501 N CASINO CT 6
Fire Station

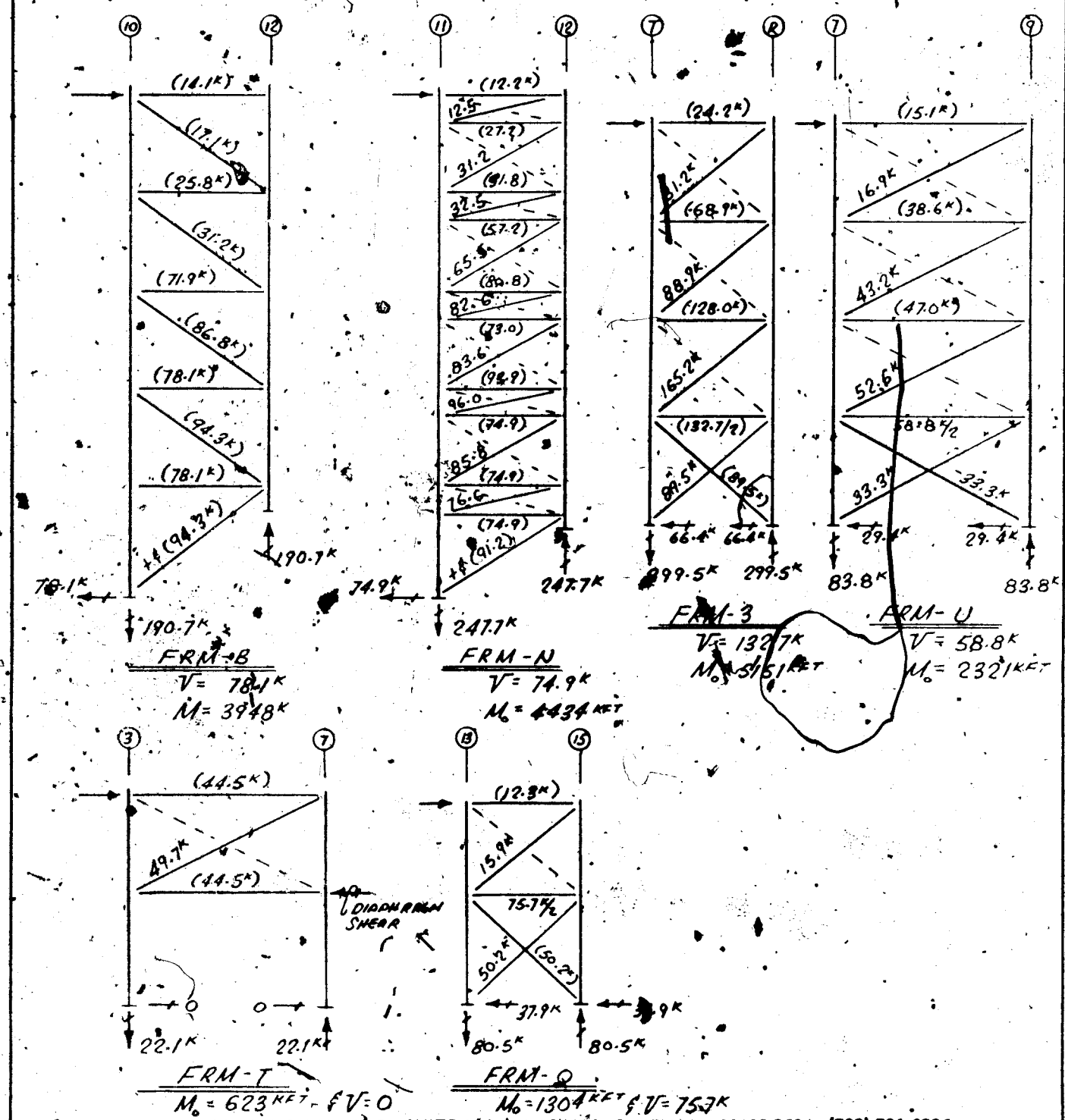
Don Hasel 12/31/87

STRAUSS & LOFTFIELD
STRUCTURAL ENGINEERS

CLIENT/ SHEET/ 300 OF 317
PROJECT/ PROJECT # 82017
DATE/ OCT. '82
ENGINEER/ HS

BRACED FRMS

SEE NOTES PRECEDING SHT.



Dora Hasel 12/31/87

STRAUSS & LOFTFIELD
STRUCTURAL ENGINEERS

CLIENT/ SHEET/ 301 OF 317
PROJECT/ PROJECT # 82017
DATE/ OCT '82
ENGINEER/ HS

BRC'D FRM'S

BRC'G LIMITED TO 9" DIMEN ⊥ TO PLANE OF FRM.

	DIAGONALS				
FRM	LENGTH	FORCE	1.25×F	MEMBER	F ALLOWABLE.
B	25.0'	± 94.3ᴷ	± 118ᴷ	W8x48	(4/3)(102) = 136ᴷ @ L_u = 25.0'
	26.2'	± 94.3ᴷ	± 118ᴷ	W8x58	(4/3)(114) = 152ᴷ @ L_u = 26.2'
N	18.3'	96.0ᴷ	120ᴷ	2L 6x4x3/8 LLBB	(4/3)(7.22-1.22)(22) = 176ᴷ
	20.5'	85.8ᴷ	108ᴷ	do	do
	21.6'	± 91.2ᴷ	± 114ᴷ	W8x40	(4/3)(108) = 144ᴷ @ L_u = 21.6'
3	22.2'	165.2ᴷ	207ᴷ	2L 6x4x1/2 LLBB	(4/3)(9.50-7.63)(22) = 231ᴷ
	22.5'	± 89.5ᴷ	± 112ᴷ	2L 8x4x1 LLBB	(4/3)(117) = 156ᴷ @ L_u = 22.5'
U	31.0'	52.6ᴷ	66ᴷ	2L 5x3 1/2 x 5/16	(4/3)(5.32-1.02)(22) = 120ᴷ
	31.2'	± 33.3ᴷ	± 42ᴷ	W8x35	(4/3)(45) = 60ᴷ @ L_u = 31.2'
T	31.5'	49.7ᴷ	62ᴷ	2L 5x3 1/2 x 5/16 LLBB	120ᴷ SEE ABOVE
Q	20.9'	15.9ᴷ	20ᴷ	2L 5x3 1/2x 5/16 LLBB	120ᴷ SEE ABOVE
	21.5'	± 50.2ᴷ	± 63ᴷ	2L 6x4x1/2 LLBB	(4/3)(58) = 77ᴷ @ L_u = 21.5'
12-J	21.7'	58.0ᴷ	73ᴷ	2L 5x3 1/2 x 5/16 LLBB	120ᴷ SEE ABOVE
	22.6'	60.4ᴷ	76ᴷ	do	do
	21.4'	± 46.6ᴷ	± 58ᴷ	2L 6x4x1/2 LLBB	77ᴷ @ L_u = 21.5' SEE ABOVE
	25.4'	± 69.7ᴷ	± 87ᴷ	2L 8x4x1 LLBB	(4/3)(91) = 121ᴷ @ L_u = 25.4'
12-B	27.9'	44.6ᴷ	56ᴷ	2L 5x3 1/2x 5/16 LLBB	120ᴷ SEE ABOVE
	28.4'	45.4ᴷ	57ᴷ	do	do
	27.5'	± 39.2ᴷ	± 49ᴷ	W8x35	(4/3)(58) = 77ᴷ @ L_u = 27.5'
	30.0'	± 53.9ᴷ	± 68ᴷ	W8x48	(4/3)(70) = 93ᴷ @ L_u = 30.0'
12-S	29.9'	100.1ᴷ	125ᴷ	2L 6x4x3/8 LLBB	176ᴷ SEE ABOVE
	30.0'	± 110.8ᴷ	139ᴷ	W10x54	(4/3)(119) = 158ᴷ @ L_u = 30'
P	30.7'	22.0ᴷ	28ᴷ	2L 5x3 1/2 x 5/16 LLBB	120ᴷ SEE ABOVE
	34.5'	± 18.6ᴷ	24ᴷ	W8x58	(4/3)(66) = 88ᴷ @ L_u = 34.5'
34	26.5'	22.8ᴷ	29ᴷ	2L 5x3 1/2 x 5/16 LLBB	120ᴷ SEE ABOVE
	30.2'	± 22.3ᴷ	± 28ᴷ	W8x31	(4/3)(42) = 56ᴷ @ L_u = 30.2'
A	29.8'	24.8ᴷ	31ᴷ	2L 5x3 1/2 x 5/16 LLBB	120ᴷ SEE ABOVE
	20.9'	± 123.0ᴷ	± 154ᴷ	W8x48	(4/3)(142) = 189ᴷ @ L_u = 20.9'

N° OF 3/4"φ A325 BOLTS = { 1.25 F / 9.9ᴷ S.S. ; 1.25 F / 18.6ᴷ D.S. }

1600 EAST DESERT INN ROAD SUITE 106 | LAS VEGAS, NEVADA 89109-2594 (702) 731-6226

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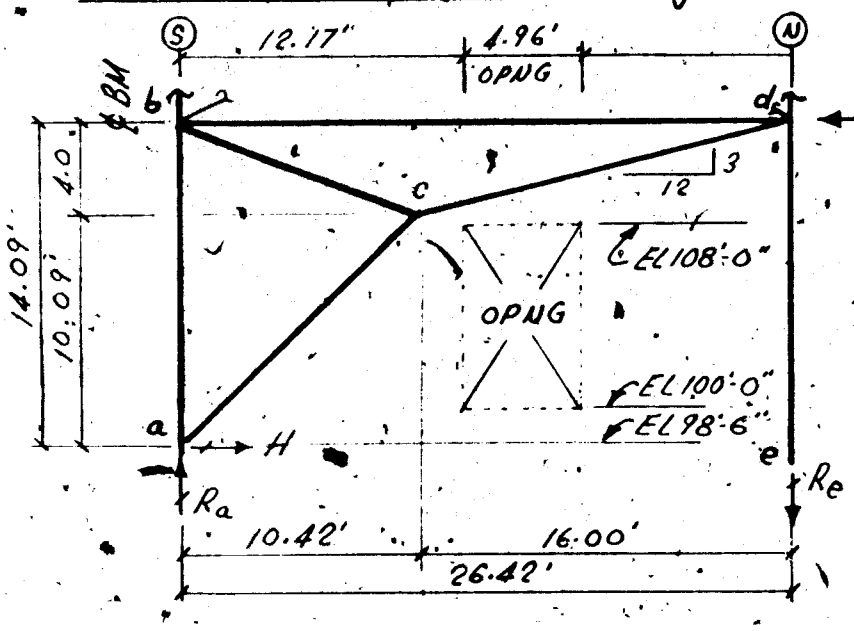
STRAUSS & LOFTFIELD
STRUCTURAL ENGINEERS

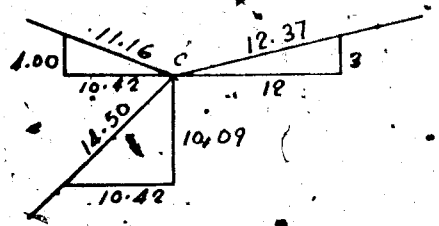
CLIENT/
PROJECT/
SHEET/ 302 OF 317
PROJECT No 8207
DATE/ OCT'87
ENGINEER/ HS

FRAME 12-S

REVISED AT 1ST STORY TO CLEAR OPNG



FRM-12-S 1ST STORY PORTION



$F = (1.25 \times 95.6^K) = 119.5^K$

$R_e = R_a = F(14.09)/26.42 = 63.73^K$

$H = F = 119.5^K$

from F.B.D. & $\Sigma M_c = 0$:

$(bd) = \dfrac{H(10.09) - R_a(10.42)}{4.00}$

$(bd) = 135.42^K$ TENS.

$(cd) = [-H-(bd)](12.37/12.0)$

$(cd) = -262.78^K$ COMPR.

$(bc) = [-(bd)](11.16/10.42)$

$(bc) = -145.04^K$ COMPR.

$(ac) = [-H](14.50/10.42)$

$(ac) = -166.29^K$ COMPR.

WITH FORCE F REVERSED:

$(bd) = -135.42^K$ COMPR.

$(cd) = 262.78^K$ TENS.

$(bc) = 145.04^K$ TENS

$(ac) = 166.29^K$ TENS

W/ DIAGONALS FLAT:

$l_x = 31.0'$, $l_y = 16.5'$ → TRY W10x60 → $l_x/(r+l_y) = 31.0/1.71 = 18.2' > l_y$ ∴ x-x AXIS GOVERNS

$P_{ALW} = 260^K$ AT $l_{ux} = 31.0'$,

USE W10x60 DIAGONALS (FLAT) ac, bc, & cd

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CLIENT/ SHEET/ 363 OF 317
PROJECT/ PROJECT # 82017
DATE/ OCT'82
ENGINEER/ HS

DRAG-STRUTS

TO FRM-A → 15.1K x 1.25 = 19K @ L_u = 24.7'

TO FRM-B → 12.3K x 1.25 = 16K @ L_u = 21.1'

TT 4x4x1/4 → P_{allw} = (4/3)(21K) = 28K @ L_u = 24.7'

USE | TT 4x4x1/4 DRAG-STRUTS AT FRMS A & B

DIAPHRAGM TO DIAPHRAGM CONN AT GRID 8 & GRID N

3RD LEVEL 50.8K
2ND LEVEL 42.9K

DESIGN 50.8K x 1.25 = 64K @ L_u = 7.0' MAX

USE | TT 6x4x 3/8 LLBB DRAG-STRUTS ⊥ TO FLR BMS

DIAPHRAGM SHEAR

LOCATION		DIAPHRAGM		
FRM	LEVEL	DEPTH (FT)	SHEAR (KIP)	UNIT SHEAR (#/FT)
B	3RD	42.0'	(19.0+6.3)=25.3	603
	2ND	42.0'	(4.0+6.0)=10.0	238
N	3RD 3RD	42.0' 70.5'	(22.5+6.3)=28.8 (9.8+6.7)=16.5	686 234
	2ND 2ND	79.0' 70.5'	(8.5+6.0)=14.5 (11.8+3.9)=15.7	184 223
T	3RD	79.2'	43.0K	543
	2ND	—— NOT USED AT 2ND LEVEL ——		
U	3RD	79.2'	43.9K	555
	2ND	79.2'	(10.8+13.0)=23.8	301
3	3RD	47.8'	46.5K	973
	2ND	47.8'	14.6K	306
12-S	3RD	38.8'	40.9K	1054
	2ND	38.8'	68.0K	1753

MARGINAL WELDS
(1150/1753)(12) = 7.9" 2ND
(1150/1054)(12) = 13.1" 3RD

SEE DIAPHRAGM SHEAR DIAGRAMS SHT N° 282 & N° 283

Continued

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CLIENT/ SHEET/ 304 OF 317
PROJECT/ PROJECT # 82017
DATE/ OCT '82
ENGINEER/ HS

DIAPHRAGM SHEAR continued

LOCATION		DIAPHRAGM		
FRM	LEVEL	DEPTH (FT)	SHEAR (KIP)	UNIT SHEAR (#/FT)
12-J & 12-B South of Grid 12	3RD.	69.2	99.6	1440
	2ND	69.2.	84.5	1221
12-J & 12-B North of Grid 12	3RD	53.7	42.1	784
	2ND	91.8	43.9	478
A	3RD	*		
	2ND	24.2 FRM 105.7 DRAG	(18.2+9.6)=27.8 35.2	1149 330
P	3RD	*		
	2ND	94.0	30.3	322
Q	3RD	35.9	12.3	343
	2ND	35.9	(44.7+8.1)=52.8	1471
34	3RD	*		
	2ND	34.0'	34.6	581

[SEE SHT N°282 & N°283 FOR DIAPHRAGM SHEAR DIAGRAMS

MARGINAL WELDS

$(1150/1471)(12) = 9.4''$ 2ND

$(1150/1440)(12) = 9.6''$ 3RD

* INDICATES FLEXIBLE ROOF DIAPHRAGM PORTION. SEE SHT N° 292

RIGID DIAPHRAGM PORTIONS

USE: 1 1/2" B-DECK 20 GA
COMPOSITE W/3 1/2" REG WT CONC COVER (5" TOT. THK)
36" WIDTH
7 - PUDDLE WELD PATTERN
BUTTON PUNCH SEAMS @ 24" o.c.
MARGINAL WELDS 6" o.c., 9" o.c., & 12" o.c.

$V_{ALLW} = 2260$ #/' W/ BMS 7'-0" MAX O.C.
$F = 0.33$

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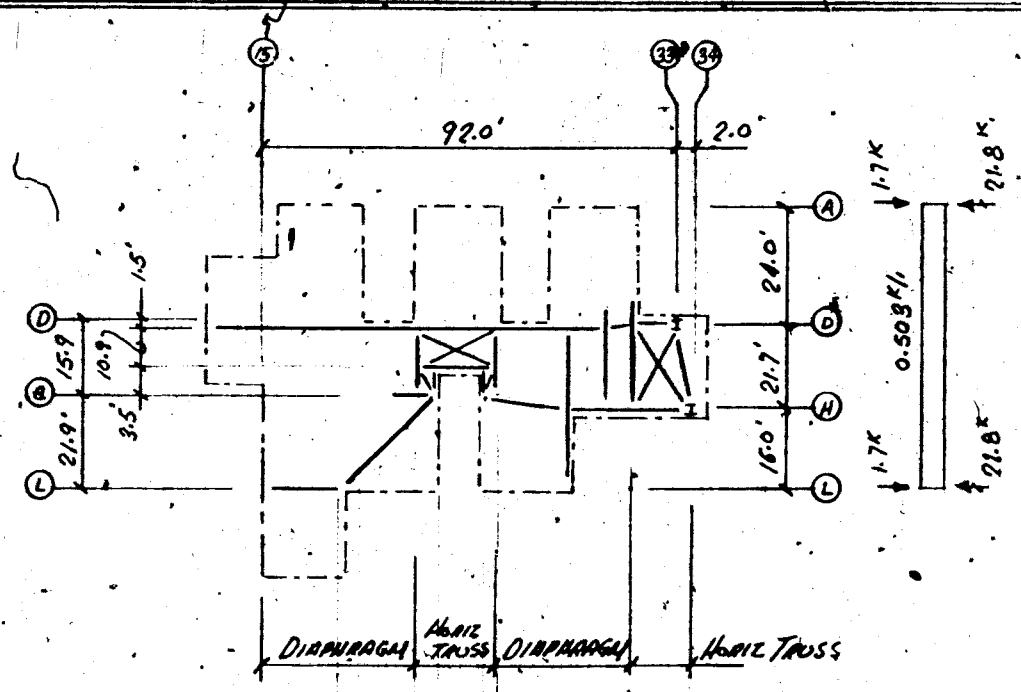
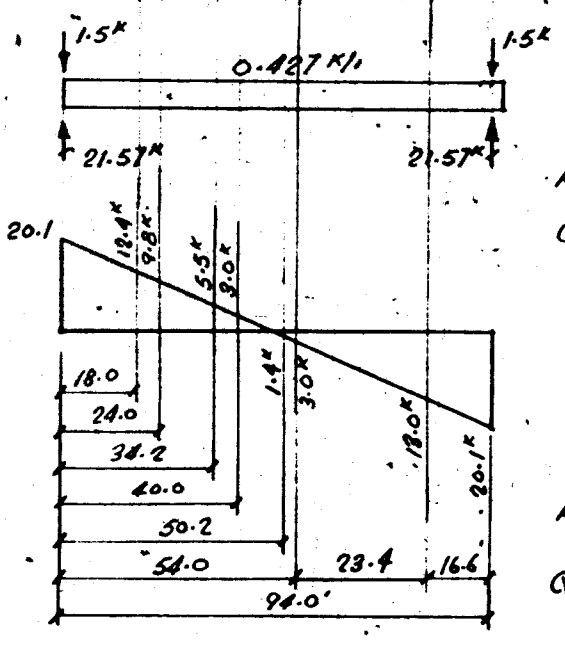
CLIENT/ SHEET/ 305 OF 317
PROJECT/ PROJECT # 82017.
DATE/ OCT '82
ENGINEER/ HS

FLEXIBLE ROOF DIAPHRAGM & HORIZ. TRUSS IN PLANE OF ROOF





$M_{MAX} = (0.427)(94)^2/8 = 472^{K-FT}$

CHORD FORCE

$F_{MAX} = 472^{K-FT}/10.9' = 43.3^K$

DIAG = $5.5^K(22.6/10.9) = 11.4^K$
AT CENTER TRUSS

DIAG = $13.0^K(27.3/21.7) = 16.4^K$
AT NORTH TRUSS

$A_{NET} = 16.4^K/22KSI(4/3) = 0.56IN^2$

CHORD TIES BAC'D BY DECK-

$A_{NET} \simeq 43.3^K/18KSI(4/3) = 1.81N^2$

USE L 6x4x⅜ LLH & COPE VERT LEG AT BMS

1½" B-DECK 20 GA
36" WIDTH BUTTON PUNCH @12" o.c
7-PUDDLE WELD PATTERN → 575#/LIN

V_{DIA}

@ X = 0 $v = 20100^{\#}/36.3' = 554^{\#}/'$
= 18 $v = 12400/36.3' = 342^{\#}/'$
= 24 $v = 9800/32.0' = 307^{\#}/'$
= 34.2 $v = 5500/11.4 = 483^{\#}/'$

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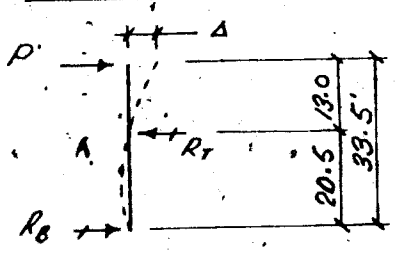
CLIENT/
PROJECT/
SHEET/ 306 OF 317
PROJECT # 82017
DATE/ OCT '82
ENGINEER/ HS

FLEXIBLE ROOF DIAPHRAGM continued

SWAY COLS AT HORIZ TRUSS. COLS D-33 & H-34.



$P = (21.6^K / 2\ Col's) = 10.8^K/Col$ SEISMIC LOAD'G

$R_T = (10.8 \times 33.5)/20.5 = 17.65^K$
$R_B = (10.8 \times 13.0)/20.5 = 6.85^K$
$M = 10.8 \times 13.0 = 140.4^{KFT}$

$$\Delta = \frac{(10.8)(13.0)^2(33.5)(1728)}{3(29\times10^3)(I)} = \frac{1214.5}{I} \leq \frac{13\times12}{200} = 0.78$$

$I > 1214.5/0.78 = 1557\ in^4$ SEISMIC

$P = (0.243^{Kli.})(94\frac{1}{2})/2 = 5.71^K/Col$ WIND LOAD'G

$$\Delta = (5.71/10.8)\left(\frac{1214.5}{I}\right) = \frac{642.1}{I} \leq \frac{13\times12}{400} = 0.39"$$

$I > 642.1/0.39 = 1646\ in^4$ WIND GOVERNS

TRY W12x170 $\{I_x = 1650\ in^4,\ A = 50.0\ in^2,\ S_x = 235\ in^3,\ r_y = 3.22",\ r_x = 5.74"\}$

CHECK COMBINED BEND'G & AXIAL

$13.0' < (76\,b_f/\sqrt{F_y})/12 = 13.26' \rightarrow F_b = 24KSI(4/3) = 32KSI$

$f_b = 140.4 \times 12/235 = 7.17\ KSI$

D-33 → P = 29.4K
H-34 → P = 21.2K

$f_a = 29.4^K\ MAX/50.0 = 0.59KSI$

$Kl_x/r_x = 2(13.0\times12)/5.74 = 54.4 \rightarrow F_e' = (4/3)(50.47) = 67.30\ KSI$
$Kl_y/r_y = 2(13.0\times12)/3.22 = 96.9 \rightarrow F_a = (4/3)(13.36) = 17.81\ KSI$

$f_a/F_a = 0.04 < 0.15$

UNITY EQUA → $0.04 + \frac{7.17}{32} = .0.27 < 1.0$

USE Col W12x170 AT D-33 & H-34

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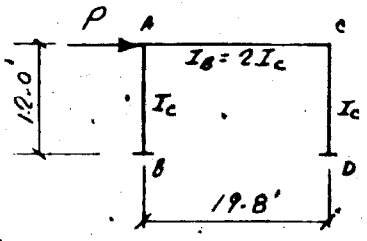
CLIENT/ SHEET/ 307 OF 317
PROJECT/ PROJECT # 82017
DATE/ OCT '82
ENGINEER/ HS

FLEXIBLE ROOF DIAPHRAGM continued
SWAY FRMS ON GRIDS A & C 2ND STORY

SIDESWAY CORRECTION

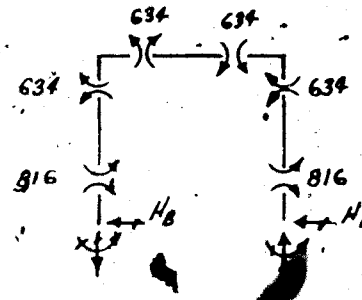


$K_{AB} = 1/12 = .083$ $DF_{AB} = 0.45$
$K_{AC} = 2/19.8 = .101$ $DF_{AC} = 0.55$
0.184

ARBITRARY SWAY OF 1000 K-FT = $M_{FOA} = \frac{6EI\Delta}{L^2}$

	A		C	
	0.45	0.55	0.55	0.45
M_F	+1000	0	0	+1000
DIST	- 450	- 550	- 550	- 450
CO	0	- 275	- 275	0
DIST	+124	+151	+151	+124
CO	0	+ 76	+ 76	0
DIST	- 34	- 42	- 42	- 34
CO	0	+ 21	+ 21	0
DIST	- 9	- 12	- 12	- 9
CO	0	- 6	- 6	0
DIST	+ 3	+ 3	+ 3	- 3
Σ	+634	-634	-634	+634

	B	D
	0	0
M_F	+1000	+1000
CO	- 225	- 225
CO	+ 62	+ 62
CO	- 17	- 17
CO	- 4	- 4
Σ	+816	+816



$H_B = H_D = \frac{(634+816)}{12.0} = 120.83^K$

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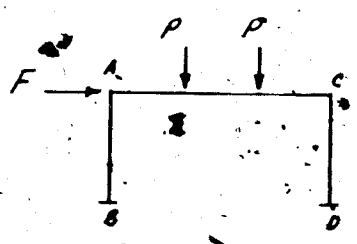
CLIENT/
PROJECT/
SHEET/ 308 OF 317
PROJECT # 82017
DATE/ OCT '82
ENGINEER/ HS

FLEXIBLE ROOF DIAHRAGM, continued

SWAY FRMS ON GRIDS A-L 2ND STORY



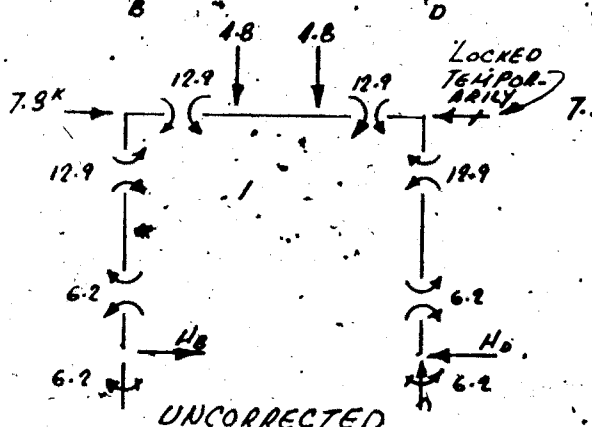
$P = 4.8^K$ REF BEAM B-37 NORTH ROOF FRMG

$M_{FAC} = \frac{4.8[(6.6)(13.2)^2 + (6.6)^2(13.2)]}{19.8^2} = 21.2^{KFT}$

$F = 21.8^K/(3\text{-FRMS}) = 7.3^K/FRM$

	A	C	C	A	B	D
	.45	.55	.55	.45		
M_F	0	+21.2	-21.2	0		
D	-9.5	-11.7	+11.7	+9.5		
CO	0	+5.9	-5.9	0		
D	-2.7	-3.2	+3.2	+2.7		
CO	0	+1.6	-1.6	0		
D	-0.7	-0.9	+0.9	+0.7		
Σ	+12.9	+12.9	-12.9	+12.9	0	0
M_F					0	0
CO					-4.8	+4.8
CO					-1.4	+1.4
Σ					-6.2	+6.2

	A	C	B	D
	.45	.55		
Muncorr.	-12.9	+12.9		
Corr.	+19.1	-19.1		
M_{corr}	+6.2	-6.2		
		-12.9	0	0
		-19.1	-6.2	+6.2
		-32.0	-6.2	+6.2
		+32.0	+24.6	+24.6
			+18.4	+30.8



UNCORRECTED

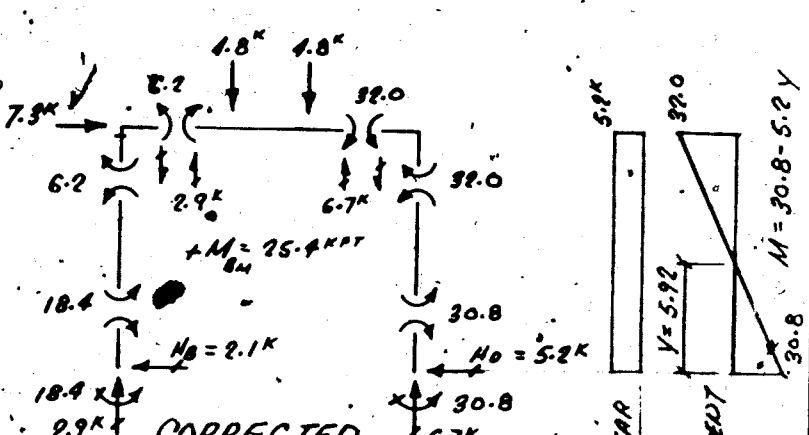
$H_B = (12.9+6.2)/12.0 = 1.59^K$

$H_D = (\ do\ )/d_o = 1.59^K$

$\Sigma H = 7.3 + 1.59 - 1.59 = 7.3^K \neq 0$

∴ SIDESWAY. CORR. FACTOR $= (7.3^K) + X(-120.83 - 120.83) = 0$

$X = 7.3/241.66 = +0.0302$ CORR. FACTOR



CORRECTED

$H_B = (6.2+18.4)/12.0 = 2.1^K$

$H_D = (32.0+30.8)/12.0 = 5.2^K$

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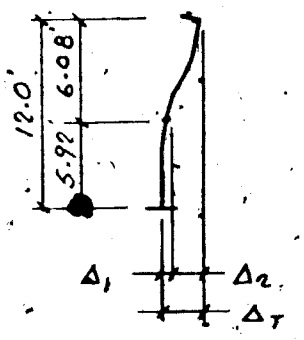
STRAUSS & LOFTFIELD
STRUCTURAL ENGINEERS

CLIENT/ . SHEET/ 309 OF 317
PROJECT/ PROJECT # 820.17
DATE/ OCT '82
ENGINEER/ HS

FLEXIBLE ROOF DIAPHRAGM continued
SWAY FRMS ON GRIDS A & L 2ND STORY



$\Delta_T = (\Delta_1 + \Delta_2) = \frac{(5.2^K)(1728^{IN^3/FT^3})}{3(29\times10^3 KSI)(I)}(5.92^3 + 6.08^3) = \frac{44.64}{I}$

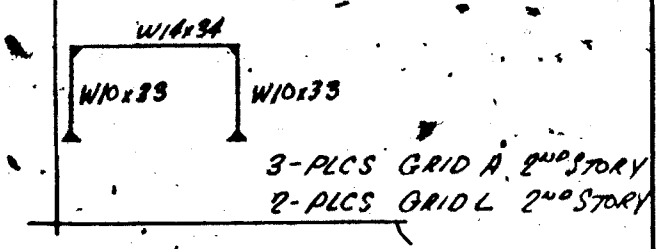
for $\Delta_T \leq 144/400 = 0.36" \rightarrow I \geq \frac{44.64}{0.36} = 124.0\ IN^4$

COL W10x33 $I_x = 170\ IN^4 > 124\ IN^4$
for $L_U = 12' \rightarrow M_R = 64^{KFT} > 32^{KFT}$.

BM W14x34 $I = 340\ IN^4$
$M_R = 97^{KFT} > 32.0^{KFT}$

$I_{W14\ BM} = 2\ I_{W10\ COL}$ AS ASSUMED
∴ REL STIFF & DISTR. OK.

USE MOM. RESIST'G FRMS
W/ W10x33 COLS & W14x34 BM.
MOM CONN COL BASE & BM TO COL



3-PLCS GRID A 2ND STORY
2-PLCS GRID L 2ND STORY

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Doris Hoesl, 12/31/87

STRAUSS & LOFTFIELD
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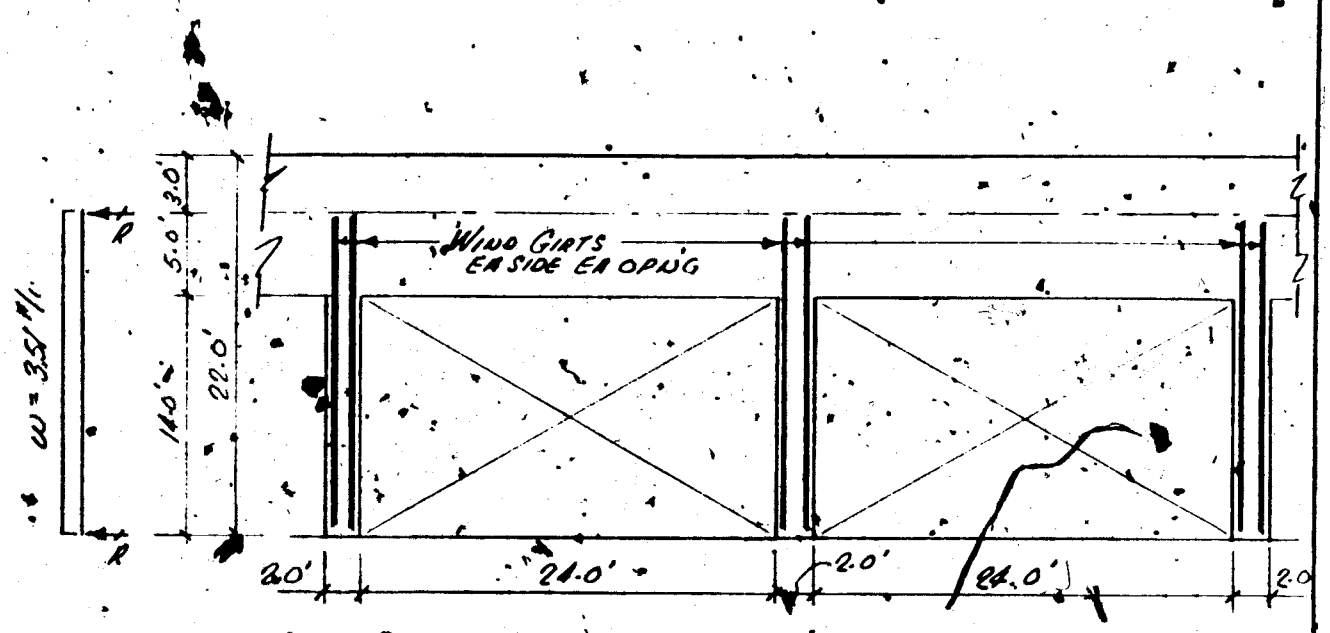
CLIENT/ SHEET/ 310 OF 317
PROJECT/ PROJECT # 82017
DATE/ OCT'82
ENGINEER/ H.S.

WIND GIRTS AT ROLL-UP-DOOR OPNGS.



$p = C_e C_q q_s I$

$p = (1.2)(1.3)(15PSF)(1.15) = 27\ PSF$

$\therefore w = (26'/2)(27PSF) = 351\ \#/ft$

$R = 3.24^K$

$M = 15.9\ KFT$

$\Delta = \frac{5(.351)(19.0)^4(1728)}{384(29\times10^3)(I)} = \frac{35.5}{I} < \frac{19\times12}{400} = 0.57"$

$I \geq 35.5/0.57 = 62.3\ in^4$

$C12\times20.7 \quad I = 129\ in^4$

$F_b = \frac{12\times10^3\times1}{14\times12\times8.13} = 8.78\ KSI$

$M_R = (4/3 \times 8.78KSI)(21.5in^3)/12 = 21.0^{KFT}$ ✓

USE C12×20.7 VERT WIND GIRTS AT ROLL-UP DOOR OPNGS

1600 EAST DESERT INN ROAD SUITE 106 | LAS VEGAS, NEVADA 89109-2594 (702) 731-6226

Dora Hasl 12/31/81

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CLIENT/
PROJECT/
SHEET/ 311 OF 317
PROJECT # 82041
DATE/ OCT 82
ENGINEER/ HS

COMBINED BEND'G & AXIAL LOAD from LATERAL ANALYSIS

FRM-B

BEAM B-8 2ND & 3RD LEVELS
BEAM B-33 PLAZA LEVEL

P = (78.1^K x 1.25) & M = 46.1^KFT ← DESIGN MAXIMUMS

W14 x 43 { A = 12.6 in² r_y = 1.89 ; S_x = 62.7 in³ r_x = 5.82" }

kl_x/r_x = 20.67 x 12 / 5.82 = 42.6 → F'_e = (4/3)(82.32) = 109.76 KSI
kl_y/r_y = 20.67 x 12 / 1.89 = 131.2 → F_a = (4/3)(8.67) = 11.56 KSI

f_a = (1.25 x 78.1) / 12.6 = 7.75 KSI → f_a/F_a = 0.67

f_b = 46.1 x 12 / 62.7 = 8.82 KSI F_b = (4/3)(24) = 32 KSI

UNITY EQUA. $0.67 + \frac{8.82}{(1 - \frac{7.75}{109.76})32} = 0.97 < 1.0$ OK

USE W14 x 43 for B-8 2ND & 3RD FLR & B-33 PLAZA

FRM-N

BEAMS B-12 & B-25 2ND & 3RD LEVELS
BEAMS B-29 & B-30 PLAZA LEVEL

P = (93.9^K x 1.26) M = 39.8^KFT ← DESIGN MAXIMUMS

W14 x 43 { A = 12.6 in² r_y = 1.89 ; S_x = 62.7 in³ r_x = 5.82 }

kl_x/r_x = 17.92 x 12 / 5.82 = 37.0 → F'_e = (4/3)(109.08) = 145.44 KSI
kl_y/r_y = 17.92 x 12 / 1.89 = 113.8 → F_a = (4/3)(11.15) = 14.87 KSI

f_a = (1.25 x 93.9) / 12.6 = 9.32 KSI → f_a/F_a = 0.63

f_b = 39.8 x 12 / 62.7 = 7.62 KSI

UNITY EQUA. $0.63 + \frac{7.62}{(1 - \frac{9.32}{145.44})(29.33)} = 0.91 < 1.0$ OK

USE W14 x 43 for B-12 & B-25 2ND & 3RD FLRS & B-29 & B-30 PLAZA LEVEL

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CLIENT/ SHEET/ 312 OF 317
PROJECT/ PROJECT # 82017
DATE/ OCT '82
ENGINEER/ HS

COMBINED BEND'G & AXIAL LOAD continued

FRM-3

BEAM B-36 2ND & 3RD LEVELS
— $R = (128.0^K \times 1.25)$ & $M = 54.9^{K\text{-}FT}$ ← DESIGN MAXIMUMS
W14x43 $\begin{cases} A = 12.6 & r_y = 1.89 \\ S = 62.7 & r_x = 5.82 \end{cases}$

$Kl_x/r_x = 17.13 \times 12/5.82 = 35.3 \rightarrow F'_e = (4/3)(119.90) = 159.86$ KSI
$Kl_y/r_y = 13.13 \times 12/1.89 = 83.4 \rightarrow F_a = (4/3)(14.97) = 19.96$ KSI
$f_a = (1.25 \times 128.0)/12.6 = 12.70$ KSI $\rightarrow f_a/F_a = 0.64$
$f_b = 54.9 \times 12/62.7 = 10.51$

UNITY EQUA. $0.64 + \frac{10.}{(1-\quad)(32)} = 0.997 \leq 1.0$ OK

USE W14x43 for B-36 2ND & 3RD LEVELS

FRM-U

BEAM B-19 2ND LEVEL & FUTURE 3RD LEVEL EXTENDED
— $P = (47.0^K \times 1.25)$ & $M = 39.3^{K\text{-}FT}$ ← DESIGN MAXIMUMS
W18x40 $\begin{cases} A = 11.8 in^2 & r_y = 1.27" \\ S = 68.4 in^3 & r_x = 7.21" \end{cases}$

$Kl_x/r_x = 27.63 \times 12/7.21 = 46.1 \rightarrow F'_e = (4/3)(70.27) = 93.69$ KSI
$Kl_y/r_y = 18.63 \times 12/1.27 = 176.0 \rightarrow F_a = (4/3)(4.82) = 6.43$ KSI
$f_a = 47 \times 1.25/11.8 = 4.98$ KSI $\rightarrow f_a/F_a = 0.78$
$f_b = 39.3 \times 12/68.4 = 6.89$

UNITY EQUA. $0.78 + \frac{6.89}{(1-\frac{4.98}{93.69})(32)} = 1.007 \doteq 1.0$ SAY OK

USE W18x40 for B-19 2ND LEVEL

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CLIENT/
PROJECT/
SHEET/ 313 OF 317
PROJECT # 82017
DATE/ OCT 82
ENGINEER/ HS

COMBINED BEND'G & AXIAL LOAD continued

FRM - T BEAM B-47 2ND LEVEL

— P = (44.5K x 1.25) & M = 467.3 KFT ← DESIGN MAX

W 27 x 94 $\begin{cases} A = 27.7 in^2 & r_y = 2.12" \\ S = 243 in^3 & r_x = 10.9" \end{cases}$

Kl_x/r_x = 28.16 x 12/10.9 = 31.0 → F'_e = (4/3)(155.39) = 207.19 KSI

Kl_y/r_y = 7.04 x 12/2.12 = 39.9 → F_a = (4/3)(19.20) = 25.60 KSI

f_a = (1.25 x 44.5)/27.7 = 2.01 KSI → f_a/F_a = 0.08 < 0.15

f_b = 467.8 x 12/243 = 23.08

UNITY EQUA. 0.08 + 23.08/32 = 0.81 < 1.0 OK

USE W27 x 94 for B-47 2ND LEVEL

BEAM B-31 3RD LEVEL

— P = (44.5K x 1.25) & M = 79.4 KFT ← DESIGN MAX

W14 x 53 $\begin{cases} A = 15.6 in^2 & r_y = 1.92" \\ S = 77.8 in^3 & r_x = 5.89" \end{cases}$

Kl_x/r_x = 28.17 x 12/5.89 = 57.4 → F'_e = (4/3)(45.33) = 60.44 KSI

Kl_y/r_y = 28.17 x 12/1.92 = 176.1 → F_a = (4/3)(4.81) = 6.41 KSI

f_a = (1.25 x 44.5)/15.6 = 3.57 KSI → f_a/F_a = 0.56

f_b = 79.4 x 12/77.8 = 12.25 KSI

UNITY EQUA $0.56 + \frac{12.25}{(1 - \frac{3.57}{60.44})(32)} = 0.97 < 1.0$ OK

USE W14 x 53 for B-31 3RD LEVEL

FRM - Q BEAMS B-28 & B-55 M.ROOF & 2ND LEVEL RESPECTIVELY

— P = (37.9K x 1.25) & M = 24.0 KFT ← DESIGN MAXIMUMS

W12 x 26 $\begin{cases} A = 7.65 in^2 & r_y = 1.51" \\ S = 33.4 in^3 & r_x = 5.17" \end{cases}$

Kl_x/r_x = 16.2 x 12/5.17 = 37.6 → F'_e = (4/3)(105.68) = 140.91 KSI

Kl_y/r_y = 16.2 x 12/1.51 = 128.8 → F_a = (4/3)(9.0) = 12.0 KSI

f_a = (1.25 x 37.9)/7.65 = 6.20 KSI → f_a/F_a = 0.52

f_b = 24 x 12/33.4 = 8.62 KSI

UNITY EQUA $0.52 + \frac{8.62}{(1 - \frac{6.2}{140.91})(32)} = 0.80 < 1.0$ OK

USE W12 x 26 for B-28 M. ROOF & B-55 M. 2ND

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CLIENT/
PROJECT/
SHEET/ 314 OF 317
PROJECT # 82017
DATE/ OCT' 82
ENGINEER/ HS

COMBINED BEND'G & AXIAL LOAD - continued

FRM-12-B BEAM B-16 2ND & 3RD LEVELS

P = (47.9 x 1.25) & M = 251.3 KFT ← DESIGN MAX

W24x68 { A = 20.1 in² ry = 1.87" ; S = 154.0 in³ rx = 9.55" }

Kl_x/r_x = 27.21x12/9.55 = 34.2 → F'_e = (1/3)(127.72) = 170.29 KSI

Kl_y/r_y = 7.0x12/1.87 = 44.9 → F_a = (1/3)(18.78) = 25.04 KSI

f_a = (1.25x47.9)/20.1 = 2.98 KSI → f_a/F_a = 0.12 < 0.15

f_b = 251.3x12/154.0 = 19.58 KSI

UNITY EQUA 0.12 + 19.58/32 = 0.73 < 1.0 OK

USE W24x68 for B-16 2ND & 3RD LEVELS

BEAM B-62 N. ROOF

P = (43.5 x 1.25) & M = 149.4 KFT ← DESIGN MAX

W21x44 { A = 13.0 in² ry = 1.26" ; S = 81.6 in³ rx = 8.06" }

Kl_x/r_x = 27.3x12/8.06 = 40.7 → F'_e = (1/3)(90.18) = 120.24 KSI

Kl_y/r_y = 7.0x12/1.26 = 66.7 → F_a = (1/3)(16.77) = 22.36 KSI

f_a = (1.25x43.5)/13.0 = 4.18 → f_a/F_a = 0.19

f_b = 149.4x12/81.6 = 21.97 KSI

UNITY EQUA. $0.19 + \frac{21.97}{(1-\frac{4.18}{120.24})(32)} = 0.90 < 1.0$ OK

USE W21x44 for B-62 N. ROOF

BEAM B-80 N. 2ND LEVEL

P = (47.9 x 1.25) & M = 195.4 KFT ← DESIGN MAX

W24x55 { A = 16.2 in² ry = 1.34" ; S = 114 in³ rx = 9.11" }

Kl_x/r_x = 27.3x12/9.11 = 36.0 → F'_e = (1/3)(115.22) = 153.62 KSI

Kl_y/r_y = 7.0x12/1.34 = 62.7 → F_a = (1/3)(17.17) = 22.89 KSI

f_a = (1.25x47.9)/16.2 = 3.70 KSI → f_a/F_a = 0.16

f_b = 195.4x12/114 = 20.57 KSI

UNITY EQUA. $0.16 + \frac{20.57}{(1-\frac{3.70}{153.62})32} = 0.82 < 1.0$ OK.

USE W24x55 for B-80 N. 2ND LEVEL

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CLIENT/ SHEET/ 315 OF 317
PROJECT/ PROJECT # 82017
DATE/ OCT'82
ENGINEER/ HS

COMBINED BEND'G & AXIAL LOAD continued

FRM - 12-J BEAM B-14 2ND & 3RD LEVELS

P = (56.1^K x 1.25) & M = 129.9^{KFT} ← DESIGN MAX

W24 x 55 { A = 16.2 in^2 r_y = 1.34" ; S = 114 in^3 r_x = 9.11" }

Kl_x/r_x = 21.0 x 12/9.11 = 27.7 → F'_e = (4/3)(194.78) = 259.70 KSI

Kl_y/r_y = 7.0 x 12/1.34 = 62.7 → F_a = (4/3)(17.27) = 22.89 KSI

f_a = (1.25 x 56.1)/16.2 = 4.33 KSI → f_a/F_a = 0.19

f_b = 129.9 x 12/114 = 13.67 KSI

UNITY EQUA $0.19 + \frac{13.67}{(1 - \frac{4.33}{259.70})(32)} = 0.63 < 1.0$

USE W24 x 55 for B-14 2ND & 3RD FLRS

BEAM B-74 N. ROOF

P = (56.1^K x 1.25) & M = 48.8^{KFT} ← DESIGN MAX

W14 x 38 { A = 11.2 in^2 r_y = 1.55" ; S = 54.6 in^3 r_x = 5.87" }

Kl_x/r_x = 21.0 x 12/5.87 = 43.0 → F'_e = (4/3)(80.76) = 107.68 KSI

Kl_y/r_y = 12.2 x 12/1.55 = 94.5 → F_a = (4/3)(13.66) = 18.21 KSI

f_a = (1.25 x 56.1)/11.2 = 6.26 KSI → f_a/F_a = 0.35

f_b = 48.8 x 12/54.6 = 10.73 KSI. $F_b = (4/3)(\frac{90^{KFT} \times 12}{54.6 in^3})$

UNITY EQUA. $0.35 + \frac{10.73}{(1 - \frac{6.26}{107.68})(26.3)} = 0.79 < 1.0$

USE W14 x 38 for B-74 N. ROOF.

BEAM B-78 N. 2ND LEVEL

P = (56.5^K x 1.25) & M = 78.4^{KFT} ← DESIGN MAX

W16 x 36 { A = 10.6 in^2 r_y = 1.52" ; S = 56.5 in^3 r_x = 6.51" }

Kl_x/r_x = 21.0 x 12/6.51 = 38.7 → F'_e = (4/3)(99.73) = 133.0 KSI

Kl_y/r_y = 7.0 x 12/1.52 = 55.3 → F_a = (4/3)(17.87) = 23.82 KSI

f_a = (1.25 x 56.5)/10.6 = 6.67 KSI → f_a/F_a = 0.28

f_b = 78.4 x 12/56.5 = 16.65 KSI

UNITY EQUA $0.28 + \frac{16.65}{(1 - \frac{6.67}{133.0})(32)} = 0.83 < 1.0$

USE W16 x 36 for B-78 N. 2ND LEVEL

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STRUCTURAL ENGINEERS

CLIENT/
PROJECT/
SHEET/ 316 OF 317
PROJECT # 82017
DATE/ OCT '82
ENGINEER/ AS

COMBINED BEND'G & AXIAL LOAD continued

FRM-12-S BEAM B-43 2ND & 3RD LEVELS

P = (97.2K x 1.25) & M = 212.4 KFT ← DESIGN MAX

W 24 x 62 { A = 18.2 IN² ry = 1.38" ; S = 131.0 IN³ rx = 9.23" }

Klx/rx = 26.4x12/9.23 = 34.4 → F'e = (4/3)(126.26) = 168.34 KSI

Kly/ry = 7.0x12/1.38 = 60.9 → Fa = (4/3)(17.34) = 23.12 KSI

fa = (1.25x97.2)/18.2 = 6.68 KSI → fa/Fa = 0.29

fb = 212.4x12/131 = 19.46 KSI

UNITY EQUA = $0.29 + \frac{19.46}{(1-\frac{6.68}{168.34})(32)} = 0.93 < 1.0$ ✓

USE W24x62 for B-43 2ND & 3RD FLRS

FRM-P BEAM B-73 N. 2ND LEVEL

P = (15.2K x 1.25) & M = 320.1 KFT ← DESIGN MAX

W 24x76 { A = 22.4 IN² ry = 1.92" ; S = 176 IN³ rx = 9.69" }

Klx/rx = 28.2x12/9.69 = 35.0 → F'e = (4/3)(121.90) = 162.50 KSI

Kly/ry = 7.0x12/1.92 = 43.8 → Fa = (4/3)(18.88) = 25.17 KSI

fa = (1.25x15.2)/22.4 = 0.85 KSI → fa/Fa = 0.04 < 0.15

fb = 320.1x12/176 = 21.83

UNITY EQUA $0.04 + \frac{21.83}{32} = 0.73 < 1.0$ ✓

USE W24x76 for B-73 N. 2ND LEVEL

FRM-34' BEAM B-29 N. 2ND LEVEL

P = (20.1 x 1.25) & M = 77.1 KFT ← DESIGN MAX

W16x36 { A = 10.6 IN² ry = 1.52" ; S = 56.5 IN³ rx = 6.51" }

Klx/rx = 23.4x12/6.51 = 43.2 → F'e = (4/3)(80.03) = 106.70 KSI

Kly/ry = 23.4x12/1.52 = 184.8 → Fa = (4/3)(4.37) = 5.83 KSI

fa = (1.25x20.1)/10.6 = 2.37 KSI → fa/Fa = 0.41

fb = 77.1x12/56.5 = 16.38 KSI

UNITY EQUA $0.41 + \frac{16.38}{(1-\frac{2.37}{106.70})(32)} = 0.94 < 1.0$ ✓

USE W16x36 for B-29 N. 2ND LEVEL

Done Hand, 12/31/87

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CLIENT/

SHEET/ 317 OF 317

PROJECT/

PROJECT # 82017

DATE/ OCT. 82

ENGINEER/ HS

COMBINED BEND'G & AXIAL LOAD. continued

FRM-A

BEAM B-37 N. 2ND LEVEL

$P = (88.3^K \times 1.25)$ & $M = 38.9^{KFT}$ ← DESIGN MAX

W14x34 $\begin{cases} A = 10.0 IN^2 & r_y = 1.53 \\ S = 48.6 IN^3 & r_x = 5.83 \end{cases}$

$K\ell_x/r_x = 24.2 \times 12 / 5.83 = 49.8 \rightarrow F'_e = (4/3)(60.22) = 80.30\ KSI$

$K\ell_y/r_y = 12.1 \times 12 / 1.53 = 94.9 \rightarrow F_a = (4/3)(13.61) = 18.14\ KSI$

$f_a = (1.25 \times 88.3) / 10.0 = 11.04\ KSI \rightarrow f_a/F_a = 0.61$

$f_b = 38.9 \times 12 / 48.6 = 9.61\ KSI$

UNITY EQUA $0.61 + \frac{9.61}{(1 - \frac{11.04}{80.30})(32)} = 0.96 < 1.0$

USE W14x34
w/ BOTT FLNG BRACED @ MID PT
for B-37 N. 2ND LEVEL

BRACE TT 3x3x1/4
w/ 2 - 3/4" Ø EA END
CONN @ 3/8"