inspected, and certified in compliance with the Table 2 frequency.

B. The laboratory shall be R-18 AASHTO accredited in the appropriate test method, where applicable, and testing reviewed and stamped by a Nevada professional engineer who has responsible charge of the work.

1. Any structural integrity test shall be reviewed and stamped by a Nevada professional engineer who has responsible charge of the work.

2. Chemical testing does not require a professional engineer's review and stamp.

Review the Clark County web site for any exceptions to the test methods listed below at http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx.

Table 2 – Inspection and Testing

Product/Material	Subsection	Referenced Specification or Test Procedure	Requirement	Frequency
Concrete Pipe				
Plant QC Program	***708.01.01***	ACPA	Certified annually	1 per new plant or revision
Reinforced Concrete Pipe	***708.03.01***	ASTM C76, ASTM C1417	Design submittal	1 per type
		ASTM C76, Section 5.1.2	Basis of manufactured lot acceptance	See Components below
Reinforced Concrete Elliptical Pipe	***708.03.01***	ASTM C507, Section 5.1.1 and ASTM C655, Section 9	Design submittal	1 per type
		ASTM C76, Section 5.1.2	Basis of manufactured lot acceptance	See Components below
Nonreinforced Concrete Pipe	***708.03.02***	AASHTO M315 and ASTM C14	Design submittal	1 per type
		ASTM C14	Basis of manufactured lot acceptance	See Components below
Perforated Concrete Pipe	***708.03.03***	ASTM C444	Design submittal	1 per type
			Basis of manufactured lot acceptance	See Components below
Reinforced Concrete Pressure Pipe (Water)	***708.03.09***	AWWA C300, AWWA C301, and AWWA C302	Design submittal	1 per type
			Basis of manufactured lot acceptance	See Components below

Table 2 – Inspection and Testing				
Product/Material	**Subsection**	**Referenced Specification or Test Procedure**	**Requirement**	**Frequency**
Components				
Cement	***708.03.01***	***Section 701***	Certificate with test of Batch lot	1 per batch or heat lot
Curing Compound and Admixtures	***708.03.01***	***Section 702***		
Fly Ash	***708.03.01***	***Section 729***		
Steel Wire Steel Welded Wire Steel Wire Welded Deformed Steel Wire Welded Wire Deformed		***Section 713***		
Aggregates Coarse and Fine		AASHTO M6 and AASHTO M80	Sieve Analysis	1 per day for QA of External Source
Concrete		***Section 501***	Design submittal	1 per new design and renewal each year
		AASHTO T22	Compressive Strength	1 set per production day per design
Pipe	***708.03.01***	ASTM C655	D-Load testing	Annually per size and class
	708.03.01	Applicable AWWA and ASTM methods	Inspection of diameter, wall thickness, steel area, product marking (size and length), length	Each piece
Pressure Pipe Joint	***708.01.01***	ASTM C497 and ASTM C443	Hydrostatic Test	1 per setup or change

END OF SECTION 708

SECTION 710 – STRUCTURAL AND EYEBAR STEEL

SCOPE

710.01.01 MATERIALS COVERED

A. This specification covers the quality of structural and eyebar steel used in highway structures.

REQUIREMENTS

710.02.01 DEFECTS

A. Finished rolled material shall be free from cracks, flaws, injurious seams, laps, blisters, ragged and imperfect edges, and other defects.

B. Material shall have a smooth, uniform finish, and shall be straightened in the mill before shipment.

C. Material shall be free from loose mill scale, rust pits, and other defects affecting its strength or durability.

D. The Engineer may reject material that Engineer deems unsuitable for the purpose intended even though the material meets the mill tolerances.

710.02.02 CHARPY V-NOTCH TEST

A. All steel used in and designated as main load carrying members subject to tensile stress shall comply with all the requirements specified for Charpy V-notch test in the various AASHTO standards for the steel involved.

B. Sampling and testing procedures shall be in accordance with the applicable AASHTO standards.

PHYSICAL PROPERTIES AND TESTS

710.03.01 CORRUGATED METAL PIPE AND PIPE ARCHES

A. This steel shall conform to AASHTO M270 Grade 36.

710.03.02 HIGH STRENGTH-LOW ALLOY STRUCTURAL MANGANESE VANADIUM STEEL

A. This steel shall conform to AASHTO M270 Grade 50.

710.03.03 HIGH TENSILE STRENGTH BOLTS

A. This steel shall conform to ASTM A325.

710.03.04 STAINLESS STEEL BOLTS

A. This steel shall conform to ASTM A276.

710.03.05 WELDED SEAMLESS STEEL PIPE

A. This steel shall conform to ASTM A53, Grade B.

710.03.06 COLD-FORMED WELDED AND SEAMLESS CARBON STEEL STRUCTURAL TUBING IN ROUNDS AND SHAPES

A. This steel shall conform to ASTM A500, Grade B, except the minimum tensile strength shall be 55,000 psi.

710.03.07 SHEAR STUD CONNECTORS

A. This steel shall conform to ASTM A108, Grade 1015 or Grade 1020.

B. Flux-retaining caps shall be low carbon grade suitable for welding and shall conform to ASTM A109.

710.03.08 PINS AND ROLLERS

A. Pins or rollers 9 inches or less in diameter shall be forged and heat treated cold finished carbon-steel shafting.

B. Pins or rollers more than 9 inches in diameter shall be forged and heat treated in accordance with ASTM A235.

END OF SECTION 710

SECTION 712 – MISCELLANEOUS METAL

SCOPE

712.01.01 MATERIALS COVERED

A. This specification covers the type and quality of miscellaneous metals used on various construction projects.

PHYSICAL PROPERTIES AND TESTS

712.03.01 STEEL CASTINGS

A. This steel shall conform to ASTM A27, Grade 65-35.

712.03.02 GRAY IRON CASTINGS

A. These castings shall conform to ASTM A48, Class 30.

712.03.03 MALLEABLE CASTINGS

A. These castings shall conform to ASTM A47, Grade 32510.

712.03.04 WROUGHT IRON PLATES

A. These plates shall conform to ASTM A42.

712.03.05 BRONZE CASTINGS

A. These castings shall conform to ASTM B22, Copper Alloy No. 863.

712.03.06 WELDING MATERIALS

A. Materials used for welding shall conform to the current Specifications for Welded Highway and Railway Bridges of the American Welding Society and current AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges.

712.03.07 STEEL PILES

A. This steel ("H" piles and sheet piling) shall conform to ASTM A36.

712.03.08 STEEL SHELL FOR PILES

A. This steel shall conform to ASTM A252, Grade 2.

END OF SECTION 712

SECTION 713 – REINFORCEMENT

SCOPE

713.01.01 MATERIALS COVERED

A. This specification covers the quality of bar steel, fabricated reinforcement, and welded steel wire used in the reinforcement of concrete.

PHYSICAL PROPERTIES AND TESTS

713.03.01 BAR STEEL REINFORCEMENT

A. This steel shall conform to the applicable following requirements.

Test	Test Method	Requirements
Deformed Billet-Steel Bars for Concrete Reinforcement	ASTM A615	Grade 40, 60
Axle-Steel Deformed Bars for Concrete Reinforcement	ASTM A996	Grade 40, 60
Spiral Reinforcement	ASTM A615	Grade 60

713.03.02 FABRICATED STEEL BAR OR ROD MATS REINFORCEMENT

A. This steel shall conform to ASTM A184.

713.03.03 WELDED STEEL WIRE FABRIC REINFORCEMENT

A. This steel shall conform to ASTM A185.

713.03.04 PRESTRESSING STEEL

A. Prestressing reinforcement shall be high tensile strength steel wire, high-tensile strength 7-strand wire, or high tensile strength alloy bars as called for on the plans or in the Special Provisions.

B. High-tensile strength steel wire shall conform to ASTM A421, except that steel may be made by the basic oxygen process.

C. High-tensile strength 7-strand wire shall conform to ASTM A416, Grade 270.

D. High-tensile-strength alloy bars shall be stress relieved and then cold stretched to a minimum of 130,000 psi. After cold stretching, the physical properties shall be as follows:

Minimum Ultimate Tensile Strength	145,000 psi
Minimum Yield Strength, Measured by the 0.7 Percent Extension, Under Load Method Shall Be Not Less Than	130,000 psi
Minimum Modulus of Elasticity	25,000,000 psi
Minimum Elongation in 20-bar Diameters After Rupture	4 percent
Diameter Tolerance	+0.03 inch, -0.01 inch

E. Testing Prestressing Reinforcement and Anchorages:

1. All wire, strand, or bars to be shipped to the site shall be assigned a lot number and tagged for identification purposes.

2. Anchorage assemblies to be shipped shall be likewise identified.

F. All samples submitted shall be representative of the lot to be furnished, and, in the case of wire or strand, shall be taken from the same master roll.

G. All of the materials specified for testing shall be furnished free of cost and shall be delivered in time for tests to be made well in advance of anticipated time of use.

H. The Contractor shall furnish for testing the following samples selected from each lot. If ordered by the Engineer, the selection of samples shall be made at the manufacturer's plant by the inspector.

1. **Pretensioning Method.**

   a. For pretensioned strands, samples at lease 5 feet long shall be furnished of each strand size.

   b. A sample shall be taken from each end of every coil.

2. **Post-Tensioning Method.** The following lengths shall be furnished:

   a. For wires requiring heading: 5 feet.

   b. For wires not requiring heading: sufficient length to make up 1 parallel-lay cable 5 feet long consisting of the same number of wires as the cable to be furnished.

   c. For strand to be furnished with fittings: 5 feet between near ends of fittings.

   d. For bars to be furnished with threaded ends and nuts: 5 feet between threads at ends.

3. **Anchorage Assemblies.** 2 anchorage assemblies shall be furnished, complete with distribution plates of each size or type to be used if anchorage assemblies are not attached to reinforcement samples.

713.03.05 COLD-DRAWN STEEL WIRE FOR SPIRAL REINFORCEMENT

A. This steel shall conform to ASTM A82.

END OF SECTION 713

SECTION 714 – PAINT AND PAVEMENT MARKINGS

SCOPE

714.01.01 MATERIALS COVERED

A. This specification covers the quality, color, and number of applications of paint used for painting the various materials of construction.

1. The raw materials for use in the various paint formulas shall conform to the specifications designated by federal or military serial number or paint material code number under the various paint classifications hereinafter specified.
2. Subsequent amendments to the specifications quoted shall apply to all raw materials and finished products.
3. No "or equal" substitutions for any specified material shall be made without written consent of the Engineer.
4. State specification numbers referred to are California State Specifications unless otherwise noted.

B. Comply with ***Section 715, "Galvanizing,"*** for galvanized coatings.

REQUIREMENTS

714.02.01 CERTIFICATES

A. The Contractor shall furnish the Engineer with written certification that all required tests have been satisfactorily completed and that the materials tested comply with all of the requirements. Samples will be taken when required by the Engineer.

B. Prior to using any material, the Contractor shall provide the Engineer with a written "Certification of Compliance" from the manufacturer of the material. The certification shall:

1. Include the manufacturer's name, business address, and location of the manufacturing plant.
2. Identify the specifications and include 1 copy.
3. Show the quantity of materials supplied for each color, batch number, and date of manufacture.

C. Manufacturer's lab test results shall be supplied upon request of the Engineer. No pavement marking material shall be used which is not on the Qualified Products List (QPL) established by the Nevada Department of Transportation (NDOT). The current NDOT QPL is available at http://www.nevadadot.com.

PHYSICAL PROPERTIES AND TESTS

714.03.01 IRON AND STEEL USE ITEM CLASSIFICATIONS

A. **Zinc-Rich Primer, Organic Vehicle Type (State Spec. 8010-61J-36):**

1. This specification covers a 1-package, thermoplastic, organic zinc-rich primer whose mechanism of drying is that of solvent release.

2. This primer is intended for use only on blast cleaned open steel structures exposed to the air.

3. This coating is intended for spray application. Limited application can be made by brushing.

B. **Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27):**

1. This specification covers a wash primer formulated specifically for application prior to painting clean aluminum, galvanized surfaces, or surfaces previously coated with an organic or inorganic zinc-rich primer.

2. This primer is also used on blast cleaned steel when specified and is mandatory as an undercoat under vinyl paint systems.

C. **Vinyl Primer, Red Iron Oxide Type (State Spec. 8010-61J-23):**

1. This specification covers a ready-mixed, vinyl-red oxide paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment Vinyl Wash Primer (State Spec. 8010-61J-27).

2. This paint should be applied alternately with Vinyl Primer, Red Iron Oxide - Titanium Dioxide Type (State Spec. 8010-61J-24) to provide a primer coating which may consist of 1 or more applications of each vinyl primer.

3. Either State Specification 8010-61J-23 or 8010-61J-24 may be used for the initial application.

4. This paint is formulated primarily for spray application.

D. **Aluminum Vehicle Varnish (State Spec. 8010-91B-75):**

1. This specification covers an aluminum vehicle clear varnish and general all purpose phenolic base spar mixing varnish.

2. This varnish should not be used on surfaces and in pigment combinations where yellowing will be objectionable.

E. **Aluminum Paint, Finish Coat, (State Spec. 8010-61J-45):**

1. This specification covers a phenolic resin varnish base aluminum paint, suitable for use as a finish coat.

2. This paint is formulated for use on structural steel and interior and underwater surfaces of steel water tanks and similar exposed surfaces.

3. This paint shall be furnished in 2-compartment containers and shall be mixed fresh each day.

F. **Vinyl Paint, Aluminum Finish Coat (State Spec. 8010-61J-25):**

1. This specification covers a vinyl type aluminum paint for use on properly prepared metal surfaces that have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27) or specified vinyl undercoats.

2. This paint is primarily formulated for spray application.

3. This paint shall be furnished in 2-compartment containers and shall be mixed fresh each day.

G. **Burnt Umber Tint Finish Coat (State Spec. 8010-61J-41):**

1. This specification covers a ready-mixed burnt umber tint paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

H. **Burnt Sienna Finish Coat (State Spec. 8010-61J-53):**

1. This specification covers a ready-mixed burnt sienna paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

I. **Green Finish Coat (State Spec. 8010-61J-47):**

1. This specification covers a ready-mixed green paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

J. **Vinyl Green Finish Coat (State Spec. 8010-61J-40):**

1. This specification covers a ready-mixed green vinyl finish paint for use on properly prepared metal surfaces that have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27), or specified vinyl undercoats.
2. This paint is formulated primarily for spray application.

K. **Vinyl Iridescent Green Finish Coat (State Spec. 8010-91B-43):**

1. This specification covers a ready-mixed iridescent green vinyl finish paint for use on properly prepared metal surfaces that have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27), or specified vinyl undercoats.
2. This paint is formulated primarily for spray application.

L. **Tan Finish Coat (State Spec. 8010-61J-51):**

1. This specification covers a ready-mixed, tan paint suitable for use as a finish coat on properly prepared structural steel surfaces.
2. This paint may be applied by spray or brush.

M. **White Tint Base Finish Vinyl Coat (State Spec. 8010-71C-35):**

1. This specification covers a ready-mixed, white tint base, vinyl finish paint for use on properly prepared metal surfaces which have been treated with Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).
2. This paint is formulated primarily for spray application.

N. **Enamel; Exterior White, Metal (State Spec. 8010-61J-09):**

1. This specification covers a fast drying, exterior, white enamel, primarily for use on metal, or for other exterior surfaces where gloss and durability are requisite.
2. This paint shall conform to the provisions of Military Specification MIL-E-1115A.

O. **Enamel; Traffic Signal, Lusterless, Black (State Spec. 8010-61J-13):**

1. This specification covers a lusterless, black enamel for use in painting traffic signal hoods, shields, and other surfaces.

2. When used on bare aluminum or zinc, Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27) shall be used first to ensure proper bond.

P. **Enamel; Traffic Signal, Dark Olive Green (State Spec. 8010-41B-A):**

1. This specification covers an enamel for use on signal poles.

2. This paint is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).

Q. **Enamel; Traffic Signal, Yellow (School Bus Yellow):**

1. This specification covers high-gloss enamel for use on signal poles.

2. This paint is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).

3. School bus yellow shall conform to Federal Color No. 13432 as shown in Table V of Federal Standard No. 595a.

R. **Enamel; Traffic Signal, Silver:**

1. This specification covers an enamel for use on signal poles.

2. This paint is formulated as a finishing coat to be used over Pre-Treatment, Vinyl Wash Primer (State Spec. 8010-61J-27).

3. The silver shall conform to Federal Color No. 17178 as shown in Table IX of Federal Standard No. 595a.

714.03.02 TIMBER USE ITEM CLASSIFICATIONS

A. **Wood Primer Latex Base:**

1. This specification covers a ready-mixed, priming paint for use on unpainted wood or exterior wood work.

2. This paint shall comply, in all respects, with Federal Specification TT-P001984, except that it shall dry hard in not more than 12 hours.

B. **Paint, Latex Base for Exterior Wood, White and Tints:**

1. This specification covers a ready-mixed paint for use on wood surfaces subject to outside exposures.

2. This paint shall comply in all respects with Federal Specification TT-P96D.

3. Unpainted wood shall first be primed with Wood Primer conforming to ***Subsection 714.03.02***, paragraph A, ***"Wood Primer, Latex Base."***

C. **Enamel; Sign Post, Black (State Spec. 8010-61J-08):**

1. This specification covers a gloss black enamel for use on wood or metal.

714.03.03 CONCRETE USE ITEMS

A. Concrete end posts (bridges), raised traffic bars, and miscellaneous concrete specified to receive paint.

Purpose	Number of Coats	Color	General Type	Formulated or Specification
Finish	1	White	Water Thinned	Acrylic Resin or Synthetic Latex Alkyd Emulsion

714.03.04 ALUMINUM USE ITEM

A. Aluminum bridge railing and posts specified to receive paint shall be prepared for painting with a coat of Pre-Treatment, Vinyl Wash Primer conforming to ***Subsection 714.03.01***, paragraph B, "***Pre-Treatment, Vinyl Wash Primer*** (State Spec. 8010-61J-27)."

B. The Contractor may use any of the paint systems specified for use on iron or steel in ***Subsection 714.03.01, "Iron and Steel Use Item Classifications,"*** for painting aluminum, and shall submit to the Engineer for approval a letter indicating Contractor's choice of system as required for iron or steel.

714.03.05 PAINT FOR TRAFFIC STRIPING, PAVEMENT MARKING, AND CURB MARKING - GENERAL

A. These specifications are intended to cover ready-mixed paints of a consistency suitable for use on highway pavements and curbing, either asphaltic or Portland cement concrete type.

B. Reference specifications and standards shall be Federal Specifications, latest revision, as herein noted, or Federal Test Method Standard No. 141, latest revision, as called for and amended in these specifications.

C. Paint shall be homogenous, free of contaminant, and of a consistency suitable for use in the capacity for which it is specified.

1. Finished paint shall be well ground and the pigment shall be properly dispersed in the vehicle according to the requirements of the paint.
2. The dispersion shall be of such nature that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled.
3. Any settlement of pigment in the paint shall be a thoroughly wetted soft mushy mass permitting the complete and easy vertical penetration of a paddle.
4. Settled pigment shall be easily redispersed, with minimum resistance to the smooth uniform product of the proper consistency.
5. The manufacturer shall include in the paint the necessary additives for control of sagging, pigment settling, leveling, drying, drier absorption and skinning, or other requisite qualities of a satisfactory working material.
6. The paint shall possess satisfactory properties, in all respects, that affect its application and curing.

D. All manufactured paint shall be prepared at the factory ready for application. The addition of thinner or other material to the paint after the paint has been shipped will not be permitted unless otherwise specified in the contract Special Provisions.

714.03.06 PAVEMENT MARKINGS

A. **Type 2:**

1. Type 2 pavement marking material shall be a durable retroreflective pavement marking for use on asphalt or concrete pavements transverse markings such as crosswalks and stop bars, and for word/symbol markings, that are subjected to severe wear conditions such as repeated shear action from stop, start, or turn movements.

2. Type 2 materials are as follows:

   a. **Preformed Pavement Marking Tape**: This material shall meet the minimum requirements set forth in ASTM D4505 except as modified below.

   b. Whiteness Index: The daylight color of the white striping shall have a minimum initial whiteness index of sixty (60) as determined in Practice E313. Color shall be determined using 0/45 or 45/0 geometry.

   c. Retroreflectance:

      1) White preformed marking tape shall have the following initial minimum retroreflectance values as measured in accordance with ASTM D4061.

      2) Retroreflectance values shall be expressed as coefficient of retroreflected luminance (R_L) in millicandelas per square foot per footcandle (mcd/ft^2/fc).

Entrance Angle	86.0°	86.5°	88.8°
Observance Angle	0.2°	1.0°	1.05°
***R*$_L$ (mcd/ft^2/fc)**	550	300	250

   d. Skid Resistance: The surface of the retroreflective pavement marking tape shall provide an initial minimum average skid resistance value of 45 BPN when tested in accordance with ASTM E303.

   e. Durability:

      1) The durability of the pavement marking material shall be the percentage of the marking material remaining on the pavement surface in satisfactory working condition.

      2) The initial value shall always be established at 100 percent.

   f. Performance Requirements:

      1) Type 2 pavement marking material, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to the temperature if the pavement surface remains stable.

      2) The material shall be weather resistant and, through normal traffic wear, shall show no fading that will significantly impair the intended use of the marking throughout its useful life.

      3) Pavement marking tape shall show no lifting or shrinkage and shall show no significant tearing, roll back, or other signs of poor adhesion.

      4) Type 2 pavement marking material shall also meet the performance criteria establish in the table below.

Performance Factor*	Heavy Traffic (greater than 6,000 ADT per lane)	Medium and Light Traffic (6,000 ADT or less per lane)
Retained Retroreflectivity	74	40
Durability	90%	75%
Whiteness Index	10	10
Whiteness Index (0.5 million vehicle passes)	20	20

***Values for the performance factors are retained values which shall be determined after the markings have been in place a minimum of one (1) year and subjected to a minimum 4,000,000 vehicle passes per lane.**

g. Installation and Warranty

1) The markings shall be applied in accordance with the manufacturer's instructions.

2) Contractor shall provide to Engineer the manufacturer's written installation instructions and a recommendation for the type of adhesive to be used prior to installation of materials.

3) The marking material and installation shall have a minimum 1-year warranty.

B. **Type 1:**

1. Type 1 pavement marking material shall be a durable retroreflective pliant pavement marking for use on asphalt or concrete pavements for longitudinal markings such as edge lines and lane lines.

2. The color of the marking material shall be white or yellow and conform to standard highway colors.

3. Type 1 materials shall be as follows

a. **Preformed Pavement Marking Tape:** This material shall meet minimum requirements set forth in ASTM D4505 except as modified below:

1) Retroreflectance:

a) White and yellow preformed marking tape shall have the following initial minimum retroreflectance values as measured in accordance with the testing procedures of ASTM D4601.

b) Retroflectance values shall be expressed as coefficient of retroreflected luminance (RL) in millicandelas per square foot per footcandle (mcd/ft2/fc).

	White			Yellow		
Entrance Angle	86.0º	86.5º*	88.8°	86.0º	86.5º*	88.8°
Observance Angle	0.2º	1.0º	1.05°	0.2º	1.0º	1.05°
R_L (mcd/ft^2/fc)	800	600	400	700	500	300

2) Skid Resistance: The surface of the retroreflective pavement marking tape shall provide an initial minimum average skid resistance value of 45 BPN when tested in accordance with ASTM E303.

b. **Preformed Thermoplastic Tape (Yellow Markings Only):**

1) The preformed retroreflective marking material shall consist of a resilient polymer thermoplastic with uniformly distributed retroreflective beads throughout its entire cross section.

2) The markings shall be fusible to asphalt and Portland cement concrete pavements by the normal heat of a propane torch as recommended by the manufacturer.

c. **Paint:**

1) Traffic paint used for pavement markings shall conform to material requirements listed in the following subsections:

a) Subsection 714.03.05, "Paint for Traffic Striping, Pavement Marking, and Curb Marking - General,"

b) Subsection 714.03.07, "Fast Dry Traffic Paint,"

c) Subsection 714.03.09, "Ready-Mixed Traffic Stripe Paints."

2) Requirements for retroreflective beads used with the application of this material are listed in ***Subsection 714.03.12, "Reflective Material."***

d. **Epoxy Paint (Yellow Marking Only):**

1) Epoxy paint marking material shall consist of a 100 percent solid, 2-part system formulated and designed to provide a simple volumetric mixing ration of 2 components.

2) Epoxy paint used for pavement markings shall conform to materials requirements listed in ***Subsection 714.03.10, "Epoxy Paint for Traffic Markings."***

3) Requirements for retroreflective beads used with the application of this material are listed in ***Subsection 714.03.12, "Reflective Material."***

e. **Polyurea Paint:**

1) Polyurea paint marking shall consist of a 100 percent solid, 2-part system formulated and designed to provide a simple volumetric mixing ratio of 2 components.

2) Polyurea paint used for pavement markings shall conform to materials requirements listed in ***Subsection 714.03.10, "Epoxy Paint for Traffic Markings."***

3) Requirements for retroreflective beads and reflective elements used with the application of this material are listed in ***Subsection 714.03.12, "Reflective Material."***

f. Durability:

1) The durability of the pavement marking material shall be the percentage of the marking material remaining on the pavement surface in satisfactory working condition.

2) The initial value shall always be established at 100 percent.

g. Performance Requirements:

1) Type 1 pavement marking material, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to the temperature if the pavement surface remains stable.

2) The material shall be weather resistant and, through normal traffic wear, shall show no fading that will significantly impair the intended use of the marking throughout its useful life.

3) Pavement marking tape shall show no lifting or shrinkage and shall show no significant tearing, roll back, or other signs of poor adhesion.

4) Type 1 pavement marking material shall also meet the performance criteria established in the table below.

Performance Factors	**Heavy Traffic** (greater than 6000 ADT per lane)		**Medium and Light Traffic** (6000 ADT or less per lane)	
	White	**Yellow**	**White**	**Yellow**
Retained Retroreflectivity	200	150	100	100
Durability	98%	95%	93%	93%
Whiteness Index	6	45	6	40

*Values for the performance factors are retained values which shall be determined after the markings have been in place a minimum of one (1) year and subjected to a minimum 4,000,000 vehicle passes per lane.

h. Installation and Warranty:

1) The markings shall be applied in accordance with the manufacturer's instructions.

2) Contractor shall provide to Engineer the manufacturer's written installation instructions and a recommendation for the type of adhesive to be used prior to installation of materials.

3) The marking material and installation shall have a minimum 1-year warranty.

i. Qualified Products List:

1) The Nevada Department of Transportation (NDOT) maintains a Qualified Products List (QPL) of all products available that satisfy the requirements of these specifications and have proven effective in field tests. The current NDOT QPL is available at: http://www.nevadadot.com.

714.03.07 FAST DRY TRAFFIC PAINT

A. Type 2 (Heatable) Fast Dry White, Type 2 (Heatable) Fast Dry Yellow, Type 1 Fast Dry White, and Type 1 Fast Dry Yellow shall comply with any western state specification valid at the time of use in addition to meeting ***Subsection 714.03.05, "Paint for Traffic Striping, Pavement Marking, and Curb Marking – General,"*** and listed on the NDOT QPL.

B. Fast dry traffic paint shall be applied at the film thickness of 15 mils to 20 mils and shall dry to "no traffic pickup" within 3 minutes.

C. The "no traffic pickup" time shall be determined by ASTM D711.

714.03.08 ALL PURPOSE BLACK TRAFFIC PAINT - PAINT FORMULA 235

A. All purpose Black Traffic Paint - Paint Formula 235 shall comply with any western state specification valid at the time of use, and listed on the NDOT QPL.

714.03.09 READY-MIXED TRAFFIC STRIPE PAINTS

A. Where ready-mixed paints are specified, they shall be suitable for use on either asphalt concrete or Portland cement concrete.

714.03.10 EPOXY PAINT FOR TRAFFIC MARKINGS

A. Epoxy traffic paints shall be a 2-component marking material suitable for use on either asphalt concrete or Portland cement concrete.

B. Mixing of 2 components shall be performed as recommended by the manufacturer.

C. Epoxy paint shall only be applied if air temperature is a minimum of 50 degrees F at the time of marking installation.

D. If the manufacturer of the marking material requires a minimum air temperature different than detailed above, the higher temperature shall be used.

E. If material needs heating prior to application, no fumes shall be exuded that are toxic or injurious to persons or property.

F. Epoxy paint shall dry to "no traffic pickup" within 45 minutes.

714.03.11 POLYUREA PAINT FOR TRAFFIC MARKINGS

A. Polyurea traffic paints shall be a 2-component marking material suitable for use on either asphalt concrete or Portland cement concrete.

B. Mixing of 2 components shall be performed as recommended by the manufacturer.

C. Polyurea paint shall be applied if air temperature is a minimum of 40 degrees F at the time of marking application.

D. If the manufacturer of the marking material requires a minimum air temperature different than detailed above, the higher temperature shall be used.

E. If material needs heating prior to application, no fumes shall be exuded that are toxic or injurious to person or property.

F. Polyurea paint shall be dry to “no traffic pickup” within 5 minutes.

714.03.12 REFLECTIVE MATERIAL

A. Reflective material shall consist of retroreflective beads and of the final coat of traffic paint or epoxy paint and polyurea paint prior to setting, so that the beads will have proper adhesion.

B. Special care shall be taken with rapid dry paint and epoxy paint materials.

C. Retroreflective beads shall conform to Federal Specification TT-B-1325B and shall be mechanically applied at a rate recommended by the manufacturer to achieve performance criteria established in ***Section 714.03.06, "Pavement Markings."***

D. Retroreflective beads shall be applied to pavement markings, curbs, and crosswalks by use of a dispensing device developed for this purpose or other methods approved by the Engineer.

E. The Engineer may authorize the use of traffic paint containing pre-mixed retroreflective beads.

1. The type, gradation, quantity, and quality of the pre-mixed retroreflective beads shall be approved prior to the manufacture of the traffic paint.

2. In addition to the specified pre-mixed beads, additional beads may need to be mechanically applied when the traffic paint is applied.

714.03.13 AIR POLLUTION

A. All paint shall meet the requirements of the Clark County Department of Air Quality and Environmental Management (DAQEM).

714.03.14 TEST REPORTS AND CERTIFICATION

A. At the time of delivery of each shipment of material, the Contractor shall, upon request, deliver to the Engineer certified copies of the manufacturer's test report.

B. The test report shall indicate the name of the manufacturer, type of material, date of manufacture, quantity, applicable State Specification Number and specification, manufacturer's lot or batch number, and results of the required tests.

1. The test report shall be signed by an authorized representative of the manufacturer.

2. The certified test reports and the testing required in connection therewith shall be at no cost to the Contracting Agency.

END OF SECTION 714

SECTION 715 – GALVANIZING

SCOPE

715.01.01 MATERIALS COVERED

A. This specification covers the quality and thickness of galvanizing used on various material when called for on the plans or designed in the specifications.

PHYSICAL PROPERTIES AND TESTS

715.03.01 PRODUCTS 1/8-INCH THICK AND THICKER

A. Galvanizing of products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strip shall conform to ASTM A123.

715.03.02 GUARDRAIL ELEMENTS

A. All rail elements shall be galvanized in accordance with AASHTO M180, Type 2.

715.03.03 HARDWARE

A. Bolts, nut, washers, and fastenings shall be galvanized in accordance with ASTM A153.

END OF SECTION 715

SECTION 716 – SIGN MATERIALS

SCOPE

716.01.01 MATERIALS COVERED

A. This specification covers the kind and quality of materials used in the construction and fabrication of traffic control devices used in temporary event zones and for permanent installations.

REQUIREMENTS

716.02.01 GENERAL

A. The following materials shall conform to the requirements as noted:

Material	Section
Portland Cement Concrete	***501***
Reinforcing Steel	***505***

716.02.02 CERTIFICATES

A. The Contractor shall ascertain that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency.

B. The Contractor shall furnish the Engineer with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

716.02.03 SUBMITTALS

A. Before fabrication is started, 5 sets of shop drawings for each overhead sign structure shall be submitted to the Engineer for approval.

PHYSICAL PROPERTIES AND TESTS

716.03.01 REFLECTIVE SHEETING

A. Sheeting for all orange signs and devices shall be Fluorescent Orange with the exception of Type 1, Type 2, and Type 3 barricades, which shall be pre-striped white and non-fluorescent Orange sheeting.

B. Fluorescent Yellow-Green sheeting shall be used on School, Bicycle, and Pedestrian signs, and related supplemental plates, or as directed by the Contracting Agency.

C. Inks and films for symbols, legends and borders on sheeting shall be in accordance with the manufacturer's sheeting specification. Films shall be a durable, transparent, acrylic colored film coated with a transparent pressure-sensitive adhesive.

D. Protective overlay film (anti-graffiti film for non-illuminated signs), shall be a durable, solvent resistant, transparent, fluoropolymer film, coated with a transparent pressure-sensitive adhesive, and applied to the finished sign in accordance with the manufacturer's sheeting specification.

E. **Non-Reboundable Signs and Devices**: Retroreflective sheeting shall conform to ASTM D4956, Type XI. The warranty for the sheeting shall be twelve years for non-fluorescent sheeting, ten years for Fluorescent Yellow and Fluorescent Yellow-Green sheeting, and three years for Fluorescent Orange sheeting,

F. **Reboundable Devices and Delineators**: Retroreflective sheeting shall conform to ASTM D4956, Type IV and Type VI with the following modifications:

1. Minimum Coefficient of Retroreflection (R_A) [cd/fc/ft^2 (cd/lx.m^2)] for both Type IV and Type VI shall conform to the requirements for ASTM D4956, Type VI as shown in Table 716-1

2. Daytime color – the chromaticity coordinates and total luminance factor shall conform to the requirements as described in 23 CFR Part 655 Appendix to Subpart F.

TABLE 716-1 MINIMUM COEFFICIENT OF RETROREFLECTION (R_A)

Observation Angle	Entrance Angle	White	Fluorescent Orange	Fluorescent Yellow	Fluorescent Yellow-Green
0.2°	-4°	500	200	300	400
0.2°	30°	200	80	120	160
0.5°	-4°	225	90	135	180
0.5°	30°	85	34	51	68

G. Fluorescence Luminance Factor (L_F) for all Fluorescent sheeting shall conform to the requirements in Table 716-2.

H. Unless otherwise specified, the Contractor shall use only Type IV, Type VI, and Type XI products listed in the NDOT QPL.

TABLE 716-2 FLUORESCENCE LUMINANCE FACTOR (Y_F)

Color	Y_F Initial Requirement	Y_F Minimum Requirement
Fluorescent Orange	20	15
Fluorescent Yellow	25	20
Fluorescent Yellow-Green	30	20

I. **Field Performance Life Requirement:**

1. The supplier shall warranty that signs supplied shall have an effective retroreflective life of not less than that specified above.
2. The retroreflective sheeting shall be considered unsatisfactory and failing this life requirement if it has deteriorated due to natural causes to the extent that 1 or more of the following is true:
   a. The sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night conditions.
   b. The values for the coefficients of retroreflection for Type IV, Type VI, and Type XI are less than 50 percent of the required values for the same sign when new in accordance with ASTM D4956.
   c. The sign material's integrity or adhesion to the sign substrate has substantially failed.
3. Sheeting which fails the life requirement within the specified required lifetime shall be replaced by the supplier at no cost to the Contracting Agency.
4. Replaced sheeting warranty shall begin at time of replacement and the warranty shall be to the life requirement per sheeting type.
5. All finished signs shall be dated with the month and year of delivery in order to ascertain compliance with the life requirements.

716.03.03 ALUMINUM SIGN PANELS (FOR REFLECTIVE SHEETING)

A. Sheet aluminum for sign panels shall be of 0.100-inch aluminum alloy Alclad 5052-H38 or 6061-T6 and shall conform to ASTM B209.

B. Sign panels for street name signs shall be as required in the Standard Drawings.

C. Sign panel sections shall be fabricated of standard width aluminum sheets not less than 4 feet wide, except that not more than 2 sheets for any 1 sign may be cut not less than 18 inches in width to provide sign widths to nearest 6-inch increments. Panel sections shall run from the top edge to the bottom edge of the sign without horizontal joints.

D. The aluminum shall be free of all corrosion, white rust, and dirt.

1. All sign dimensions, metal gauge, and bolt holes shall conform to the plans and these specifications.
2. Blanks shall be cleaned, degreased, and chromated or otherwise properly prepared according to methods recommended by the sheeting manufacturer.

E. Metal shall not be handled, except by device or clean canvas gloves, between all cleaning operations and the applications of the sign background material. There shall be no opportunity for the aluminum to come in contact with greases, oils, or other contaminants prior to application of the background material.

F. All fabrication, including cutting, shall be completed prior to the cleaning process.

1. Metal panels shall be cut to size and shape and shall be free of defects resulting from fabrication.

2. The surface of all sign panels shall be a plane surface.

716.03.05 OVERHEAD SIGN STRUCTURES AND SIGN FRAMES

N. The materials used in the fabrication of overhead sign structures and footings shall conform to the requirements specified below.

O. **Sign Frames:** Bars, plates, and shapes shall be structural steel conforming to ASTM A36.

P. **Sign Pipe Posts:**

1. Pipe posts shall be welded or seamless steel pipe conforming to ASTM A53, Grade B.

2. At the option of the Contractor, posts may be fabricated from structural steel conforming to ASTM A36 or ASTM A283, Grade D, except that plates more than 1 inch in thickness shall be structural steel conforming to ASTM A373.

Q. **Sign Steel Walkway Gratings:** Steel walkway gratings shall be furnished and installed in accordance with details shown on the plans and the following provisions:

1. Gratings shall be the standard product of an established grating manufacturer.

2. Material for gratings shall be structural steel conforming to ASTM A36.

3. For welded type gratings, each joint shall be full resistance welded under pressure to provide a sound, completely beaded joint.

4. For mechanically locked gratings, the method of fabrication and interlocking of the members shall be approved by the Engineer, and the fabricated grating shall be equal in strength to the welded type.

5. After fabrication, gratings shall be hot-dip galvanized.

6. Gratings shall be free from warps, twists, and other defects affecting their appearance or serviceability.

   a. The tops of the bearing bars and cross members shall be in the same plane.

   b. Gratings distorted by the galvanizing process shall be straightened.

R. **Bolts and Nuts:**

1. Bolts and nuts shall conform to ASTM A307.

2. Bolted connections shall conform to ***Subsection 506.03.07, "Bolts and Bolted Connections."***

S. Bearing plates and gusset or stiffener plates shall be of the sizes and dimensions shown on the plans and shall be galvanized after fabrication.

1. Steel shall conform to ASTM A36.

2. Galvanizing shall conform to ASTM A123.

3. All welding shall conform to ***Subsection 506.03.17, "Welding."***

T. Anchor bolts, nuts, and washers shall be of structural carbon steel conforming ***to Section 710, "Structural and Eyebar Steel,"*** and shall be galvanized in accordance with ASTM A153 or cadmium plated in accordance with ASTM A165, Type TS.

1. The top portion of anchor bolts shall be galvanized or cadmium plated so that the galvanized or cadmium plated portion will extend at least 2 inches into concrete.
2. Anchor bolts shall be of the size, shape, and length shown on the plans.

U. All bolts, nuts, clamps, and metal washers not otherwise noted shall be galvanized or cadmium plated.

1. Cadmium plating shall conform to ASTM A165, minimum thickness as prescribed for grade Type TS.
2. Galvanizing shall conform to ASTM A153.

V. Supporting frame shall be manufactured in accordance with the plans and requirements herein specified.

1. All metal parts shall be galvanized after fabrication, in accordance with ***Section 715, "Galvanizing."***
2. When permission is granted by the Engineer to zinc coat a surface by means other than hot-dip galvanizing, the metalizing process shall be used to place the zinc.
3. Metalizing shall be performed in accordance with AWS specifications and the thickness of the sprayed zinc coat shall be at least 5 mils.

W. Truss frames shall be fabricated to the largest practical sections prior to galvanizing.

1. Splice locations shall be submitted to the Engineer for approval.
2. Contractor shall not commence fabrication until such splice locations are approved.

X. All welding on the fabrication of the structure shall be done by welders qualified in accordance with AWS requirements using the inert-gas shielded-arc method.

1. Welds shall be free from cracks, blow holes, and other irregularities.
2. Welds shall be wire brushed or otherwise cleaned.
3. No field welding on any part of the structural assembly will be permitted.

716.03.06 SIGN HARDWARE, POST, AND RELATED MATERIALS

A. Bearing plates and gusset or stiffener plates shall be of the sizes and dimensions shown on the plans and shall be galvanized after fabrication.

1. Steel shall conform to ASTM A36.
2. Galvanizing shall conform to ASTM A123.
3. All welding shall conform to ***Subsection 506.03.17, "Welding."***

B. Structural I-beam steel shall be galvanized in accordance with ASTM A153 or cadmium plated in accordance with ASTM A165, Type TS.

C. Anchor bolts, nuts, and washers shall be of structural carbon steel conforming to ***Section 710, "Structural and Eyebar Steel."***

1. The top portion of anchor bolts shall be galvanized or cadmium plated so that the galvanized or cadmium plated portion will extend at least 2 inches into the concrete.
2. Anchor bolts shall be of the size, shape, and length shown on the plans.

D. Steel pipe for posts shall conform to ASTM A53, Grade B, and shall be galvanized.

1. Galvanized steel pipe posts shall be of the diameter and length shown on the plans.
2. The top of the posts shall be fitted with a cover.
3. Posts showing damage shall be repaired or rejected.

E. BLANK

F. Aluminum stiffeners, braces, and stringers used as horizontal supporting structural members shall be of aluminum alloy 6061-T6.

1. These extrusions shall have a continuous, inverted "T" slot.
2. The inverted "T" shall accommodate positionable stainless steel clamping devices.
3. The clamping devices shall provide complete freedom of alignment within the slot, forming an interlocking clamp system for fastening the sign to the post.
4. The sign support system described herein shall conform to AASHTO *Standard Specifications for Highway Signs, Luminaires and Traffic Signals*, latest revision, and be rated for minimum wind velocities of 80 mph.
5. All bolts, nuts, clamps, and metal washers in contact with this aluminum channel shall be Stainless Steel Type 304.
6. The system shall be compatible with all I-beam, steel post, and wood post systems.

G. All other bolts, nuts, clamps, and metal washers in contact with other aluminum components shall be galvanized or cadmium plated.

1. Cadmium plating shall conform to ASTM B766, minimum thickness as prescribed for Class 5 Type 3.
2. Galvanizing shall conform to ASTM A153.

H. Cantilever arm brackets shall be used when it is desired to offset the entire length of a sign to 1 side of a post or pole.

1. Cantilever arm brackets shall consist of a stainless steel or aluminum head mounted to an extruded aluminum "TEE" section.
2. The "TEE" section shall have a continuous slot that will accept signs up to 1/8 inch thick.
3. If sign thickness, including aluminum sign panel and reflective sheeting, exceeds the width of the "TEE" section slot, sign panel thickness may be reduced to not less than 0.080 inch, or reflective sheeting may be eliminated in the bracket area, as directed by the Engineer.
4. The heads shall be designed to accept 3/4-inch stainless steel banding.
5. The "TEE"-shaped extrusions shall be made from 6061-T6 aluminum alloy.
6. The cantilever arm brackets shall be used to support the entire length of the sign on both the top and the bottom.
7. The sign shall be attached to the brackets using 1/8-inch rivets spaced according to the hole pattern pre-drilled on the extruded "TEE" section.

8. The cantilever arm brackets shall be compatible with any size and shape of post or pole.
9. The system shall be designed for use on signs up to 72 inches in length with a maximum surface area of 9.5 square feet.
10. Signs with surface area greater than 2 square feet shall be fastened to round posts or poles using 3/4-inch by 0.030-inch stainless steel banding.
11. When mounting to square posts or flat surfaces, compatible stainless steel threaded studs or bolts can be used as well as 3/4-inch by 0.030-inch stainless steel banding.
12. For signs less than 2 square feet in surface area, 5/8-inch banding is acceptable.

END OF SECTION 716

SECTION 721 – OBJECT MARKERS AND GUIDE POSTS

SCOPE

721.01.01 MATERIALS COVERED

A. This specification covers the quality and kind of material used in the construction of object markers and guide posts.

REQUIREMENTS

721.02.01 CERTIFICATES

A. At no additional cost to the Contracting Agency, 2 certificates covering each order of material (plates, reflectors, and posts) shall be furnished by the manufacturer, certifying that the product complies with the specifications.

B. Certificates shall be delivered to the Engineer at the time of, or prior to, delivery of the order.

C. For steel used in posts, the Contractor shall furnish 2 certified copies of mill test reports showing the chemical and physical characteristics from each heat.

PHYSICAL PROPERTIES AND TESTS

721.03.01 METAL POSTS

A. Posts shall be steel conforming to ASTM A570, Grade C.

B. Metal posts shall be galvanized in accordance with ***Section 715, "Galvanizing."***

721.03.02 TARGET PLATES

A. **Base Metal:** Base metal for target plates shall be zinc-coated steel sheet or aluminum sheet.

B. Zinc-Coated Steel Sheet:

1. The zinc-coated steel sheet shall comply with Federal Specification QQ-S-775, Steel Sheet, carbon, zinc-coated Type 1, Classes d and e, except that the zinc-coated surface shall withstand a 180-degree bend on itself at room temperature without flaking the coating.

2. The zinc-coated surface shall be prepared for painting by the application of phosphate coating.

3. Surface preparation shall conform to the following requirements:

   a. The phosphatizing process shall be accomplished without damaging or removing the galvanized coating from the steel base metal.

   b. Any evidence of damage or removal of the zinc coating shall be cause for rejection of the entire lot.

C. Aluminum Sheet:

1. The aluminum shall be prepared for painting with a chemical conversion coating conforming to Federal Specification MIL-C-5541.

2. The coating shall be applied in accordance with the manufacturer's specifications and recommended sequence of operation.

3. Contractor shall furnish 2 copies of certified mill tests of the aluminum sheets to the Engineer.

D. Target plates shall be fabricated from 20 gauge steel sheet or 0.050-inch thick aluminum sheet, alloy 3005-H14.

E. Fabrication of all metal parts shall be accomplished in a uniform and workmanlike manner.

1. Plates shall be cut to size and shape and the holes punched for mounting bolts and reflectors in accordance with the details shown on the plans.

2. Surfaces and edges of the plates shall be free from defects resulting from fabrication.

F. **Paint:**

1. Target plates shall have satisfactory paint adherence.

2. The plates shall be coated with baked enamel conforming to the following provisions:

a. The enamel finish coat for plates shall comply in all respects with Federal Specification TT-E-489, Class B baking type enamel, with the added requirement that the yellowness index of the white enamel shall not exceed 0.08 when tested in accordance with Federal Test Method Standard No. 141, Method 6131.

b. Application of the baking enamel may be by spray, roller, or dip, at the option of the manufacturer. Other methods may be used provided they are approved prior to use.

c. The dry film thickness of the baked enamel coating on the galvanized steel plates shall be not less than 2.0 mils on both front and back surfaces.

d. The dry film thickness on both front and back surfaces of the aluminum plates shall be:

1) Not less than 1.5 mils on each side if enamel is applied by spray or dip method.

2) Not less than 1.0 mil if enamel is applied by continuous roller coat method.

e. The coating shall be uniform throughout and shall be smooth and free from flow lines, streaks, blisters, and other surface imperfections.

G. The finished plates shall be free from dents and defects. The maximum surface deviation from a horizontal plane on which the finished plate lies shall not exceed 0.25 inch.

702.03.03 REFLECTORS

A. **Photometric Requirements:**

1. Each reflective delineator shall have the following minimum brightness values at 2 degrees divergence expressed as candlepower per foot candle.

2. Measurements shall be conducted in accordance with standard photometric testing procedures for reflex reflectors of the Society of Automotive Engineers.

Angle of Incidence	Silver-White		Yellow	
	Divergence Angle			
	0.2	0.5	0.2	0.5
	Brightness (cd/ftcd)			
0 degrees	9.0	3.8	5.3	2.3
15 degrees	8.0	3.4	4.4	2.0
30 degrees	5.4	2.9	2.7	1.2
45 degrees	2.6	1.1	1.0	0.5

3. The brightness of the reflective sheeting, totally wet by rain, shall not be less than 90 percent of the above values.

4. Wet performance measurements shall be conducted in conformance with standard rainfall tests specified in MIL-R-13689A.

B. **Durability.** The delineator surface shall readily be refurbished by cleaning and clear overcoating in accordance with the manufacturer's recommendations.

END OF SECTION 721

SECTION 722 – WATER

SCOPE

722.01.01 MATERIALS COVERED

A. This specification covers the quality of water from non-potable sources for use in preparing cement concrete or soil-cement mixtures, and for wetting embankment, backfill, subgrade, and gravel base and surfacing courses.

REQUIREMENTS

722.02.01 GENERAL

A. All water for embankments, backfill, subgrade, gravel base, landscaping, and surface courses and cement concrete curing shall be free from an excessive amount of acids, alkali, oil, and other substances which, in the opinion of the Engineer, will cause damage to the above mentioned items.

PHYSICAL PROPERTIES AND TESTS

722.02.02 CONCRETE USE

A. Samples submitted for tests shall consist of 2 quarts of water, obtained and shipped in clean glass containers carefully packed and labeled.

B. Tests shall be made in accordance with AASHTO T26.

C. Any indication of unsoundness, marked change in time of setting, or a reduction of more than 10 percent in strength from results obtained with concrete mixtures containing the water of satisfactory quality shall be sufficient cause for rejection of the water under tests.

END OF SECTION 722

SECTION 725 – ELASTOMERIC BEARING PADS

SCOPE

725.01.01 MATERIALS COVERED

A. Elastomeric bearing pads shall be preformed pads formed by casting or extruding natural rubber or neoprene under pressure and heat.

B. The pads shall be cast or extruded in a single, integral layer to the required thickness, unless pads with nonelastic lamination are called for on the plans.

C. All components of a laminated pad shall be molded together into an integral unit and all edges of the laminates shall be covered by a minimum of 1/8 inch of elastomer, except at laminate restraining devices and around holes that will be entirely closed on the finished structure.

D. Laminates shall be of the material and thickness called for on the plans.

REQUIREMENTS

725.02.01 CERTIFICATE OF INSPECTION

A. The material furnished will be evaluated for acceptance on the basis of the manufacturer's Certified Report of Test or Analysis indicating compliance with these special properties, but the Engineer may obtain test specimens on request.

B. Contractor shall furnish to the Engineer 3 copies of the manufacturer's Certified Report of Test or Analysis before use of the material in the work.

C. Test specimens, when required, shall be in accordance with ASTM D15, Part B.

PHYSICAL PROPERTIES AND TESTS

725.03.01 GENERAL

A. The pads shall conform to the following physical properties:

	Natural Rubber	Neoprene
Grade (Durometer)	60	60
Physical Properties:		
Hardness, (ASTM D 2240)	60 ±5	60 ±5
Tensile Strength, min. psi, (ASTM D412)	2,500	2,500
Ultimate elongation, min. percent	400	350
Heat Resistance, 70 hours at 158°F (ASTM D573):		
Hardness, max. points change	10	15
Tensile strength, max. percent change	-25	-15
Ultimate elongation, max. percent change	-25	-40
Compression Set (ASTM D395, Method B):		
22 hours at 158°F, max. percent	25	--
22 hours at 212°F, max. percent	--	35

	Natural Rubber	Neoprene
Ozone (ASTM D1149), 20 percent strain 100°F ±2°F, mounting procedure ASTM D518, Procedure A:		
225 pphm ozone in air by volume, 48 hours	No cracks	---
100 pphm ozone in air by volume, 100 hours	--	No cracks
Adhesion (ASTM D429, Method B):		
Bonds made during vulcanization, pounds per inch	40	40

END OF SECTION 725

SECTION 726 – ROADSIDE MATERIALS

SCOPE

726.01.01 MATERIALS COVERED

A. This specification covers the materials used in erosion control, landscaping, and irrigation systems.

REQUIREMENTS

726.02.01 CERTIFICATES AND SAMPLES

A. **Planting Soil:**

1. Before imported planting soil is brought on the jobsite, a 10-pound sample shall be submitted to the Engineer for approval.
2. The sample shall be accompanied by a current report, furnished by the Contractor, from a recognized testing laboratory indicating the particle size, clay content, the pH factor, electrical conductivity, and analysis of salt concentrate.

B. **Fertilizer:** The fertilizer containers shall have the manufacturer's guaranteed statement of analysis clearly marked, all in accordance with state and federal laws.

C. **Organic Material:**

1. Before bulk organic material is brought to the jobsite, a 10-pound sample shall be submitted to the Engineer for approval.
2. The sample shall be accompanied by a current report, furnished by the Contractor, from a recognized testing laboratory indicating the moisture retention capacity, organic matter (based on dry weight), mineral matter (ash), silica (acid insoluble ash), nitrogen (based on dry weight), pH factor, and the amount of Douglas Fir bark.

D. **Plants:**

1. All plants shall be nursery grown, healthy, vigorous, well-rooted, shall be true to type or name as shown on the plans, and shall conform to ANSI Z60.1, No. 1 grade.
2. Plants shall be tagged in accordance with the most recent standard practice recommended by the American Association of Nurserymen and the latest edition of Standardized Plant Names, American Joint Committee on Horticultural Nomenclature.
3. All plants shall comply with federal and state laws requiring inspection for plant diseases and infestations.
4. Inspection certificates required by law shall accompany each shipment of plants, and all plant shipments shall be inspected and passed by the Nevada Department of Agriculture.
5. All shipments of pine nursery stock shall meet all applicable state and federal quarantine regulations.

E. **Seeds:** The Contractor shall furnish to the Engineer duplicate copies of a statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before the date of delivery on the project.

F. **Irrigation Materials:**

1. The Contractor shall ascertain that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency.

2. The Contractor shall furnish the Engineer with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

G. All materials shall be approved prior to use.

PHYSICAL PROPERTIES AND TESTS

726.03.01 PLANTING SOIL

A. Planting soil shall consist of friable soil of loamy character.

B. The soil shall be obtained from well-drained arable land and shall be free from subsoil, refuse, roots, heavy or stiff clay, stones larger than 1 inch in largest dimension, coarse sand, sticks, brush, litter, and other deleterious substances.

C. Requirements for planting soil shall be as follows:

Organic Matter	0.1 to 1.0% by dry weight of soil
Particle Size	3/8 inch (0.953 centimeters) maximum
Clay Content	20% maximum (by weight)
pH Factor	6.5 to 8.0
Electrical Conductivity	0.5 to 1.0 mmhos. per centimeter of the saturation paste extract

726.03.02 FERTILIZER

A. Fertilizer and agricultural minerals shall be a standard commercial grade of organic or inorganic fertilizer of the kind and quality specified in the contract documents.

1. Fertilizer may be separate or in a mixture containing the percentage of total nitrogen, available phosphoric acid, and water-soluble potash in the amounts specified.

2. All fertilizers and agricultural minerals shall be furnished in standard, unopened containers with weight, name of plant nutrients, and manufacturer's guaranteed statement of analysis clearly marked, all in accordance with state and federal laws.

B. Acceptable commercial fertilizer and agricultural minerals will be specified in 1 of the following forms:

1. A dry, free-flowing, granular material suitable for application by agricultural fertilizer spreaders.

2. A soluble fertilizer and agricultural mineral ground to a fineness that will permit complete suspension of insoluble particles in water, suitable for application by power sprayers.

3. A granular or pelleted fertilizer and agricultural mineral suitable for application by blower equipment.

4. A non-volatile liquid fertilizer or agricultural mineral.

726.03.03 ORGANIC MATERIAL

A. Organic matter shall be processed, composted, fine-ground bark of White Fir, Pine, or Redwood, or a mixture of these in any proportion.

B. Organic matter shall be free of lumps and clods and shall be fine enough so that 100 percent of the material will pass a 1/2-inch screen and 85 percent will pass a No. 6 screen.

C. Requirements for organic material shall be as follows:

Moisture Retention Capacity	35 percent minimum
Organic Matter Based on Dry Weight	95 percent minimum
Mineral Matter (Ash)	5 percent maximum
Silica (Acid Insoluble Ash)	3 percent maximum
Nitrogen Based on Dry Weight	0.8 percent minimum
pH Value Based on 1:5 Solution	4.0 to 6.0 maximum
Douglas Fir Bark	0 percent

726.03.04 MULCH

A. **Hay or Straw:**

1. All hay or straw mulch materials shall be in an air-dried condition free of noxious weeds, weed seeds, and other materials detrimental to plant life.

2. Unless otherwise specified in the contract documents, hay or straw mulch material shall be of approved field grasses or legumes indigenous to the area.

B. Mulch shall also conform to the following requirements:

Moisture Content	12.0% ± 3.0%
Organic Matter (Oven-Dried Basis)	99.6% ± 0.2%
Ash Content	0.8% ± 0.2%
Water Holding Capacity (Grams of Water/ Grams of Fiber)	1,150 minimum

C. **Wood Cellulose Fiber:**

1. Wood cellulose fiber mulch shall be specially processed wood fiber containing no growth or germination inhibiting factors.

2. Mulch shall be dyed a suitable color to facilitate inspection of the placement of the material.

D. **Wood Chips and Shavings:**

1. Wood chips and shavings shall be manufactured from any clean wood free of infestations.

2. Chips from kiln-dried or air-dried material will not be acceptable.
3. Chips shall be produced by machinery equipped with knives or blades which cut rather than shred or break the material.
4. Chips shall be graded so that substantially all chips are from 1/2 inch to 3 inches in length, 1/2 inch to 1-1/2 inches in width, and from 1/8 inch to 1/2 inch in thickness.

E. **Bark:**

1. Bark shall be 100 percent bark derived from the bark of White Fir, Red Fir, or Pine and shall contain no Douglas Fir.
2. The bark shall be granular or chunky in nature with all particles between 1-1/4 inches and 2-1/2 inches in diameter.

726.03.05 JUTE MATTING

A. Jute matting shall be of a uniform, open, plain weave of undyed and unbleached single jute yarn.

B. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than 1/2 its normal diameter.

C. Jute matting shall be furnished in rolled strips as follows:

1. Length shall be approximately 50 yards.
2. Matting width shall be 48 inches with an average weight of 0.92 pounds per square yard. A tolerance of ±1 inch in width and of 5 percent in weight will be allowed.

726.03.06 PLANTS

A. All plants shall be nursery grown, representative specimens of their species, and shall be true to type or name as shown on the plans.

B. All plants shall be uniform in growth, in healthy condition, and free from insects, pests, diseases, and injuries, and without evidence of being or having been in a wilted condition.

726.03.07 SEEDS

A. Grasses, legumes, or cover crop seed shall be furnished in standard containers on which shall be shown the following information:

1. Date of Test.
2. Seed Name.
3. Lot Number.
4. Net Weight.
5. Percentage of Purity.
6. Percentage of Germination (in the case of legumes, percentage of germination shall include hard seed).
7. Percentage of Weed Seed Content and Inert Material, clearly marked for each kind of seed, in accordance with applicable state and federal laws.

8. No noxious weed seed present.

B. Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

C. Seed shall be at least 95 percent pure and shall have a minimum of 85 percent germination.

726.03.08 TREE TIES

A. Tree ties shall be strips of vinyl-coated nylon, durable, non-hardening, long-life material approximately 1 inch wide and approximately 10 mils thick, or other suitable material approved by the Engineer.

B. A 10-gauge galvanized wire encased in at least 1/2-inch rubber hose may be used when permitted by the Engineer.

726.03.09 PIPE AND FITTINGS

A. **Plastic Pipe:**

1. Plastic pipe, shall be PVC 1120 or 1220 pressure pipe as shown in the irrigation system legend on the plans.
2. All PVC pipe shall be extruded from 100 percent virgin material and shall be NSF approved, except plastic pipe for soaker lines shall be flexible PVC conforming to ASTM D2287.
3. Fittings for PVC plastic pipe shall be rigid polyvinyl chloride, standard weight, Schedule 40, and shall be solvent weld type except as shown on the plans.
4. Fittings for PVC pipe shall have higher bursting pressure than the pipe.
5. All plastic pipe shall be continuously and permanently marked with the following information:
    a. Manufacturer's name and trademark.
    b. Pipe size.
    c. Pipe class.
    d. Type of pipe.
    e. Working pressure at 73.4 degrees F.
    f. National Sanitation Foundation (NSF) rating.
6. All PVC plastic pipe shall be homogeneous throughout; smooth inside and outside; and free from cracks, holes, foreign materials, dents, wrinkles, and blisters.

B. **Delivery:** Plastic pipe shall be delivered to the site in unbroken bundles packaged to provide adequate protection for the pipe ends.

726.03.10 CONTROL TUBING

A. Control tubing shall be PVC tubing meeting NSF rating in the size specified on the plans.

726.03.11 GATE VALVES

A. Gate valves, when called for on the plans, shall be heavy-duty bronze conforming to ASTM B62.

726.03.12 QUICK COUPLER VALVES

A. Quick coupler valves shall have a service rating not less than 150 psi for non-shock cold water.

B. Body of the valves shall be a single-piece construction of sand-cast semi-red brass alloy No. 5-A as given in ASTM B584.

726.03.13 MASONRY

A. Hollow load-bearing concrete masonry blocks shall conform to ASTM C90.

B. Hollow non-load-bearing concrete masonry blocks shall conform to ASTM C129.

END OF SECTION 726

SECTION 727 – CONCRETE SURFACE FINISHING MATERIAL

SCOPE

727.01.01 MATERIALS COVERED

A. This specification covers the types and quality of concrete surface finishing materials.

PHYSICAL PROPERTIES AND TESTS

727.02.01 REQUIREMENTS

A. Bonded grout finishing material shall conform to the provisions specified below.

B. Except as noted herein, tests shall be made in accordance with test method indicated. Federal standard test methods are as contained in FED-STD-141, most current edition.

C. Viscosity: 110-115 K.U., using pin paddle. (Federal Standard. Method No. 4281)

D. Total Solids (Federal Standard Test Method No. 4042):

1. By weight: 65% minimum.
2. By volume: 48% minimum.

E. Flexibility (Federal Standard Test Method No. 6221):

1. Pass 1/8-inch mandrel when spread 12 mils wet on a tin panel and air dried 16 hours at 120 degrees F.
2. Panel shall show no mud cracking and no loss in adhesion to the panel when bent.

F. Water Resistance: No softening when tested as follows (ASTM D1647):

1. Spread a 12-mil film on tin panel and allow to air dry 48 hours.
2. Immerse in water for 16 hours and allow to dry for 8 hours.
3. There shall be no effect on the material.

G. Weatherometer Durability (Federal Standard Test Method No. 6152):

1. Expose a 12-mil film applied to asbestos cement board for 500 hours in an Atlas Twin-Arc weatherometer.
2. There shall be no erosion, cracking, softening, or other visible defects in the coating.

END OF SECTION 727

SECTION 728 – EPOXY

SCOPE

728.01.01 MATERIALS COVERED

A. These specifications are intended to specify epoxy that will meet service requirements for street and highway construction.

B. Epoxy shall be furnished as 2 components that shall be mixed together at the site of the work.

REQUIREMENTS

728.02.01 SAMPLING AND TESTING

A. Epoxy shall not be used prior to sampling and testing unless its use is permitted prior to said sampling and testing in accordance with the provisions in ***Subsection 106.05, "Certificate of Compliance."***

B. All tests will be conducted in accordance with the latest test methods of ASTM International and Federal Test Method Standard No. 141.

728.02.02 CERTIFICATES

A. Without expense to the Contracting Agency, 2 certificates covering each order of material shall be furnished by the manufacturer, certifying that the product complies with the specifications.

B. Certificates shall be delivered to the Engineer in charge at the jobsite at the time of, or prior to, delivery of the order.

728.02.03 PACKAGING, LABELING, AND STORING

A. Each component shall be packaged in steel containers not larger than 5 gallons in volume.

B. When the components are to be mixed at a ratio of 2 parts Component A to 1 part Component B, by volume, the container containing Component B shall be 1/2 the volume of the container containing Component A.

C. The containers shall have lug-type crimp lids with ring seals, shall be new, shall be not less than 24 gauge, shall otherwise meet U.S. Department of Transportation Hazardous Materials Shipping Regulations, and shall be well sealed to prevent leakage.

D. If a lining is used in the containers, it shall be of a character to resist any action by the components.

E. Each container shall be clearly labeled with the designation (Component A or Component B), manufacturer's name, date of manufacture, batch number (a batch shall consist of a single charge of all components in a mixing chamber), all directions for use specified elsewhere, and the following warning:

CAUTION

This material will cause dermatitis if it is allowed to come in contact with the skin or eyes. Use gloves and protective creams on the hands. Should this material contact the skin, wash thoroughly with soap and water. Do not attempt to remove this material from the skin with solvents. If any gets in the eyes, flush for 10 minutes with water and secure immediate medical attention.

F. Attention is directed to the characteristics of some epoxy components to crystallize or thicken excessively prior to use when stored at temperatures below 35 degrees F. Any material that shows evidence or crystallization or a permanent increase in viscosity or settling of pigments that cannot be readily redispersed with a paddle shall not be used.

728.02.04 DIRECTIONS FOR USE

A. At the time of mixing, Component A and Component B shall be at a temperature between 60 degrees F and 85 degrees F, unless otherwise specified.

B. Any heating of the adhesive components shall be done by application of indirect heat.

C. Immediately prior to mixing, each component shall be thoroughly mixed with a paddle. Separate paddles shall be used to stir each component.

D. Immediately prior to use, the 2 components shall be thoroughly mixed together in the specified ratios.

1. When mixed, all adhesive, except coal tar modified epoxy, shall have a uniform gray color without black or white streaks.

2. No solvent shall be added to any epoxy.

E. After mixing, all epoxies shall be placed in the work and any overlaying or inserted material that is to be bonded to the work by the epoxy shall also be placed before thickening of the epoxy has begun.

F. Surfaces upon which epoxy is to be placed shall be free of rust, paint, grease, asphalt, and loose and deleterious material.

G. When epoxy is used as a binder to make epoxy concrete or mortar, the 2 components of epoxy shall be thoroughly mixed together before the aggregate is added and, unless otherwise specified, the mix proportions shall consist of 1 part binder to approximately 4 parts aggregate, by volume.

H. Aggregate for use in epoxy concrete and mortar shall be clean and shall have a moisture content of not more than 0.50 percent when tested in accordance with ASTM D2216.

I. All surfaces against which epoxy concrete and mortar are to be placed shall be primed with a coat of the epoxy used just prior to placing the mortar.

PHYSICAL PROPERTIES AND TESTS

728.03.01 BINFER (ADHESIVE), EPOXY RESIN BASE

A. **Classification:**

1. This specification covers a low viscosity, liquid polysulfide extended epoxy formulated primarily for use in making high-strength epoxy concrete and epoxy mortar, in fastening metal anchors in vertical holes in concrete, and in pressure grouting of cracks in concrete.
2. Thick sections of this epoxy are not suitable for use in freeze-thaw environments.
3. Epoxy Resin Base Binder (Adhesive) shall conform to AASHTO M235 or ASTM C881.

B. **Directions for use:**

1. The ingredients in Component A and Component B shall be thoroughly dispersed such that each component forms a fluid mixture.
2. The mixing ratio is 2 parts by volume of Component A to 1 part by volume of Component B.
3. No more material shall be mixed than can be used within 10 minutes from the time mixing operations are started.

728.03.02 COAL TAR MODIFIED EPOXY RESIN

A. **Classification:**

1. This specification covers a low viscosity, liquid coal tar extended epoxy formulated primarily for use with a cover of aggregate as a black seal and skid resistant surfacing for Portland cement concrete and for use in making low strength epoxy concrete and epoxy mortar.
2. This epoxy is suitable for use in freeze-thaw environments.
3. Coal Tar Modified Epoxy Resin shall conform to ASTM C881.

B. **Directions for use:**

1. Equal parts, by weight or volume, of Component A and Component B shall be mechanically batch mixed, or continuously mixed in automatic paving equipment that provides continuous metering, mixing, and application at a controlled rate.
2. If the components are to be batch mixed, mixing shall be performed with a propeller type stirrer, or other power driven agitator attached to a 1/2 inch heavy duty drill.
3. Care shall be exercised to thoroughly incorporate material at the sides and bottom of the mixing container.
4. When mixed in batches, the mixing time shall be 5 minutes at 60 degrees F to 80 degrees F or 3 minutes at 80 degrees F to 100 degrees F and the batch size shall not exceed 5 gallons.
5. The mixed material will set quickly if allowed to remain in large mass, due to the heat generated as the 2 components react.
6. Pot life in large quantities (1 gallon to 5 gallons) is approximately:

Material Temperature	Pot Life (Measured from Beginning of Mixing)
60-70 degrees F	18 minutes
70-80 degrees F	12 minutes
80-90 degrees F	10 minutes
90-100 degrees F	8 minutes

728.03.03 EPOXY RESIN ADHESIVE FOR BONDING NEW CONCRETE TO OLD CONCRETE

A. **Classification:**

1. This specification covers a low viscosity paste polysulfide extended epoxy formulated primarily for use in bonding new Portland cement concrete to old Portland cement concrete and in fastening metal anchors in horizontal holes in concrete.
2. This epoxy is available in 2 types:
   a. Type I for general use.
   b. Type II for use when cure temperatures are below 60 degrees F, or when a faster cure is required.
3. Thick sections of this epoxy are not suitable for use in freeze-thaw environments.
4. Epoxy Resin Adhesive shall conform to AASHTO M235 or ASTM C881.

B. **Directions for use:**

1. The ingredients in Component A and Component B shall be thoroughly agitated so each component forms a uniform paste.
2. The mixing ratio is 2 parts by volume of Component A to 1 part by volume of Component B.
3. When measuring individual Component A and Component B, stir and tap the measuring containers to remove possible air voids.
4. Do not mix more material than can be spread within 8 minutes from the time mixing operations are started.
5. The spreading rate shall be sufficient to thoroughly coat the surface.
6. Spread the mixed adhesive by brush or roller over thoroughly cleaned concrete at a rate not exceeding 40 square feet per gallon.
7. On very rough surfaces, the spreading rate shall be 25 square feet per gallon.
8. The new concrete shall be placed against the adhesive coating on the old concrete within 15 minutes after spreading at temperatures below 90 degrees F or within 10 minutes at temperatures above 90 degrees F.

728.03.06 BINDER (ADHESIVE), EPOXY RESIN BASE, ALKYLBENZENE EXTENDED

A. **Classification:**

1. This specification covers a medium viscosity, liquid alkylbenzene extended epoxy formulated primarily for use with aggregate as a gray seal and skid-resistant surfacing for Portland cement concrete and for preparing low-strength epoxy mortar and epoxy concrete.
2. This epoxy is suitable for use in freeze-thaw environments.
3. Alkylbenzene Extended Epoxy Resin Base Binder (Adhesive) shall conform to ASTM C881.

B. **Directions for use:**

1. The mixing ratio is 1 part by volume of Component A to 1 part by volume of Component B.
2. No more material shall be mixed than can be used within 10 minutes from the time mixing operations are started.

728.03.07 BINDER (ADHESIVE), EPOXY RESIN BASE, FAST SETTING

A. **Classification:**

1. This specification covers a medium viscosity, liquid rapid set epoxy formulated primarily for use in making high-strength epoxy concrete and epoxy mortar where low curing temperatures are expected or when a fast cure is required.
2. This epoxy is not formulated for use in bonding of new Portland cement concrete to old Portland cement concrete.
3. This epoxy is suitable for use in freeze-thaw environments.
4. Fast Setting Epoxy Resin Base Binder (Adhesive) shall conform to ASTM C881.

B. **Directions for use:**

1. The mixing ratio is 2 parts by volume of Component A to 1 part by volume of Component B.
2. Aggregate shall be added immediately after Component A and Component B are thoroughly mixed.
3. The epoxy mortar or concrete shall be placed as soon as possible.
4. The useful work life of the mortar will depend on temperature, but shall be about 10 minutes to 15 minutes at 75 degrees F.
5. All surfaces shall be primed with mixed epoxy.

728.03.08 BINDER (ADHESIVE), EPOXY RESIN BASE, FAST SETTING, ALKYLBENZENE EXTENDED

A. **Classification:**

1. This specification covers a medium viscosity, liquid rapid set, alkylbenzene extended epoxy formulated primarily for use with aggregate as a gray seal and as a skid-resistant surfacing for Portland cement concrete and for use in making low-strength

epoxy concrete and epoxy mortar where low curing temperatures are expected or when a fast cure is required.

2. This epoxy is suitable for use in freeze-thaw environments.

3. Fast Setting Epoxy Resin Base Alkylbenzene Extended Binder (Adhesive) shall conform to ASTM C881.

B. **Directions for use:**

1. The mixing ratio is 1 part by volume of Component A to 1 part by volume of Component B.

2. Do not mix more material than can be used within 10 minutes from the time mixing operations are started.

3. When applying resinous seal, the aggregate shall be sprinkled in the epoxy film not later than 5 minutes after epoxy is applied to the road surface.

728.03.09 EPOXY SEALANT FOR INDUCTIVE LOOPS

A. **Classification:**

1. This specification covers a high viscosity, liquid epoxy formulated primarily for use in sealing inductive wire loops and leads imbedded in asphalt concrete and Portland cement concrete for traffic signal controls and vehicle counters.

2. This epoxy is to be used for repair work on existing spalls, cracks, and other deformations in and around saw cuts and housing inductor loops and leads.

3. The rapid cure allows minimum traffic delay.

4. This sealant is suitable for use in freeze-thaw areas and can be used on grades up to 15 percent without excessive flow of material.

5. Epoxy Sealant for Inductive Loops shall conform to ASTM C881.

B. **Directions for use:**

1. Saw cuts shall be blown clean and dry with compressed air to remove all excessive moisture and debris.

2. For repairing damaged saw cuts, all loose, spalled material shall be cleaned away from saw cut, chipping back to sound asphalt concrete or Portland cement concrete, and all loose material cleaned from loop wires.

3. The mixing ratio is 1 part by volume of Component A to 1 part by volume of Component B. No more material shall be mixed than can be used within 10 minutes from the time mixing operations are started.

728.03.10 EPOXY ADHESIVES FOR PAVEMENT MARKERS

A. **Rapid-Set Epoxy Adhesive:**

1. This specification covers a high viscosity, rapid set epoxy formulated primarily for use in bonding pavement markers to Portland cement concrete and asphalt cement.

2. The epoxy used under this specification shall conform to AASHTO M237, Type I.

3. Tests for requirements for AASHTO M237 shall be performed in accordance with AASHTO T237.

B. **Standard-Set Epoxy Adhesive:**

1. This specification covers a high viscosity, rapid set epoxy formulated primarily for use in bonding pavement markers to Portland cement concrete and asphalt cement.
2. The epoxy used under this specification shall conform to AASHTO M237, Type II.
3. Tests for requirements for AASHTO M237 shall be performed in accordance with AASHTO T237.

728.03.11 BINDER (ADHESIVE), STRUCTURAL EPOXY

A. **Classification:**

1. This specification covers a multipurpose, 2-component, moisture tolerant, structural epoxy adhesive, formulated primarily for bonding new concrete to asphalt cement pavement.
2. This epoxy is formulated for hot weather concrete placements requiring a bonding adhesive and is suitable for minimum substrate and ambient temperature of 40 degrees F.
3. Physical properties shall meet the criteria a minimum of 2,200 psi and heat deflection temperature at 14 days shall be a minimum of 108 degrees F.

B. **Directions for use:**

1. The epoxy shall not be mixed with more material than can be used within 60 minutes at 73 degrees F or 30 minutes at 100 degrees F from the time mixing operations begin.
2. Surface shall be clean and sound.
3. Surface may be dry or damp, but shall be free of standing water, dust, curing compound, and other contaminants.

END OF SECTION 728

SECTION 729 – FLY ASH

SCOPE

729.01.01 MATERIALS COVERED

A. This specification covers the quality of fly ash used in Portland cement products.

REQUIREMENTS

729.02.01 REQUIREMENTS

A. Fly ash shall conform to ASTM C618 for Class F, with the following exceptions:

1. The maximum loss of ignition shall be 6 percent.
2. The sulfate resistance factor, R, shall not exceed 1.5, where

$$R = \frac{(\%\ CaO - 5)}{\%\ Fe_2O_3}$$

B. Certification that the fly ash used in Portland cement concrete conforms to ASTM C618 shall be provided by the supplier of the fly ash.

C. Copies of the certification shall be provided to the Engineer by the supplier of the fly ash or supplier of the Portland cement concrete fly ash upon request.

D. The certification provided is to be a maximum of 30 days old.

END OF SECTION 729

APPENDIX A – SWPPP CHECKLIST

LAS VEGAS VALLEY STORMWATER QUALITY MANAGEMENT PROGRAM
CONSTRUCTION PERMIT SUBMITTAL CHECKLIST

(Applies to all Grading, Site Development, Building, and Encroachment Permits and plans including Final, Parcel, Subdivision, Site Drainage and Erosion and Sediment Control Plans)

Owner / Operator (applicant) Information

Name:_____

Address:_____

City:_____ State:___ Zip Code:_____ Phone:_____

Project Name: _____

Project Address/Location:_____

Signature:_____Date:_____

Total area of land disturbance =_____acres, _____square feet (must match permit application).

If the area of land disturbance is one acre or more, the applicant must submit a copy of their Notice of Intent (NOI) to Nevada Division of Environmental Protection (NDEP) to be regulated under Stormwater General Permit NVR100000 and submit a copy of the receipt for payment of the annual fee or the letter of authorization from NDEP (address attached). Once payment has been received by NDEP, the applicant is immediately covered under the State's permit.

☐ 1. Copy of NOI attached
☐ 2. Copy of receipt **or** letter of authorization attached

By submitting a copy of the NOI and the receipt or authorization from NDEP, the applicant acknowledges that they are aware of the requirements set forth in the State's General Permit and have developed and will implement a site specific Stormwater Pollution Prevention Plan (SWPPP). The applicant further acknowledges that they are aware of the Las Vegas Valley Construction Site BMP Guidance Manual and the required performance standards set forth in Section 3.2 of the manual. To ensure compliance with these performance standards, the applicant shall submit a completed Performance Standards Compliance Checklist, indicating the BMPs that implement standards 1 – 12. It is recommended that the applicant also attach a copy of the checklist to their SWPPP.

☐ Copy of Performance Standards Compliance Checklist completed (see reverse side)

Yes	No	
☐	☐	Were calculations required for sizing of diversion channels and/or sediment retention basins? If the answer is yes, pursuant to NRS 625.565, a Nevada Registered Professional Engineer must review and stamp plans, such as grading plans and reports that require engineering calculations.

In addition to the submittal requirements specified above and in the ordinances, the following shall be included as a set of standard notes to be depicted on all site plans that disturb one acre or larger:

☐ Standard notes from Section 3.5 of the Las Vegas Valley Construction Site BMP Guidance Manual on design plans

To submit a Notice of Intent (NOI), contact:
Nevada Division of Environmental Protection
Bureau of Water Pollution Control
901 South Stewart Street
Suite 4001
Carson City, NV 89701-5249
Phone: (775) 687-9429
Fax: (775) 687-4684
Web: http://ndep.nv.gov/bwpc/index.htm

LAS VEGAS VALLEY STORMWATER QUALITY MANAGEMENT ROGRAM
CONSTRUCTION PERMIT SUBMITTAL CHECKLIST

The checklist that follows identifies the BMPs that can be used at construction sites to meet each of the Performance Standards of the Las Vegas Valley Construction Site BMP Guidance Manual (BMP Guidance Manual). You must select at least one BMP for each performance standard to meet the minimum requirements. Please refer to the BMP Guidance Manual to assist you in selecting BMPs for your site. It is the responsibility of the person who fills out this checklist to ensure that the BMPs selected are included in the contract bid documents and implemented at the site. If your project or site has characteristics that make meeting a performance standard infeasible or inapplicable (e.g. size of site, slope of site), please explain these characteristics at the bottom of the form.

Performance Standard	Check if Selected	BMPs	Comments
1. Schedule construction and minimize clearing and grading	☐	PL-1 Site Design	
	☐	PL-2 Scheduling	
	☐	PL-3 Phased Construction	
	☐	PL-4 Topsoil Reuse	
	☐	EC-3 Protect Trees/Vegetation	
	☐	Other or N/A (explain)	
2. Stabilize disturbed areas	☐	EC-1 Erosion Control Mats	
	☐	EC-2 Mulching	
	☐	EC-7 Dust Control	
	☐	EC-12 Surface Roughening	
	☐	SPC-6 Revegetation	
	☐	Other or N/A (explain)	
3. Protect slopes	☐	EC-9 Diversion Dikes	
	☐	EC-4 Pipe Slope Drains	
	☐	EC-12 Surface Roughening	
	☐	EC-7 Dust Control	
	☐	EC-1 Erosion Control Mats	
	☐	SPC-6 Revegetation	
	☐	SPC-1 Organic Filter Barriers	
	☐	SPC-2 Sand Bag Barrier	
	☐	SPC-3 Gravel Filter Berms	
	☐	Other or N/A (explain)	
4. Design conveyance for non-erosive velocities	☐	EC-9 Diversion Dikes	
	☐	SPC-4 Check Dams	
	☐	EC-11 Outlet Protection	
	☐	Other or N/A (explain)	
5. Protect waterways, natural drainages and storm drains	☐	PL-1 Site Design	
	☐	EC-9 Diversion Dikes	
	☐	EC-3 Protect Trees/Vegetation	
	☐	SPC-1 Organic Filter Barriers	
	☐	SPC-2 Sand Bag Barriers	
	☐	SPC-3 Gravel Filter Berms	
	☐	SPC-5 Silt Fence	
	☐	SPC-8 Temporary Stream Crossing	
	☐	EC-11 Outlet Protection	
	☐	SPC-7 Storm Drain Inlet Protection	
	☐	Other or N/A (explain)	

Performance Standard	Check if Selected	BMPs	Comments
6. Install sediment traps / retain eroded sediments on-site	☐	SPC-4 Check Dams	
	☐	SPC-1 Organic Filter Barrier	
	☐	SPC-2 Sand Bag Barrier	
	☐	SPC-3 Gravel Filter Berm	
	☐	SPC-5 Silt Fence	
	☐	SPC-9 Temporary Sediment Traps	
	☐	SPC-8 Temporary Sediment Basins	
	☐	Other or N/A (explain)	
7. Remove accumulated sediment	☐	Use Standard Note No. 5	
	☐	Other or N/A (explain)	
8. Control site entrances and exits	☐	EC-5 Stabilized Site Entrance	
	☐	EC-6 Construction Road Stabilization	
	☐	SPC-11 Entrance/Exit Tire Wash	
	☐	GH-6 Road Sweeping/Trackout Cleaning	
	☐	Other or N/A (explain)	
9. Manage materials and wastes	☐	GH-2 Solid Waste Management	
	☐	GH-5 Spill Containment Plan	
	☐	Other or N/A (explain)	
10. Manage equipment and vehicles	☐	GH-3 Equipment Maintenance Procedures	
	☐	GH-4 Designated Washdown Area	
	☐	Other or N/A (explain)	
11. Stabilization of inactive disturbed areas	☐	PL-4 Topsoil Reuse	
	☐	EC-2 Mulching	
	☐	EC-7 Dust Control	
	☐	SPC-6 Revegetation	
	☐	Other or N/A (explain)	

Explanation why performance standard(s) cannot be met: