

Norton & Schmidt

Consulting Engineers, LLC

Structural Calculations for



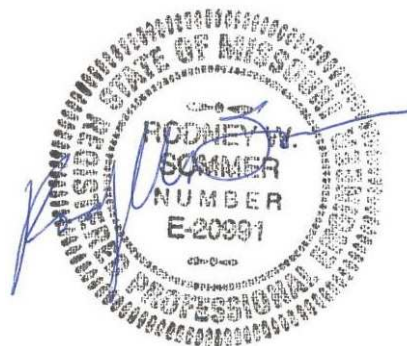
QuikTrip

QT No. 0183

**1001 SW Blue Parkway
Lees Summit, MO**

N&S No. 2024-2239

Mo. Certificate Of Authority #
2008019746



2024-11-25

311 E. 11TH AVENUE, NORTH KANSAS CITY, MO 64116
PHONE (816) 421-4232 FAX (816) 421-1956

QT #0183 @ Lees Summit MO

Project No. 2024-2239

Roof Loads

Dead Loads:

- | | |
|-----------------|---------|
| • Roofing (TPO) | 1 PSF |
| • Insulation: | 1.2 PSF |
| • Steel Deck: | 1.8 PSF |
| • Joists: | 5.5 PSF |
| • MEP: | 3 PSF |
| • Clg., Misc: | 2.5 PSF |

TOTAL:	16 PSF
--------	--------

<u>Live Load:</u>	20 PSF
-------------------	--------

Snow Load:

- | | |
|-------|----------------------|
| • Pg: | 20 PSF |
| • Pf: | 14 PSF Plus drifting |

SNOW DRIFTING

$$p_g = 35 \text{ PSF}$$

$$p_f = 0.7(1.0)(1.0)(1.0)35 = 24.5 \text{ PSF}$$

$$L(\text{FRONT TO REAR}) = 58'$$

$$h_d = 2.5'$$

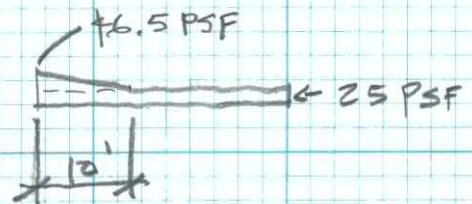
$$L(\text{SIDE TO SIDE}) = 92'$$

$$h_d = 3.1'$$

DRIFT TO FRONT CANOPY:

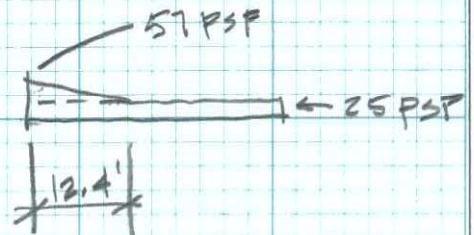
$$x = 0.13(35) + 1' = 18.6 \text{ PCF}$$

$$W = 4(2.5) = 10'$$

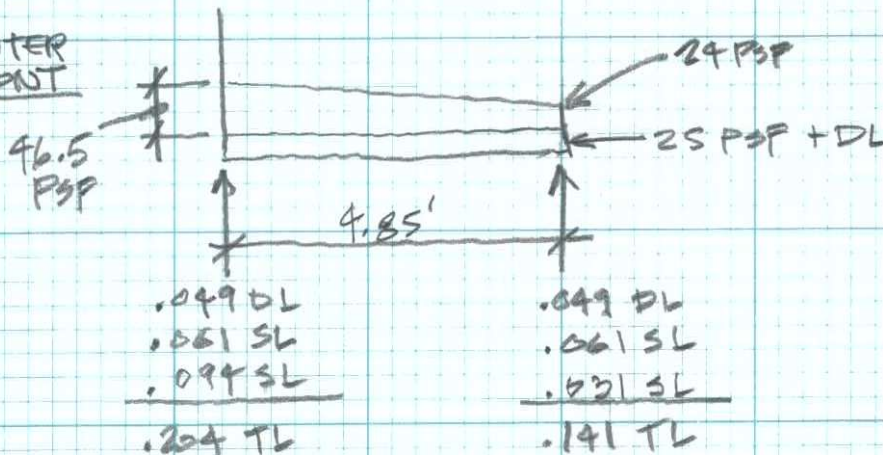


DRIFT TO SIDE CANOPIES:

$$W = 4(3.1) = 12.4'$$



CENTER FRONT



DRIFT @ SIDE PARAPETS:

$$h_d = .75(3.1) = 2.33'$$

$$p_d = 43 \text{ PSF}$$

$$W = 4(2.33) = 9.3'$$

NORTON & SCHMIDT

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Project _____

Job No. _____

Calculated by _____ Date _____

Checked by _____ Sheet No. _____ of _____

DRIFT @ FRONT PARAPET:

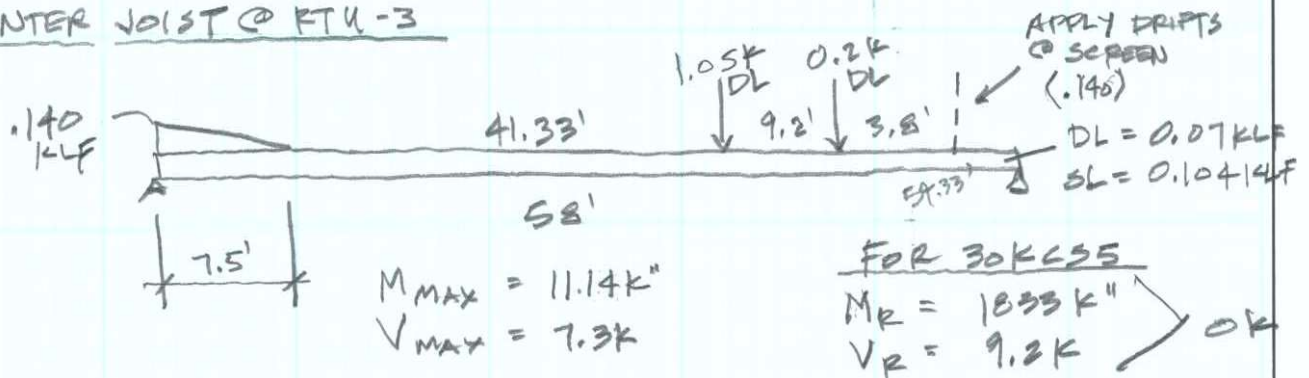
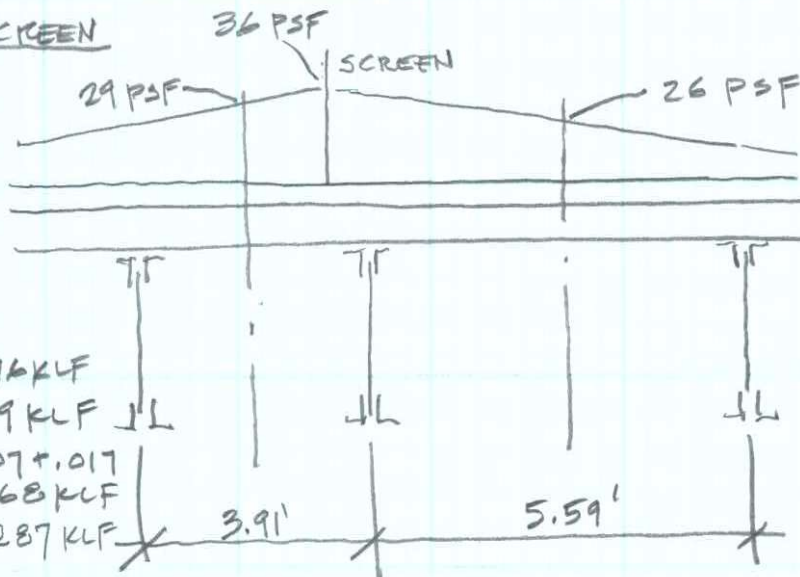
$$h_d = 2.5'(.75) = 1.88'; \quad P_d = 1.88(18.6) = 34 \text{ PSF}$$

(USE SAME DRIFT @ REAR MECH. SCREEN)

DRIFT @ SIDE MECH. SCREENS:

$$l = 73'; \quad h_d = 2.6' \quad P_d = 2.6(18.6)(.75) = 36 \text{ PSF}$$

$$W = 10.4'$$

CENTER JOIST @ RTU-3JOIST @ MECH. SCREEN

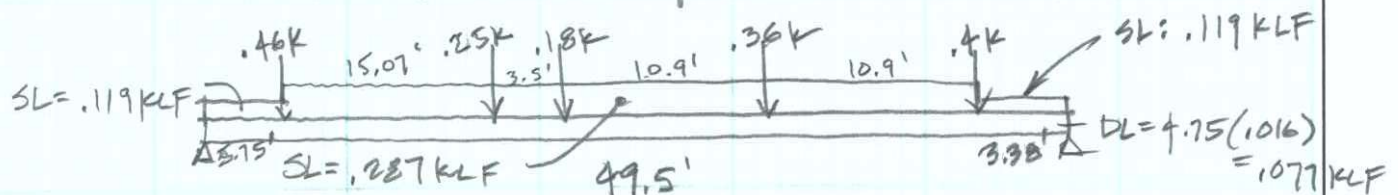
LOAD TO CENTER JOIST:

$$DL = 4.75(.016) = .076 \text{ KLF}$$

$$SL = 4.75(.025) = .119 \text{ KLF}$$

$$+.058 + .086 + .007 + .017 = .168 \text{ KLF}$$

$$\text{TOTAL SL} = .287 \text{ KLF}$$



$$M_{\text{MAX}} = 14.26 \text{ K'}$$

$$V_{\text{MAX}} = 9.22 \text{ K}$$

$$\text{FOR 26 KCS5}$$

$$M_R = 15.76 \text{ K'}$$

$$V_R = 9.2 \text{ K}$$

General Beam

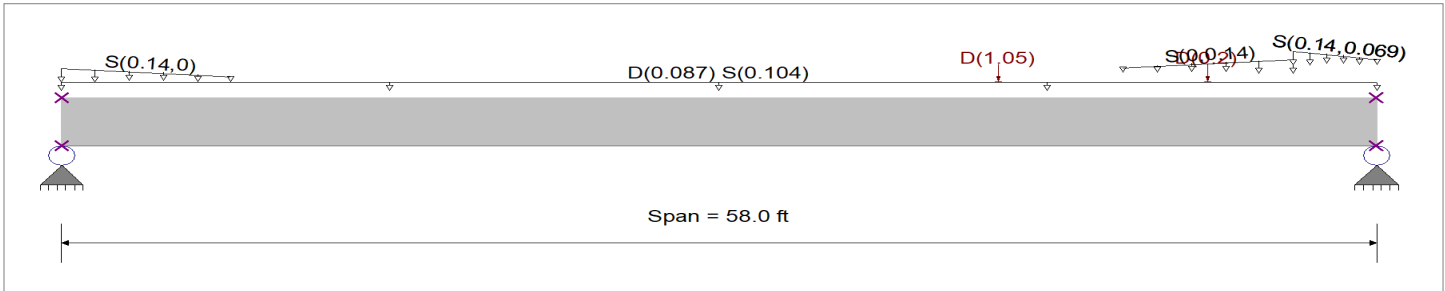
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DESCRIPTION: Center Joist @ RTU-3

General Beam Properties

Elastic Modulus = 29,000.0 ksi
Span #1 Span Length = 58.0 ft Area = 10.0 in² Moment of Inertia = 100.0 in⁴



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0870, S = 0.1040 k/ft, Tributary Width = 1.0 ft

Varying Uniform Load : S = 0.140->0.0 k/ft, Extent = 0.0 -->> 7.50 ft, Trib Width = 1.0 ft

Point Load : D = 1.050 k @ 41.330 ft

Point Load : D = 0.20 k @ 50.530 ft

Varying Uniform Load : S = 0.0->0.140 k/ft, Extent = 46.830 -->> 54.330 ft, Trib Width = 1.0 ft

Varying Uniform Load : S = 0.140->0.0690 k/ft, Extent = 54.330 -->> 58.0 ft, Trib Width = 1.0 ft

DESIGN SUMMARY

Maximum Bending =	92.848 k-ft	Maximum Shear =	7.323 k
Load Combination	+D+S	Load Combination	+D+S
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Location of maximum on span	31.030 ft	Location of maximum on span	58.000 ft
Maximum Deflection			
Max Downward Transient Deflection	9.869 in		70
Max Upward Transient Deflection	0.157 in		4441
Max Downward Total Deflection	19.723 in		35
Max Upward Total Deflection	0.091 in		7657

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values (k-ft)							Shear Values (k)		
			M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope														
Dsgn. L = 58.00 ft		1			92.85		92.85					7.32		
D Only														
Dsgn. L = 58.00 ft		1			46.70		46.70					3.45		
+D+S														
Dsgn. L = 58.00 ft		1			92.85		92.85					7.32		
+D+0.750S														
Dsgn. L = 58.00 ft		1			81.28		81.28					6.35		
+0.60D														
Dsgn. L = 58.00 ft		1			28.02		28.02					2.07		

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	6.438	7.323
Overall MINimum		
D Only	2.851	3.445
+D+S	6.438	7.323
+D+0.750S	5.541	6.354
+0.60D	1.710	2.067

General Beam

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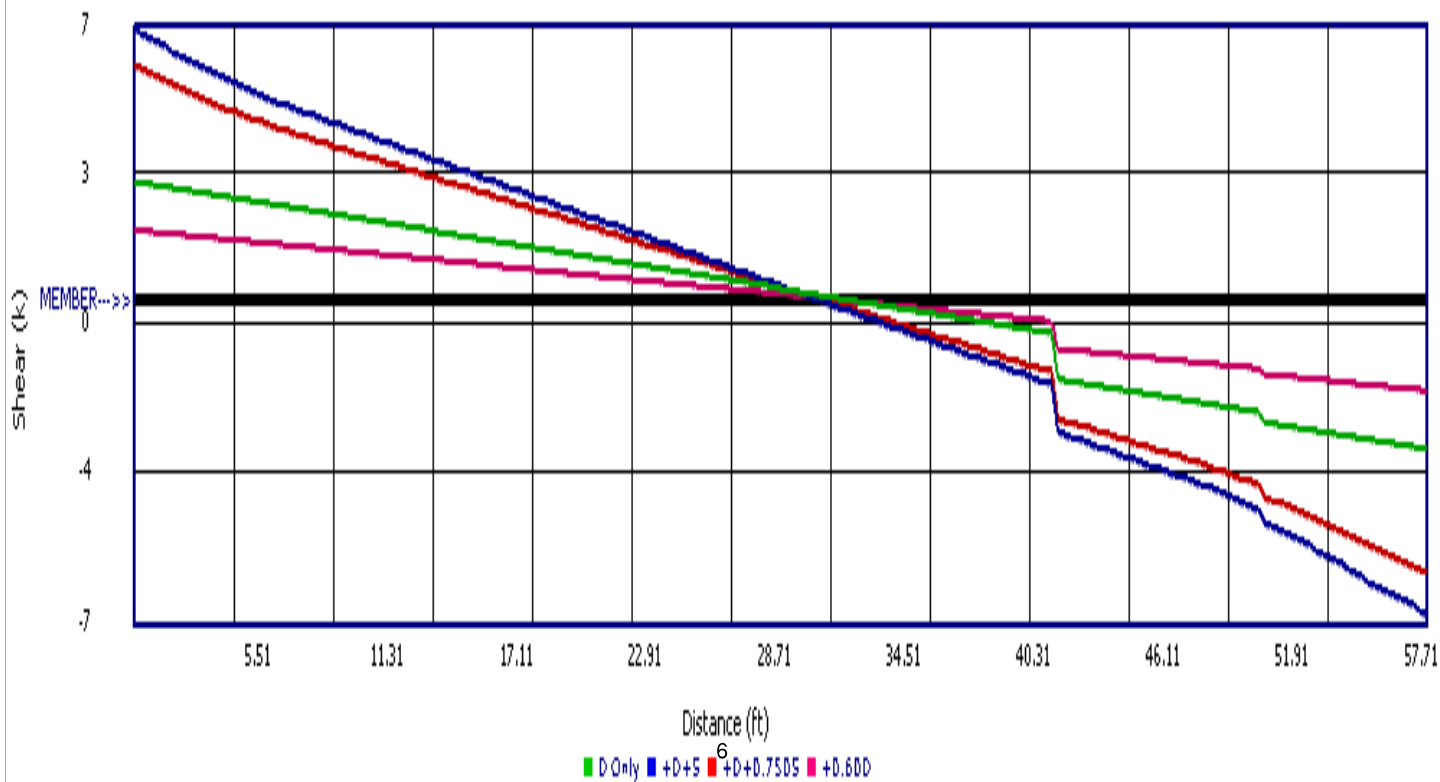
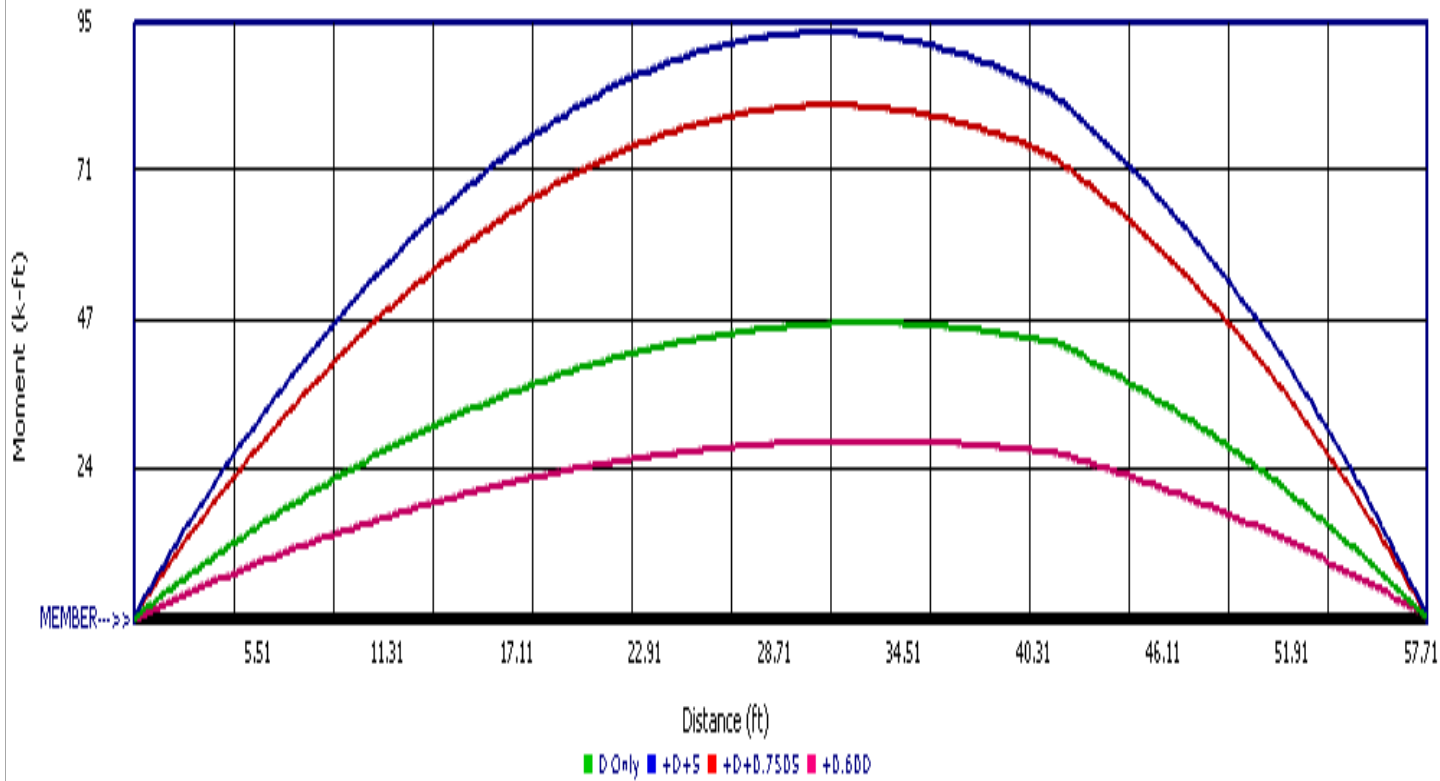
DESCRIPTION: Center Joist @ RTU-3

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
S Only	3.588	3.878

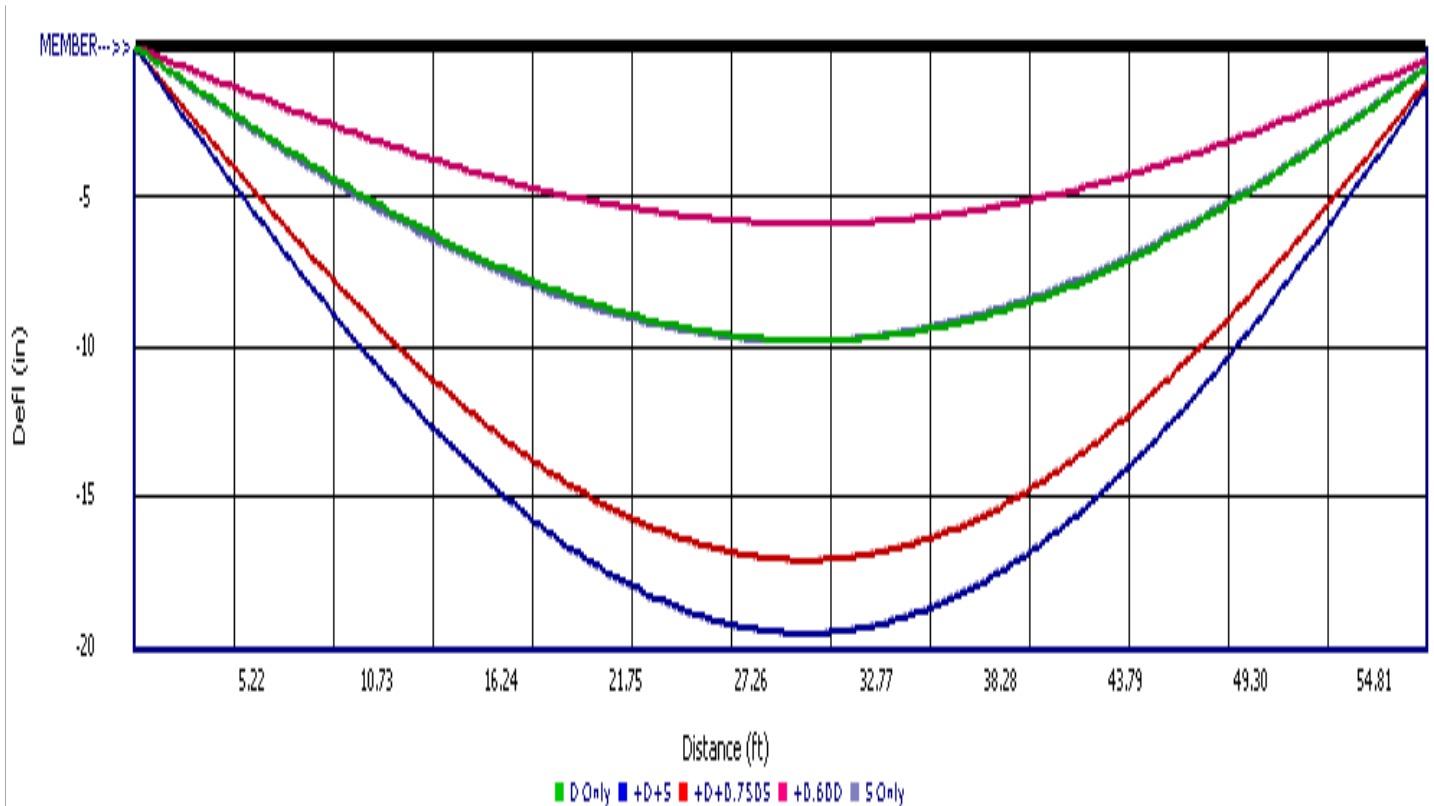


General Beam

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DESCRIPTION: Center Joist @ RTU-3



Summary of Values per Beam Span

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
Overall MAXimum Envelope	0.00	Span 1	6.438	0.000
Overall MAXimum Envelope	5.80	Span 1	4.832	32.382
Overall MAXimum Envelope	11.60	Span 1	3.698	57.056
Overall MAXimum Envelope	17.40	Span 1	2.590	75.290
Overall MAXimum Envelope	23.20	Span 1	1.482	87.098
Overall MAXimum Envelope	29.00	Span 1	0.374	92.482
Overall MAXimum Envelope	34.80	Span 1	-0.734	91.440
Overall MAXimum Envelope	40.60	Span 1	-1.841	83.973
Overall MAXimum Envelope	46.40	Span 1	-3.999	64.757
Overall MAXimum Envelope	52.20	Span 1	-5.576	37.534
Overall MAXimum Envelope	58.00	Span 1	-7.323	0.000
D Only	0.00	Span 1	2.851	0.000
D Only	5.80	Span 1	2.346	15.070
D Only	11.60	Span 1	1.841	27.213
D Only	17.40	Span 1	1.337	36.429
D Only	23.20	Span 1	0.832	42.719
D Only	29.00	Span 1	0.328	46.082
D Only	34.80	Span 1	-0.177	46.519
D Only	40.60	Span 1	-0.682	44.028
D Only	46.40	Span 1	-2.236	33.288
D Only	52.20	Span 1	-2.941	18.520
D Only	58.00	Span 1	-3.445	0.000
+D+S	0.00	Span 1	6.438	0.000

General Beam

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DESCRIPTION: Center Joist @ RTU-3

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+D+S	5.80	Span 1	4.832	32.382
+D+S	11.60	Span 1	3.698	57.056
+D+S	17.40	Span 1	2.590	75.290
+D+S	23.20	Span 1	1.482	87.098
+D+S	29.00	Span 1	0.374	92.482
+D+S	34.80	Span 1	-0.734	91.440
+D+S	40.60	Span 1	-1.841	83.973
+D+S	46.40	Span 1	-3.999	64.757
+D+S	52.20	Span 1	-5.576	37.534
+D+S	58.00	Span 1	-7.323	0.000
+D+0.750S	0.00	Span 1	5.541	0.000
+D+0.750S	5.80	Span 1	4.211	28.054
+D+0.750S	11.60	Span 1	3.234	49.595
+D+0.750S	17.40	Span 1	2.277	65.575
+D+0.750S	23.20	Span 1	1.320	76.004
+D+0.750S	29.00	Span 1	0.363	80.882
+D+0.750S	34.80	Span 1	-0.594	80.210
+D+0.750S	40.60	Span 1	-1.551	73.987
+D+0.750S	46.40	Span 1	-3.558	56.890
+D+0.750S	52.20	Span 1	-4.917	32.780
+D+0.750S	58.00	Span 1	-6.354	0.000
+0.60D	0.00	Span 1	1.710	0.000
+0.60D	5.80	Span 1	1.408	9.042
+0.60D	11.60	Span 1	1.105	16.328
+0.60D	17.40	Span 1	0.802	21.858
+0.60D	23.20	Span 1	0.499	25.631
+0.60D	29.00	Span 1	0.197	27.649
+0.60D	34.80	Span 1	-0.106	27.911
+0.60D	40.60	Span 1	-0.409	26.417
+0.60D	46.40	Span 1	-1.342	19.973
+0.60D	52.20	Span 1	-1.765	11.112
+0.60D	58.00	Span 1	-2.067	0.000

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	0.00	Span 1	0.000
Overall MAXimum Envelope	6.09	Span 1	6.348
Overall MAXimum Envelope	12.18	Span 1	11.979
Overall MAXimum Envelope	18.27	Span 1	16.328
Overall MAXimum Envelope	24.36	Span 1	18.986
Overall MAXimum Envelope	30.45	Span 1	19.701
Overall MAXimum Envelope	36.54	Span 1	18.378
Overall MAXimum Envelope	42.63	Span 1	15.078
Overall MAXimum Envelope	48.72	Span 1	10.060
Overall MAXimum Envelope	54.81	Span 1	3.829
Overall MAXimum Envelope	58.00	Span 1	0.317

General Beam

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DESCRIPTION: Center Joist @ RTU-3

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
D Only	0.00	Span 1	0.000
D Only	6.09	Span 1	3.125
D Only	12.18	Span 1	5.915
D Only	18.27	Span 1	8.092
D Only	24.36	Span 1	9.449
D Only	30.45	Span 1	9.850
D Only	36.54	Span 1	9.231
D Only	42.63	Span 1	7.599
D Only	48.72	Span 1	5.071
D Only	54.81	Span 1	1.927
D Only	58.00	Span 1	0.157
+D+S	0.00	Span 1	0.000
+D+S	6.09	Span 1	6.348
+D+S	12.18	Span 1	11.979
+D+S	18.27	Span 1	16.328
+D+S	24.36	Span 1	18.986
+D+S	30.45	Span 1	19.701
+D+S	36.54	Span 1	18.378
+D+S	42.63	Span 1	15.078
+D+S	48.72	Span 1	10.060
+D+S	54.81	Span 1	3.829
+D+S	58.00	Span 1	0.317
+D+0.750S	0.00	Span 1	0.000
+D+0.750S	6.09	Span 1	5.542
+D+0.750S	12.18	Span 1	10.463
+D+0.750S	18.27	Span 1	14.269
+D+0.750S	24.36	Span 1	16.602
+D+0.750S	30.45	Span 1	17.238
+D+0.750S	36.54	Span 1	16.091
+D+0.750S	42.63	Span 1	13.208
+D+0.750S	48.72	Span 1	8.812
+D+0.750S	54.81	Span 1	3.354
+D+0.750S	58.00	Span 1	0.277
+0.60D	0.00	Span 1	0.000
+0.60D	6.09	Span 1	1.875
+0.60D	12.18	Span 1	3.549
+0.60D	18.27	Span 1	4.855
+0.60D	24.36	Span 1	5.669
+0.60D	30.45	Span 1	5.910
+0.60D	36.54	Span 1	5.539
+0.60D	42.63	Span 1	4.559
+0.60D	48.72	Span 1 ⁹	3.043

General Beam

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DESCRIPTION: Center Joist @ RTU-3

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
+0.60D	54.81	Span 1	1.156
+0.60D	58.00	Span 1	0.094
S Only	0.00	Span 1	0.000
S Only	6.09	Span 1	3.223
S Only	12.18	Span 1	6.065
S Only	18.27	Span 1	8.236
S Only	24.36	Span 1	9.537
S Only	30.45	Span 1	9.850
S Only	36.54	Span 1	9.146
S Only	42.63	Span 1	7.479
S Only	48.72	Span 1	4.989
S Only	54.81	Span 1	1.903
S Only	58.00	Span 1	0.159

General Beam

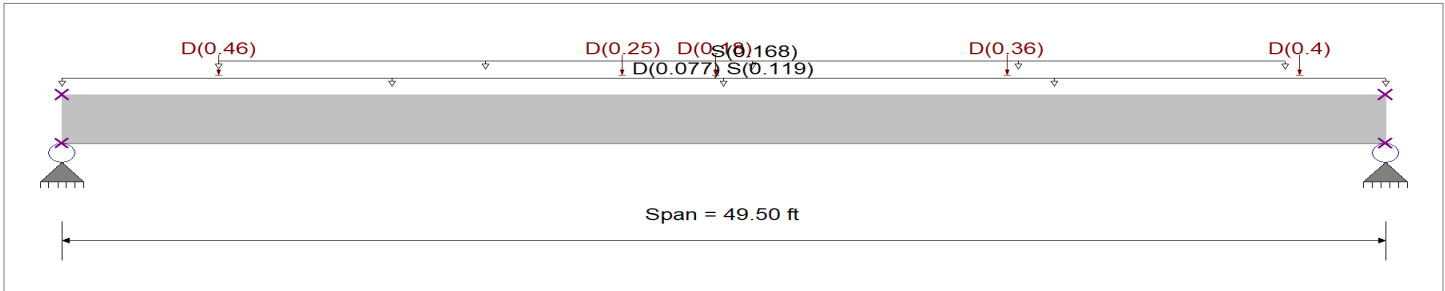
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DESCRIPTION: Joist @ Mech Screen

General Beam Properties

Elastic Modulus = 29,000.0 ksi
Span #1 Span Length = 49.50 ft Area = 10.0 in² Moment of Inertia = 100.0 in⁴



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0770, S = 0.1190 k/ft, Tributary Width = 1.0 ft

Point Load : D = 0.460 k @ 5.90 ft

Point Load : D = 0.250 k @ 20.970 ft

Point Load : D = 0.180 k @ 24.470 ft

Point Load : D = 0.360 k @ 35.370 ft

Point Load : D = 0.40 k @ 46.270 ft

Uniform Load : S = 0.1680 k/ft, Extent = 5.90 --> 45.750 ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Maximum Bending =	118.814 k-ft	Maximum Shear =	9.225 k
Load Combination	+D+S	Load Combination	+D+S
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Location of maximum on span	24.503 ft	Location of maximum on span	49.500 ft
Maximum Deflection			
Max Downward Transient Deflection	13.100 in	45	
Max Upward Transient Deflection	0.206 in	2881	
Max Downward Total Deflection	18.136 in	32	
Max Upward Total Deflection	0.048 in	12377	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values (k-ft)							Shear Values (k)		
			M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope														
Dsgn. L = 49.50 ft		1			118.81		118.81					9.22		
D Only														
Dsgn. L = 49.50 ft		1			32.98		32.98					2.79		
+D+S														
Dsgn. L = 49.50 ft		1			118.81		118.81					9.22		
+D+0.750S														
Dsgn. L = 49.50 ft		1			97.36		97.36					7.62		
+0.60D														
Dsgn. L = 49.50 ft		1			19.79		19.79					1.67		

Vertical Reactions

Support notation : Far left is #1

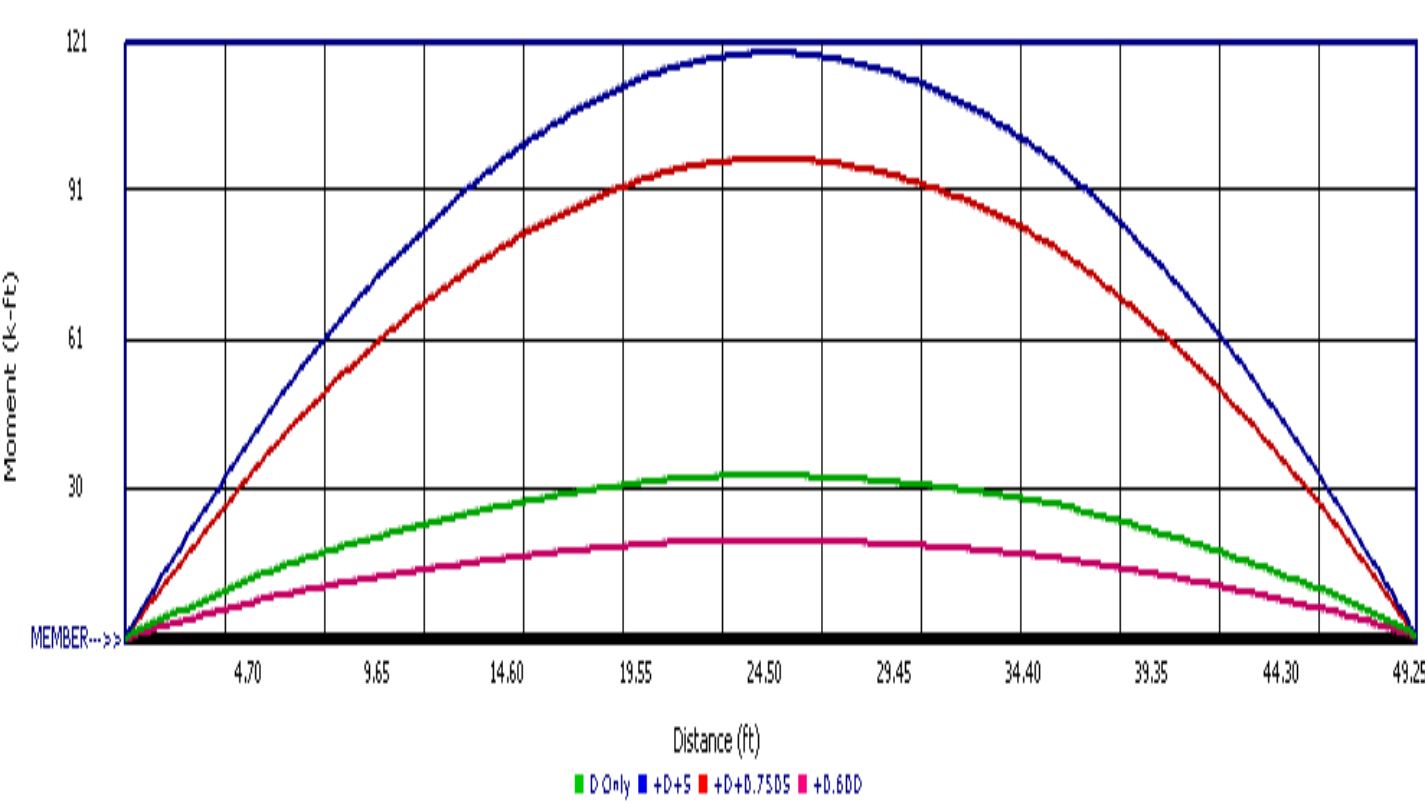
Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	8.822	9.225
Overall MINimum		
D Only	2.675	2.787

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DESCRIPTION: Joist @ Mech Screen

Vertical Reactions			Support notation : Far left is #1	Values in KIPS
Load Combination	Support 1	Support 2		
+D+S	8.822	9.225		
+D+0.750S	7.285	7.615		
+0.60D	1.605	1.672		
S Only	6.147	6.438		

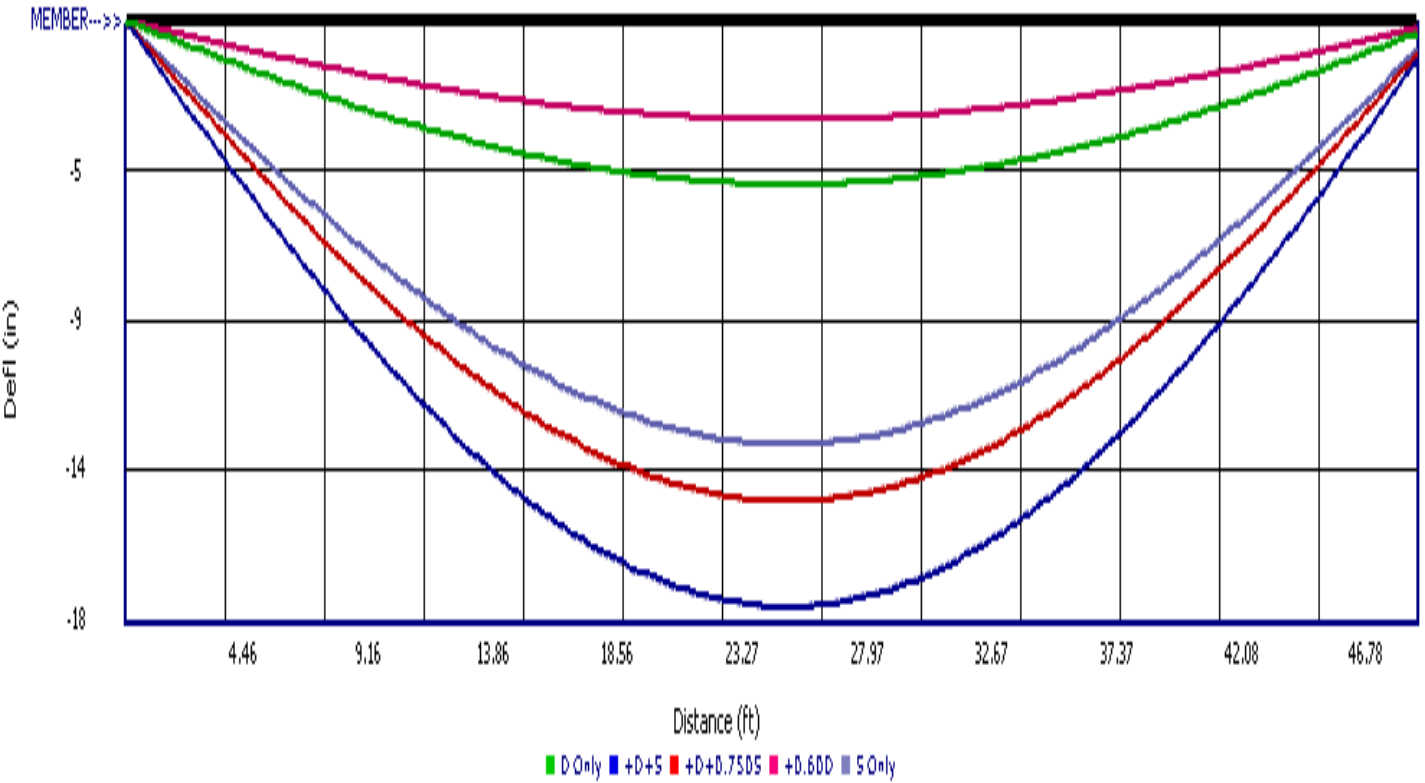
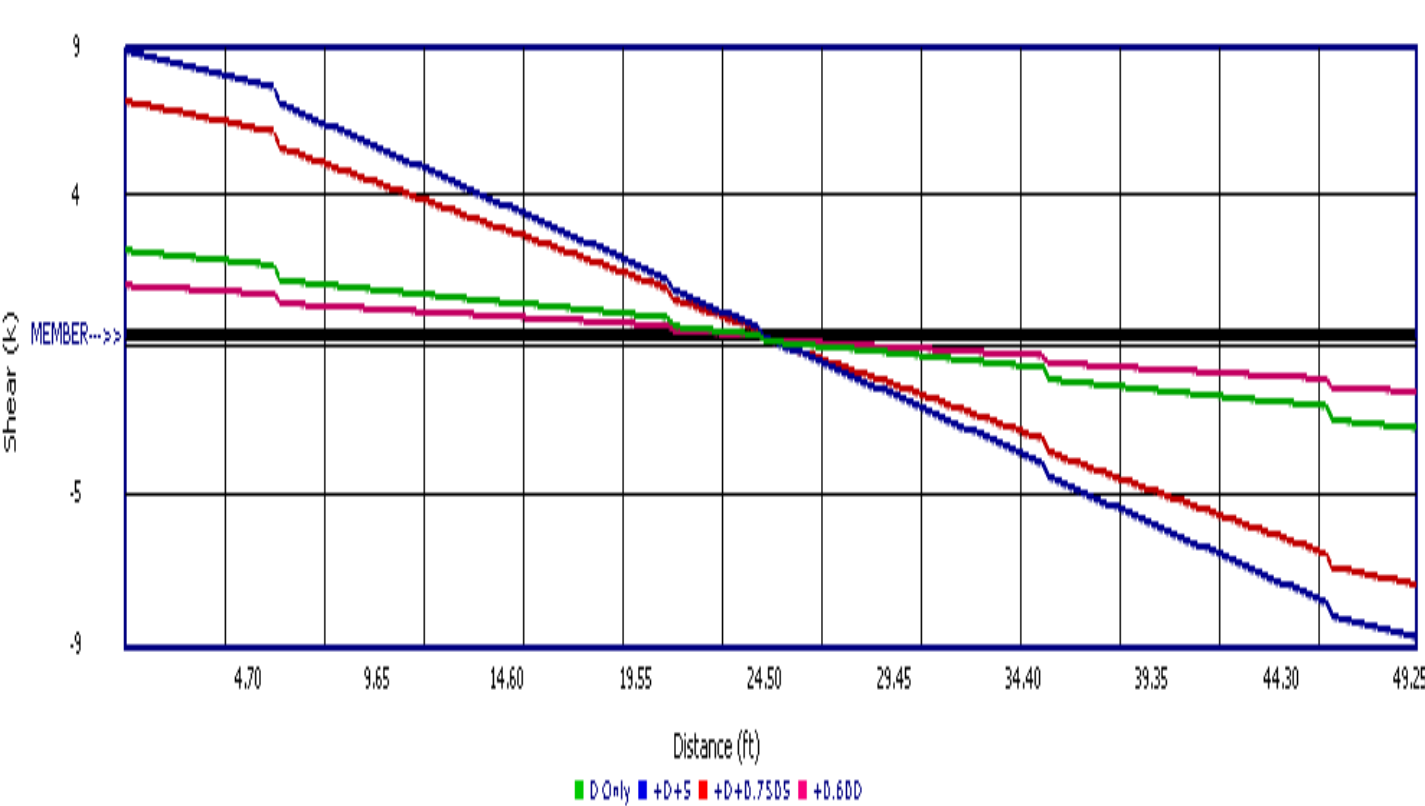


General Beam

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DESCRIPTION: Joist @ Mech Screen



Summary of Values per Beam Span

General Beam

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DESCRIPTION: Joist @ Mech Screen

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
Overall MAXimum Envelope	0.00	Span 1	8.822	0.000
Overall MAXimum Envelope	4.95	Span 1	7.852	41.268
Overall MAXimum Envelope	9.90	Span 1	5.750	74.550
Overall MAXimum Envelope	14.85	Span 1	3.948	98.552
Overall MAXimum Envelope	19.80	Span 1	2.146	113.635
Overall MAXimum Envelope	24.75	Span 1	-0.121	118.804
Overall MAXimum Envelope	29.70	Span 1	-1.887	113.920
Overall MAXimum Envelope	34.65	Span 1	-3.689	100.118
Overall MAXimum Envelope	39.60	Span 1	-5.851	75.874
Overall MAXimum Envelope	44.55	Span 1	-7.653	42.452
Overall MAXimum Envelope	49.50	Span 1	-9.225	0.000
D Only	0.00	Span 1	2.675	0.000
D Only	4.95	Span 1	2.294	12.297
D Only	9.90	Span 1	1.453	20.868
D Only	14.85	Span 1	1.071	27.115
D Only	19.80	Span 1	0.690	31.475
D Only	24.75	Span 1	-0.121	32.954
D Only	29.70	Span 1	-0.502	31.412
D Only	34.65	Span 1	-0.883	27.984
D Only	39.60	Span 1	-1.624	21.146
D Only	44.55	Span 1	-2.005	12.162
D Only	49.50	Span 1	-2.787	0.000
+D+S	0.00	Span 1	8.822	0.000
+D+S	4.95	Span 1	7.852	41.268
+D+S	9.90	Span 1	5.750	74.550
+D+S	14.85	Span 1	3.948	98.552
+D+S	19.80	Span 1	2.146	113.635
+D+S	24.75	Span 1	-0.086	118.804
+D+S	29.70	Span 1	-1.887	113.920
+D+S	34.65	Span 1	-3.689	100.118
+D+S	39.60	Span 1	-5.851	75.874
+D+S	44.55	Span 1	-7.653	42.452
+D+S	49.50	Span 1	-9.225	0.000
+D+0.750S	0.00	Span 1	7.285	0.000
+D+0.750S	4.95	Span 1	6.462	34.026
+D+0.750S	9.90	Span 1	4.675	61.130
+D+0.750S	14.85	Span 1	3.229	80.693
+D+0.750S	19.80	Span 1	1.782	93.095
+D+0.750S	24.75	Span 1	-0.094	97.341
+D+0.750S	29.70	Span 1	-1.541	93.293
+D+0.750S	34.65	Span 1	-2.988	82.084
+D+0.750S	39.60	Span 1	-4.794	62.192
+D+0.750S	44.55	Span 1	-6.241	34.879
+D+0.750S	49.50	Span 1	-7.615	0.000
+0.60D	0.00	Span 1	1.605	0.000
+0.60D	4.95	Span 1	1.376	7.378
+0.60D	9.90	Span 1 ⁴	0.872	12.521

General Beam

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 NORTON & SCHMIDT

Lic. #: KW-06000335

DESCRIPTION: Joist @ Mech Screen

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+0.60D	14.85	Span 1	0.643	16.269
+0.60D	19.80	Span 1	0.414	18.885
+0.60D	24.75	Span 1	-0.073	19.772
+0.60D	29.70	Span 1	-0.301	18.847
+0.60D	34.65	Span 1	-0.530	16.790
+0.60D	39.60	Span 1	-0.975	12.688
+0.60D	44.55	Span 1	-1.203	7.297
+0.60D	49.50	Span 1	-1.672	0.000

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	0.00	Span 1	0.000
Overall MAXimum Envelope	5.20	Span 1	5.898
Overall MAXimum Envelope	10.40	Span 1	11.129
Overall MAXimum Envelope	15.59	Span 1	15.139
Overall MAXimum Envelope	20.79	Span 1	17.537
Overall MAXimum Envelope	25.99	Span 1	18.095
Overall MAXimum Envelope	31.19	Span 1	16.760
Overall MAXimum Envelope	36.38	Span 1	13.651
Overall MAXimum Envelope	41.58	Span 1	9.055
Overall MAXimum Envelope	46.78	Span 1	3.436
Overall MAXimum Envelope	49.50	Span 1	0.288
D Only	0.00	Span 1	0.000
D Only	5.20	Span 1	1.646
D Only	10.40	Span 1	3.097
D Only	15.59	Span 1	4.205
D Only	20.79	Span 1	4.870
D Only	25.99	Span 1	5.024
D Only	31.19	Span 1	4.655
D Only	36.38	Span 1	3.795
D Only	41.58	Span 1	2.520
D Only	46.78	Span 1	0.958
D Only	49.50	Span 1	0.081
+D+S	0.00	Span 1	0.000
+D+S	5.20	Span 1	5.898
+D+S	10.40	Span 1	11.129
+D+S	15.59	Span 1	15.139
+D+S	20.79	Span 1	17.537
+D+S	25.99	Span 1	18.095
+D+S	31.19	Span 1	16.760
+D+S	36.38	Span 1	13.651
+D+S	41.58	Span 1	9.055
+D+S	46.78	Span 1	3.436

General Beam

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Lic. # : KW-06000335

DESCRIPTION: Joist @ Mech Screen

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
+D+S	49.50	Span 1	0.288
+D+0.750S	0.00	Span 1	0.000
+D+0.750S	5.20	Span 1	4.835
+D+0.750S	10.40	Span 1	9.121
+D+0.750S	15.59	Span 1	12.405
+D+0.750S	20.79	Span 1	14.370
+D+0.750S	25.99	Span 1	14.828
+D+0.750S	31.19	Span 1	13.734
+D+0.750S	36.38	Span 1	11.187
+D+0.750S	41.58	Span 1	7.422
+D+0.750S	46.78	Span 1	2.817
+D+0.750S	49.50	Span 1	0.236
+0.60D	0.00	Span 1	0.000
+0.60D	5.20	Span 1	0.988
+0.60D	10.40	Span 1	1.858
+0.60D	15.59	Span 1	2.523
+0.60D	20.79	Span 1	2.922
+0.60D	25.99	Span 1	3.015
+0.60D	31.19	Span 1	2.793
+0.60D	36.38	Span 1	2.277
+0.60D	41.58	Span 1	1.512
+0.60D	46.78	Span 1	0.575
+0.60D	49.50	Span 1	0.048
S Only	0.00	Span 1	0.000
S Only	5.20	Span 1	4.252
S Only	10.40	Span 1	8.032
S Only	15.59	Span 1	10.934
S Only	20.79	Span 1	12.668
S Only	25.99	Span 1	13.071
S Only	31.19	Span 1	12.105
S Only	36.38	Span 1	9.856
S Only	41.58	Span 1	6.535
S Only	46.78	Span 1	2.478
S Only	49.50	Span 1	0.208

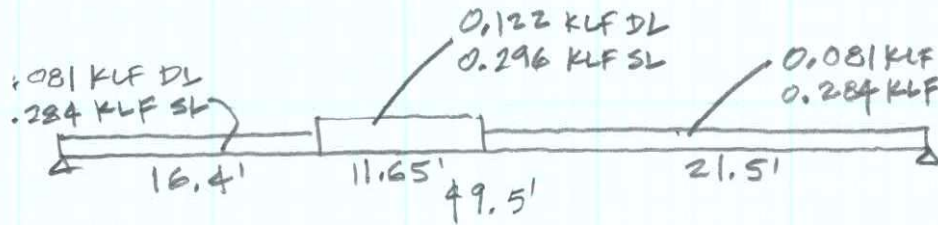
Phone: (816) 421-4232 Fax: (816) 421-1956

Checked by _____ Sheet No. _____ of _____

NORTON & SCHMIDT
 Consulting Engineers, LLC
 311 E. 11th Avenue
 North Kansas City, MO 64116
 Phone: (816) 421-4232 Fax: (816) 421-1956

Project _____
 Job No. _____
 Calculated by _____ Date _____
 Checked by _____ Sheet No. _____ of _____

SIDEWALK LIST



$$M_{MAX} = 1421 \text{ K"} \\ V_{MAX} = 9.37 \text{ K}$$

FOR 26 KCS5

$$M_R = 1576 \text{ K"} \quad \checkmark \\ V_R = 9.2 \text{ K} \quad 1.9\% \text{ OVER} \\ \text{OK}$$

General Beam

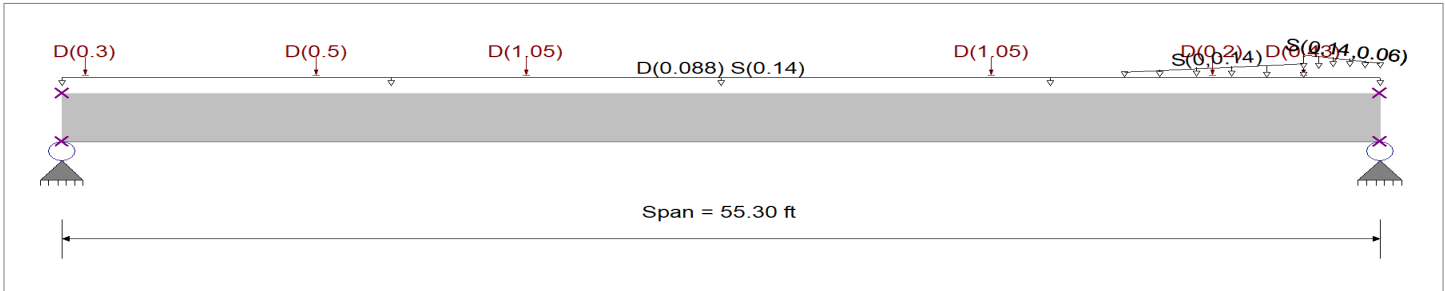
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Lic. #: KW-06000335

DESCRIPTION: Joist @ RTU-1 and RTU-3

General Beam Properties

Elastic Modulus = 29,000.0 ksi
Span #1 Span Length = 55.30 ft Area = 10.0 in² Moment of Inertia = 100.0 in⁴



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0880, S = 0.140 k/ft, Tributary Width = 1.0 ft

Point Load : D = 0.30 k @ 1.0 ft

Point Load : D = 0.50 k @ 10.70 ft

Point Load : D = 1.050 k @ 19.50 ft

Point Load : D = 1.050 k @ 39.0 ft

Point Load : D = 0.20 k @ 48.280 ft

Point Load : D = 0.430 k @ 52.080 ft

Varying Uniform Load : S = 0.0->0.140 k/ft, Extent = 44.580 --> 52.080 ft, Trib Width = 1.0 ft

Varying Uniform Load : S = 0.140->0.060 k/ft, Extent = 52.080 --> 55.30 ft, Trib Width = 1.0 ft

DESIGN SUMMARY

Maximum Bending =	111.970 k-ft	Maximum Shear =	8.879 k
Load Combination	+D+S	Load Combination	+D+S
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Location of maximum on span	27.374 ft	Location of maximum on span	55.300 ft
Maximum Deflection			
Max Downward Transient Deflection	10.645 in		62
Max Upward Transient Deflection	0.168 in		3951
Max Downward Total Deflection	21.713 in		30
Max Upward Total Deflection	0.106 in		6285

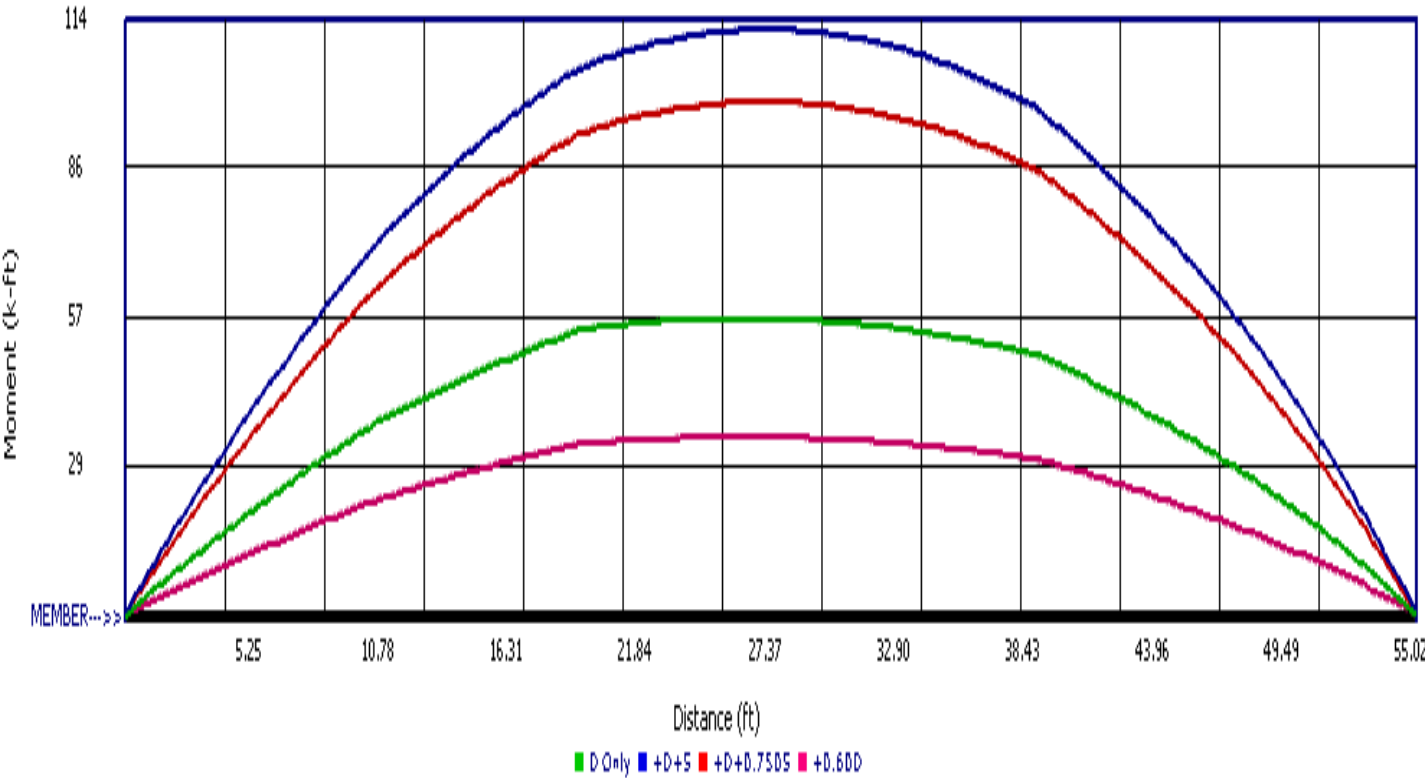
Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values (k-ft)							Shear Values (k)		
			M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope														
Dsgn. L = 55.30 ft		1			111.97		111.97					8.88		
D Only														
Dsgn. L = 55.30 ft		1			56.72		56.72					4.23		
+D+S														
Dsgn. L = 55.30 ft		1			111.97		111.97					8.88		
+D+0.750S														
Dsgn. L = 55.30 ft		1			98.15		98.15					7.72		
+0.60D														
Dsgn. L = 55.30 ft		1			34.03	19	34.03					2.54		

Lic. # : KW-06000335

DESCRIPTION: Joist @ RTU-1 and RTU-3

Vertical Reactions			Support notation : Far left is #1	Values in KIPS
Load Combination	Support 1	Support 2		
Overall MAXimum	8.107	8.879		
Overall MINimum				
D Only	4.171	4.226		
+D+S	8.107	8.879		
+D+0.750S	7.123	7.716		
+0.60D	2.502	2.535		
S Only	3.936	4.653		

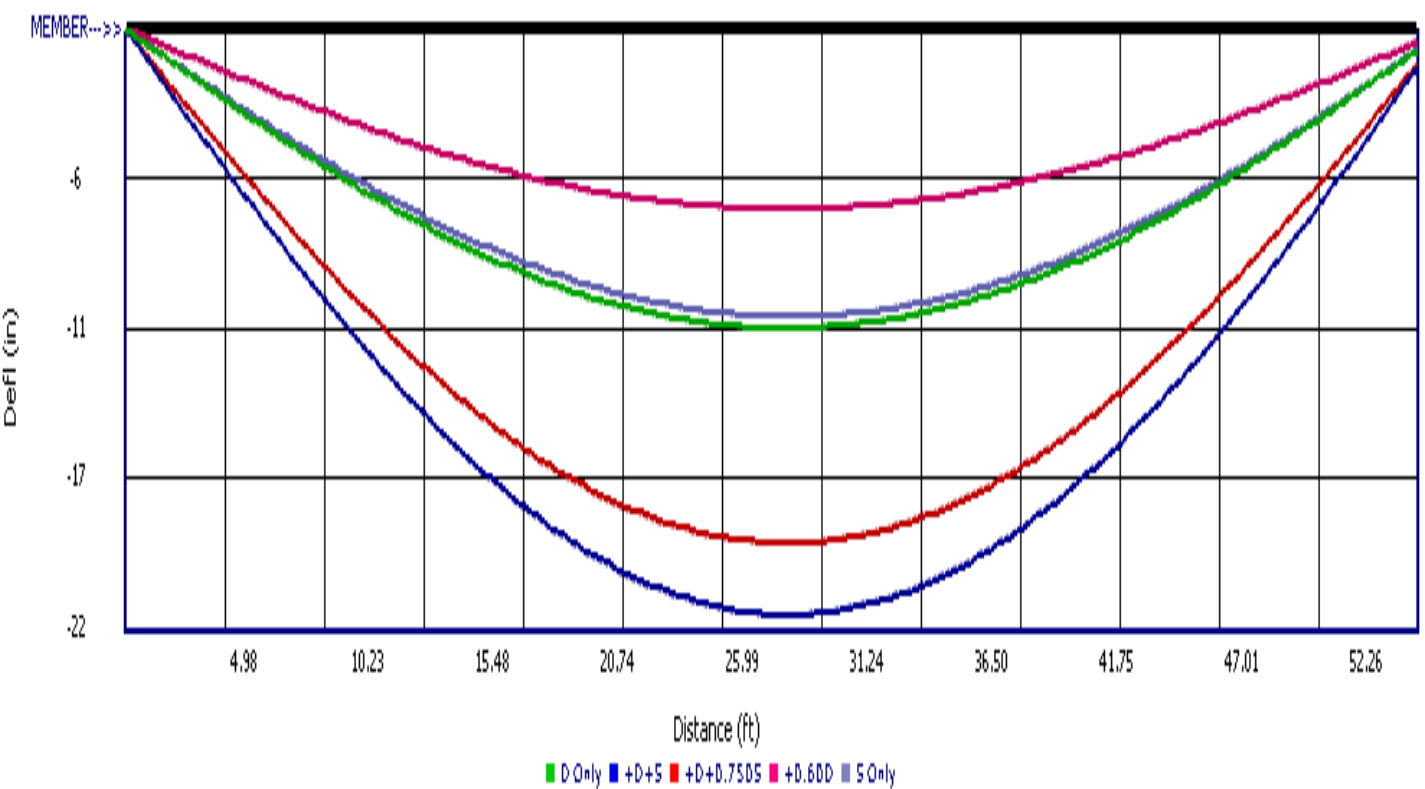
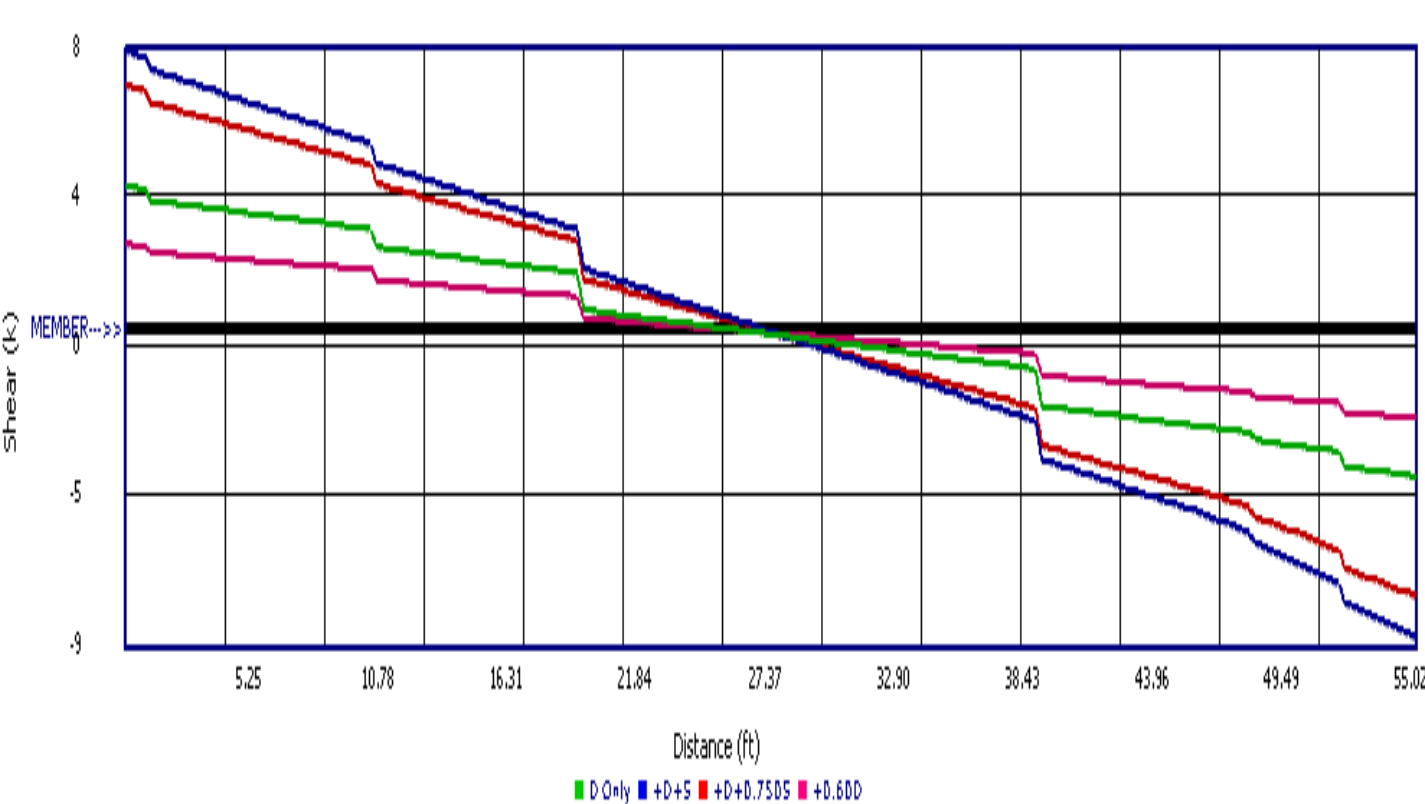


General Beam

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DESCRIPTION: Joist @ RTU-1 and RTU-3



Summary of Values per Beam Span

General Beam

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Lic. #: KW-06000335

DESCRIPTION: Joist @ RTU-1 and RTU-3

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
Overall MAXimum Envelope	0.00	Span 1	8.107	0.000
Overall MAXimum Envelope	5.53	Span 1	6.546	39.984
Overall MAXimum Envelope	11.06	Span 1	4.785	72.516
Overall MAXimum Envelope	16.59	Span 1	3.524	95.491
Overall MAXimum Envelope	22.12	Span 1	1.213	108.742
Overall MAXimum Envelope	27.65	Span 1	-0.113	111.965
Overall MAXimum Envelope	33.18	Span 1	-1.308	108.216
Overall MAXimum Envelope	38.71	Span 1	-2.569	97.494
Overall MAXimum Envelope	44.24	Span 1	-4.880	74.298
Overall MAXimum Envelope	49.77	Span 1	-6.592	43.092
Overall MAXimum Envelope	55.30	Span 1	-8.879	0.000
D Only	0.00	Span 1	4.171	0.000
D Only	5.53	Span 1	3.384	20.359
D Only	11.06	Span 1	2.397	37.548
D Only	16.59	Span 1	1.911	49.460
D Only	22.12	Span 1	0.374	55.930
D Only	27.65	Span 1	-0.113	56.653
D Only	33.18	Span 1	-0.599	54.686
D Only	38.71	Span 1	-1.086	50.027
D Only	44.24	Span 1	-2.622	37.175
D Only	49.77	Span 1	-3.309	21.029
D Only	55.30	Span 1	-4.226	0.000
+D+S	0.00	Span 1	8.107	0.000
+D+S	5.53	Span 1	6.546	39.984
+D+S	11.06	Span 1	4.785	72.516
+D+S	16.59	Span 1	3.524	95.491
+D+S	22.12	Span 1	1.213	108.742
+D+S	27.65	Span 1	-0.048	111.965
+D+S	33.18	Span 1	-1.308	108.216
+D+S	38.71	Span 1	-2.569	97.494
+D+S	44.24	Span 1	-4.880	74.298
+D+S	49.77	Span 1	-6.592	43.092
+D+S	55.30	Span 1	-8.879	0.000
+D+0.750S	0.00	Span 1	7.123	0.000
+D+0.750S	5.53	Span 1	5.755	35.078
+D+0.750S	11.06	Span 1	4.188	63.774
+D+0.750S	16.59	Span 1	3.121	83.983
+D+0.750S	22.12	Span 1	1.003	95.539
+D+0.750S	27.65	Span 1	-0.064	98.137
+D+0.750S	33.18	Span 1	-1.131	94.833
+D+0.750S	38.71	Span 1	-2.198	85.627
+D+0.750S	44.24	Span 1	-4.316	65.017
+D+0.750S	49.77	Span 1	-5.772	37.576
+D+0.750S	55.30	Span 1	-7.716	0.000
+0.60D	0.00	Span 1	2.502	0.000
+0.60D	5.53	Span 1	2.030	12.216
+0.60D	11.06	Span 1	1.438	22.529

General Beam

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DESCRIPTION: Joist @ RTU-1 and RTU-3

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+0.60D	16.59	Span 1	1.146	29.676
+0.60D	22.12	Span 1	0.224	33.558
+0.60D	27.65	Span 1	-0.068	33.992
+0.60D	33.18	Span 1	-0.359	32.811
+0.60D	38.71	Span 1	-0.651	30.016
+0.60D	44.24	Span 1	-1.573	22.305
+0.60D	49.77	Span 1	-1.985	12.618
+0.60D	55.30	Span 1	-2.535	0.000

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	0.00	Span 1	0.000
Overall MAXimum Envelope	5.81	Span 1	7.084
Overall MAXimum Envelope	11.61	Span 1	13.359
Overall MAXimum Envelope	17.42	Span 1	18.158
Overall MAXimum Envelope	23.23	Span 1	21.008
Overall MAXimum Envelope	29.03	Span 1	21.665
Overall MAXimum Envelope	34.84	Span 1	20.091
Overall MAXimum Envelope	40.65	Span 1	16.402
Overall MAXimum Envelope	46.45	Span 1	10.907
Overall MAXimum Envelope	52.26	Span 1	4.149
Overall MAXimum Envelope	55.30	Span 1	0.348
D Only	0.00	Span 1	0.000
D Only	5.81	Span 1	3.625
D Only	11.61	Span 1	6.837
D Only	17.42	Span 1	9.286
D Only	23.23	Span 1	10.725
D Only	29.03	Span 1	11.040
D Only	34.84	Span 1	10.226
D Only	40.65	Span 1	8.340
D Only	46.45	Span 1	5.535
D Only	52.26	Span 1	2.102
D Only	55.30	Span 1	0.177
+D+S	0.00	Span 1	0.000
+D+S	5.81	Span 1	7.084
+D+S	11.61	Span 1	13.359
+D+S	17.42	Span 1	18.158
+D+S	23.23	Span 1	21.008
+D+S	29.03	Span 1	21.665
+D+S	34.84	Span 1	20.091
+D+S	40.65	Span 1	16.402
+D+S	46.45	Span 1	10.907
+D+S	52.26	Span 1	4.149

General Beam

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DESCRIPTION: Joist @ RTU-1 and RTU-3

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
+D+S	55.30	Span 1	0.348
+D+0.750S	0.00	Span 1	0.000
+D+0.750S	5.81	Span 1	6.219
+D+0.750S	11.61	Span 1	11.729
+D+0.750S	17.42	Span 1	15.940
+D+0.750S	23.23	Span 1	18.437
+D+0.750S	29.03	Span 1	19.009
+D+0.750S	34.84	Span 1	17.625
+D+0.750S	40.65	Span 1	14.386
+D+0.750S	46.45	Span 1	9.564
+D+0.750S	52.26	Span 1	3.637
+D+0.750S	55.30	Span 1	0.305
+0.60D	0.00	Span 1	0.000
+0.60D	5.81	Span 1	2.175
+0.60D	11.61	Span 1	4.102
+0.60D	17.42	Span 1	5.572
+0.60D	23.23	Span 1	6.435
+0.60D	29.03	Span 1	6.624
+0.60D	34.84	Span 1	6.136
+0.60D	40.65	Span 1	5.004
+0.60D	46.45	Span 1	3.321
+0.60D	52.26	Span 1	1.261
+0.60D	55.30	Span 1	0.106
S Only	0.00	Span 1	0.000
S Only	5.81	Span 1	3.459
S Only	11.61	Span 1	6.522
S Only	17.42	Span 1	8.872
S Only	23.23	Span 1	10.282
S Only	29.03	Span 1	10.625
S Only	34.84	Span 1	9.865
S Only	40.65	Span 1	8.062
S Only	46.45	Span 1	5.372
S Only	52.26	Span 1	2.047
S Only	55.30	Span 1	0.171

General Beam

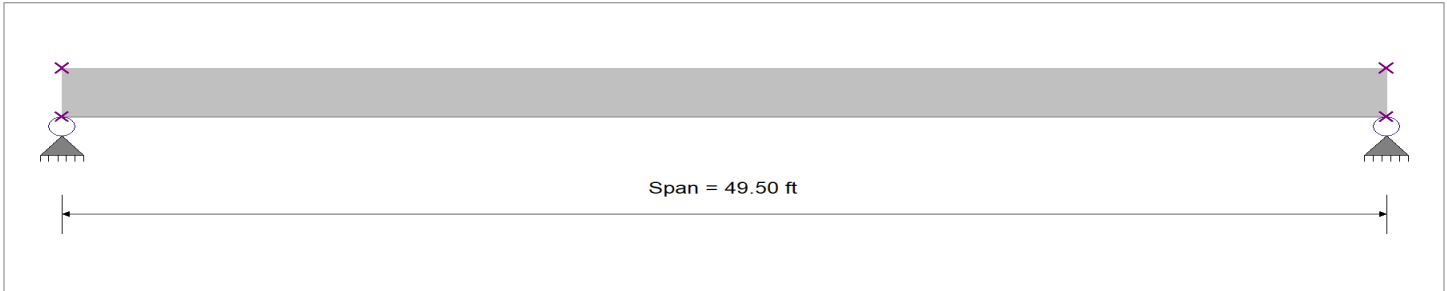
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DESCRIPTION: Sidewall Joist (@Penthouse)

General Beam Properties

Elastic Modulus 29,000.0 ksi
Span #1 Span Length = 49.50 ft Area = 10.0 in² Moment of Inertia = 100.0 in⁴



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0810, S = 0.2840 k/ft, Tributary Width = 1.0 ft

Uniform Load : D = 0.0410, S = 0.0120 k/ft, Extent = 16.40 --> 28.050 ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Maximum Bending =	118.378 k-ft	Maximum Shear =	9.374 k
Load Combination	+D+S	Load Combination	+D+S
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Location of maximum on span	24.503 ft	Location of maximum on span	0.000 ft
Maximum Deflection			
Max Downward Transient Deflection	13.538 in		43
Max Upward Transient Deflection	0.215 in		2764
Max Downward Total Deflection	18.038 in		32
Max Upward Total Deflection	0.043 in		13907

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values (k-ft)							Shear Values (k)		
			M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope														
Dsgn. L = 49.50 ft		1			118.38		118.38					9.37		
D Only														
Dsgn. L = 49.50 ft		1			29.92		29.92					2.27		
+D+S														
Dsgn. L = 49.50 ft		1			118.38		118.38					9.37		
+D+0.750S														
Dsgn. L = 49.50 ft		1			96.26		96.26					7.60		
+0.60D														
Dsgn. L = 49.50 ft		1			17.95		17.95					1.36		

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

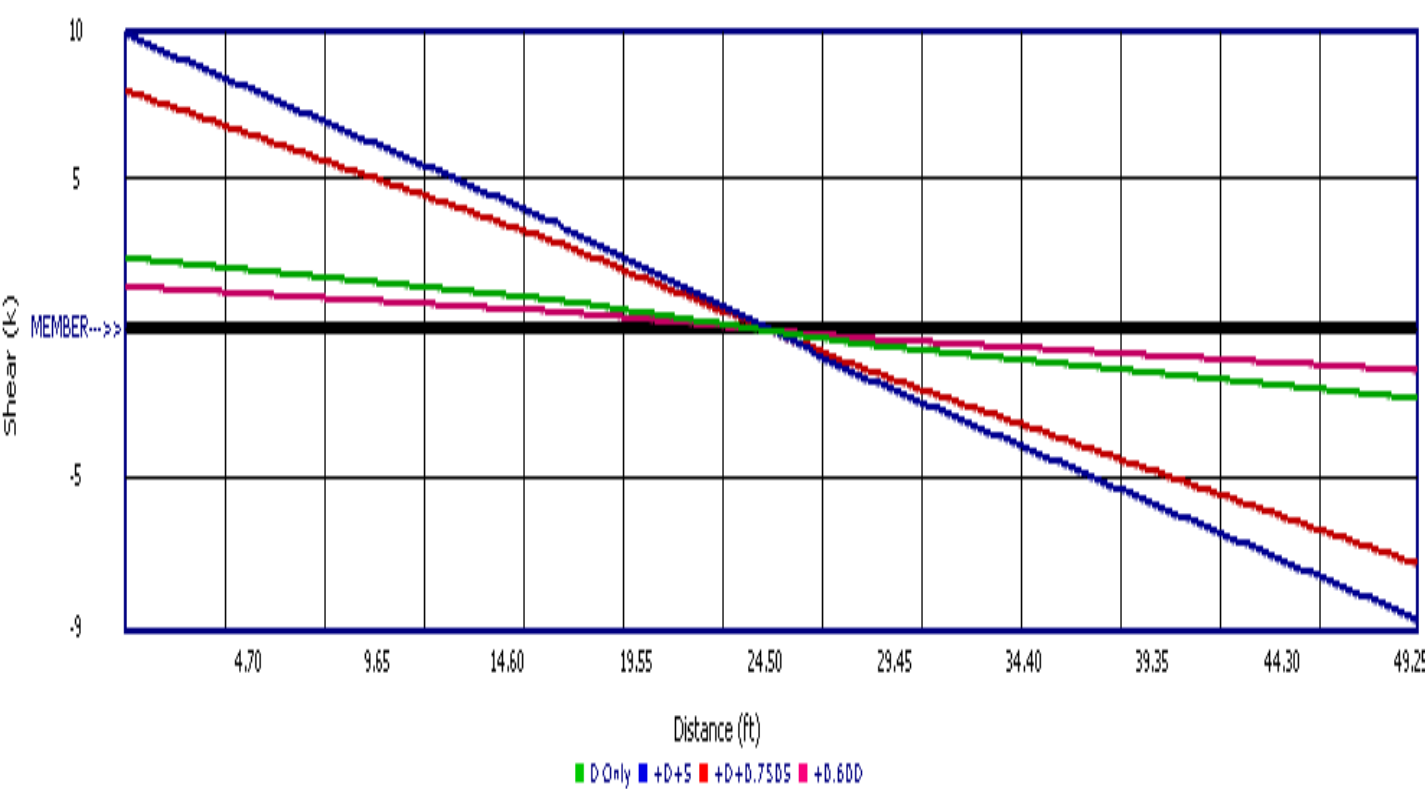
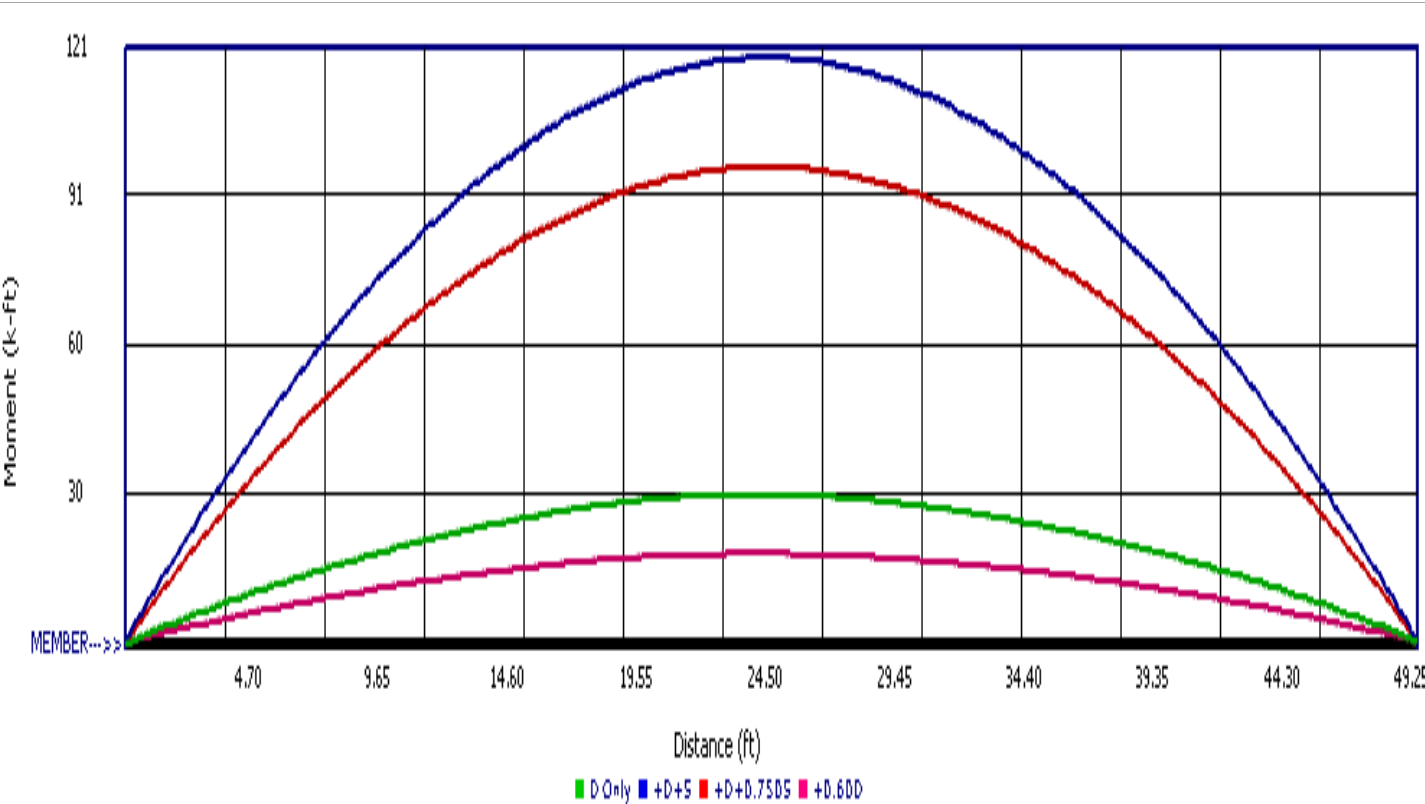
Load Combination	Support 1	Support 2
Overall MAXimum	9.374	9.311
Overall MINimum		
D Only	2.268	2.219
+D+S	9.374	9.311
+D+0.750S	7.597	7.538
+0.60D	1.361	1.332
S Only	7.106	7.092

General Beam

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DESCRIPTION: Sidewall Joist (@Penthouse)

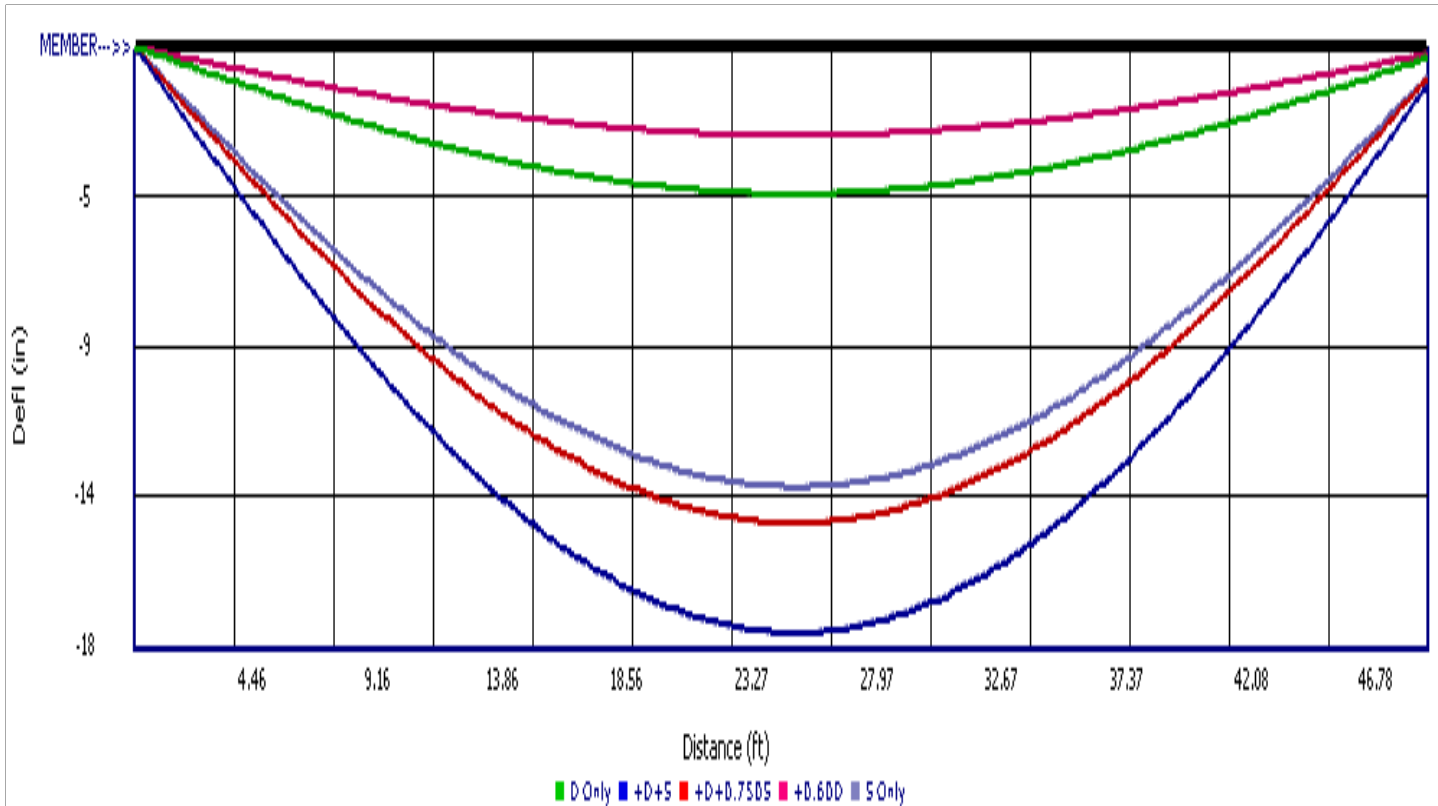


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DESCRIPTION: Sidewall Joist (@Penthouse)



Summary of Values per Beam Span

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
Overall MAXimum Envelope	0.00	Span 1	9.374	0.000
Overall MAXimum Envelope	4.95	Span 1	7.567	41.929
Overall MAXimum Envelope	9.90	Span 1	5.760	74.915
Overall MAXimum Envelope	14.85	Span 1	3.954	98.958
Overall MAXimum Envelope	19.80	Span 1	1.967	113.751
Overall MAXimum Envelope	24.75	Span 1	-0.102	118.365
Overall MAXimum Envelope	29.70	Span 1	-2.084	112.810
Overall MAXimum Envelope	34.65	Span 1	-3.891	98.023
Overall MAXimum Envelope	39.60	Span 1	-5.697	74.292
Overall MAXimum Envelope	44.55	Span 1	-7.504	41.618
Overall MAXimum Envelope	49.50	Span 1	-9.311	0.000
D Only	0.00	Span 1	2.268	0.000
D Only	4.95	Span 1	1.867	10.234
D Only	9.90	Span 1	1.466	18.483
D Only	14.85	Span 1	1.065	24.748
D Only	19.80	Span 1	0.525	28.791
D Only	24.75	Span 1	-0.079	29.893
D Only	29.70	Span 1	-0.615	28.063
D Only	34.65	Span 1	-1.016	24.024
D Only	39.60	Span 1	-1.417	18.001
D Only	44.55	Span 1	-1.818	9.993
D Only	49.50	Span 1	-2.219	0.000
+D+S	0.00	Span 1	9.374	0.000

General Beam

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DESCRIPTION: Sidewall Joist (@Penthouse)

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+D+S	4.95	Span 1	7.567	41.929
+D+S	9.90	Span 1	5.760	74.915
+D+S	14.85	Span 1	3.954	98.958
+D+S	19.80	Span 1	1.967	113.751
+D+S	24.75	Span 1	-0.102	118.365
+D+S	29.70	Span 1	-2.084	112.810
+D+S	34.65	Span 1	-3.891	98.023
+D+S	39.60	Span 1	-5.697	74.292
+D+S	44.55	Span 1	-7.504	41.618
+D+S	49.50	Span 1	-9.311	0.000
+D+0.750S	0.00	Span 1	7.597	0.000
+D+0.750S	4.95	Span 1	6.142	34.006
+D+0.750S	9.90	Span 1	4.687	60.807
+D+0.750S	14.85	Span 1	3.232	80.406
+D+0.750S	19.80	Span 1	1.606	92.511
+D+0.750S	24.75	Span 1	-0.097	96.247
+D+0.750S	29.70	Span 1	-1.717	91.623
+D+0.750S	34.65	Span 1	-3.172	79.523
+D+0.750S	39.60	Span 1	-4.627	60.219
+D+0.750S	44.55	Span 1	-6.083	33.711
+D+0.750S	49.50	Span 1	-7.538	0.000
+0.60D	0.00	Span 1	1.361	0.000
+0.60D	4.95	Span 1	1.120	6.140
+0.60D	9.90	Span 1	0.880	11.090
+0.60D	14.85	Span 1	0.639	14.849
+0.60D	19.80	Span 1	0.315	17.274
+0.60D	24.75	Span 1	-0.047	17.936
+0.60D	29.70	Span 1	-0.369	16.838
+0.60D	34.65	Span 1	-0.610	14.414
+0.60D	39.60	Span 1	-0.850	10.800
+0.60D	44.55	Span 1	-1.091	5.996
+0.60D	49.50	Span 1	-1.332	0.000

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	0.00	Span 1	0.000
Overall MAXimum Envelope	5.20	Span 1	5.891
Overall MAXimum Envelope	10.40	Span 1	11.105
Overall MAXimum Envelope	15.59	Span 1	15.092
Overall MAXimum Envelope	20.79	Span 1	17.462
Overall MAXimum Envelope	25.99	Span 1	17.992
Overall MAXimum Envelope	31.19	Span 1	16.637
Overall MAXimum Envelope	36.38	Span 1	13.530
Overall MAXimum Envelope	41.58	Span 1	8.968
Overall MAXimum Envelope	46.78	Span 1	3.403
Overall MAXimum Envelope	49.50	Span 1	0.287

General Beam

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DESCRIPTION: Sidewall Joist (@Penthouse)

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
D Only	0.00	Span 1	0.000
D Only	5.20	Span 1	1.467
D Only	10.40	Span 1	2.768
D Only	15.59	Span 1	3.766
D Only	20.79	Span 1	4.359
D Only	25.99	Span 1	4.486
D Only	31.19	Span 1	4.139
D Only	36.38	Span 1	3.358
D Only	41.58	Span 1	2.221
D Only	46.78	Span 1	0.842
D Only	49.50	Span 1	0.071
+D+S	0.00	Span 1	0.000
+D+S	5.20	Span 1	5.891
+D+S	10.40	Span 1	11.105
+D+S	15.59	Span 1	15.092
+D+S	20.79	Span 1	17.462
+D+S	25.99	Span 1	17.992
+D+S	31.19	Span 1	16.637
+D+S	36.38	Span 1	13.530
+D+S	41.58	Span 1	8.968
+D+S	46.78	Span 1	3.403
+D+S	49.50	Span 1	0.287
+D+0.750S	0.00	Span 1	0.000
+D+0.750S	5.20	Span 1	4.785
+D+0.750S	10.40	Span 1	9.021
+D+0.750S	15.59	Span 1	12.261
+D+0.750S	20.79	Span 1	14.187
+D+0.750S	25.99	Span 1	14.615
+D+0.750S	31.19	Span 1	13.512
+D+0.750S	36.38	Span 1	10.987
+D+0.750S	41.58	Span 1	7.281
+D+0.750S	46.78	Span 1	2.762
+D+0.750S	49.50	Span 1	0.233
+0.60D	0.00	Span 1	0.000
+0.60D	5.20	Span 1	0.880
+0.60D	10.40	Span 1	1.661
+0.60D	15.59	Span 1	2.260
+0.60D	20.79	Span 1	2.615
+0.60D	25.99	Span 1	2.692
+0.60D	31.19	Span 1	2.483
+0.60D	36.38	Span 1	2.015
+0.60D	41.58	Span 1	1.333

General Beam

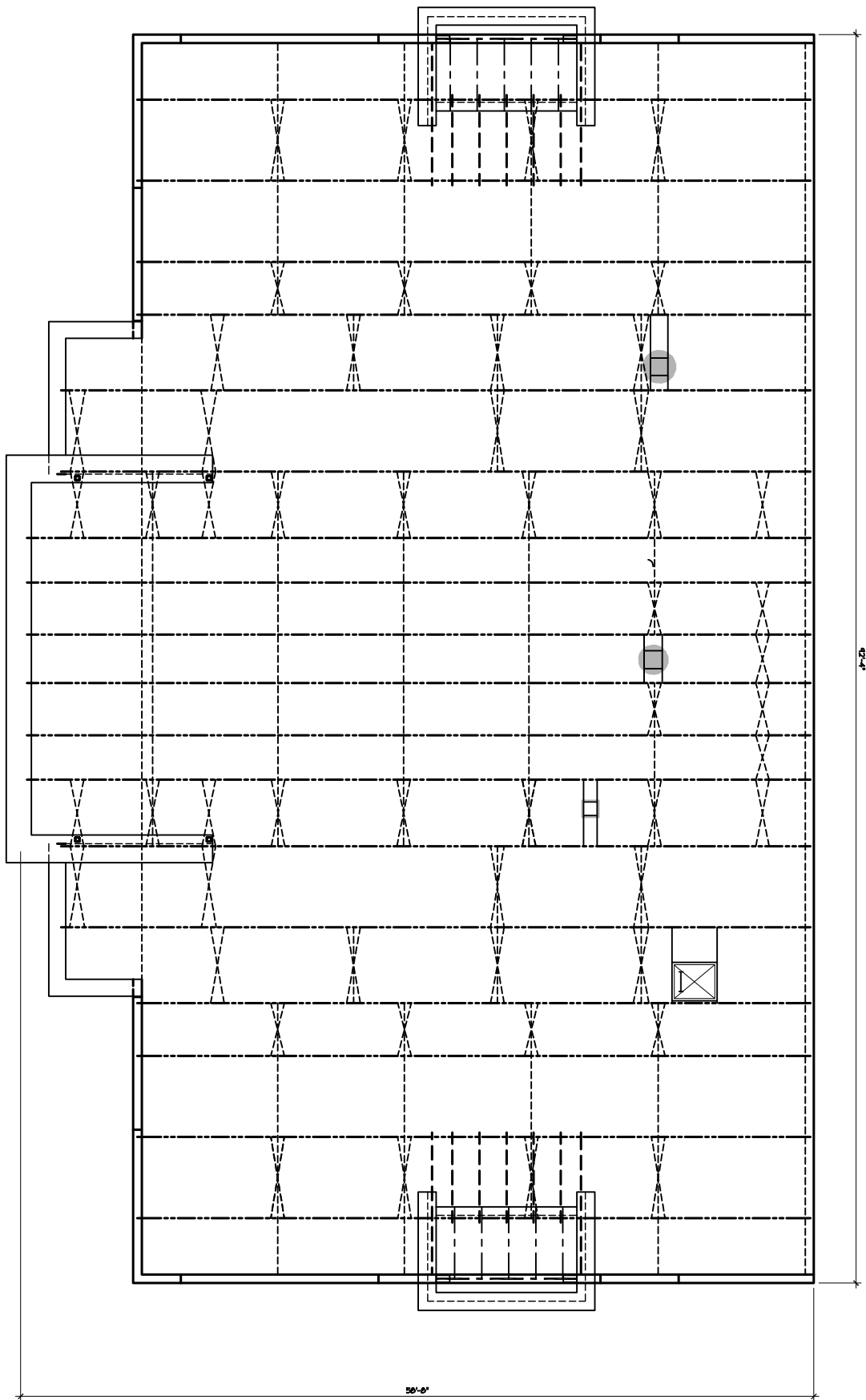
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Lic. # : KW-06000335

DESCRIPTION: Sidewall Joist (@Penthouse)

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
+0.60D	46.78	Span 1	0.505
+0.60D	49.50	Span 1	0.043
S Only	0.00	Span 1	0.000
S Only	5.20	Span 1	4.424
S Only	10.40	Span 1	8.337
S Only	15.59	Span 1	11.326
S Only	20.79	Span 1	13.103
S Only	25.99	Span 1	13.506
S Only	31.19	Span 1	12.498
S Only	36.38	Span 1	10.172
S Only	41.58	Span 1	6.747
S Only	46.78	Span 1	2.561
S Only	49.50	Span 1	0.216



MecaWind v2400

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Calculations Prepared by:

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PO Box 1032
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Date: Dec 17, 2021

Basic Wind Parameters

Wind Load Standard	= ASCE 7-16	Exposure Category	= B
Wind Design Speed	= 115.0 mph	Risk Category	= II
Structure Type	= Building	Building Type	= Enclosed

General Wind Settings

Incl_LF	= Include ASD Load Factor of 0.6 in Pressures	= True
DynType	= Dynamic Type of Structure	= Rigid
Zg	= Altitude (Ground Elevation) above Sea Level	= 0.000 ft
Bdist	= Base Elevation of Structure	= 5431.000 ft
SDB	= Simple Diaphragm Building	= False
MWFRSType	= MWFRS Method Selected	= Ch 27 Pt 1

Topographic Factor per Fig 26.8-1

Topo	= Topographic Feature	= None
Kzt	= Topographic Factor	= 1.000

Building Inputs

Roof	: Building Roof Type	= Monoslope	W	: Width Perp to Ridge	= 59.000 ft
L	: Length Along Ridge	= 94.000 ft	EHT	: Eave Height	= 14.670 ft
RE	: Roof Entry Method	= Slope	Slope	: Slope of Roof	= 0.25 :12
Theta	: Roof Slope	= 1.19 Deg	Par	: Is there a Parapet	= True
PHT	: Height of Parapet	= 3.500 ft	Por	: Parapet Porosity	= Solid
P_GCPi	: Parapet Int Press	= +/-0.00			

Exposure Constants per Table 26.11-1:

Alpha:	Table 26.11-1 Const	= 7.000	Zg:	Table 26.11-1 Const	= 1200.000 ft
At:	Table 26.11-1 Const	= 0.143	Bt:	Table 26.11-1 Const	= 0.840
Am:	Table 26.11-1 Const	= 0.250	Bm:	Table 26.11-1 Const	= 0.450
C:	Table 26.11-1 Const	= 0.300	Eps:	Table 26.11-1 Const	= 0.333

Main Wind Force Resisting System (MWFRS) Calculations per Ch 27 Part 1:

h	= Mean Roof Height above grade	= 5445.670 ft
Kh	= 15 ft [4.572 m] < Z < Zg --> $(2.01 * (Z/zg)^{(2/Alpha)})$ {Table 26.10-1}	= 3.097
Kzt	= Topographic Factor is 1 since no Topographic feature specified	= 1.000
Kd	= Wind Directionality Factor per Table 26.6-1	= 0.85
Zg	= Elevation above Sea Level	= 0.000 ft
Ke	= Ground Elevation Factor: $Ke = e^{-(0.0000362 * Zg)}$ {Table 26.9-1}	= 1.000
GCPi	= Ref Table 26.13-1 for Enclosed Building	= +/-0.18
RA	= Roof Area	= 5547.20 sq ft
LF	= Load Factor based upon ASD Design	= 0.60
qh	= $(0.00256 * Kh * Kzt * Kd * Ke * V^2) * LF$	= 53.47 psf
qin	= For Negative Internal Pressure of Enclosed Building use $qh * LF$	= 53.47 psf
qip	= For Positive Internal Pressure of Enclosed Building use $qh * LF$	= 53.47 psf

Gust Factor Calculation:

Gust Factor Category I Rigid Structures - Simplified Method	
G1	= For Rigid Structures (Nat. Freq. > 1 Hz) use 0.85
Gust Factor Category II Rigid Structures - Complete Analysis	
Zm	= $\text{Max}(0.6 * Ht, Zmin)$
Izm	= $Cc * (33 / Zm) ^ 0.167$
Lzm	= $L * (Zm / 33) ^ Eps$
Q	= $(1 / (1 + 0.63 * ((B + Ht) / Lzm)^{0.63}))^{0.5}$
G2	= $0.925 * ((1 + 0.7 * Izm * 3.4 * Q) / (1 + 0.7 * 3.4 * Izm))$
Gust Factor Used in Analysis	
G	= Lessor Of G1 Or G2

MWFRS Wind Normal to Ridge (Ref Fig 27.3-1)

h	= Mean Roof Height Of Building	= 14.670 ft
hp	= Height to the top of the Parapet	= 19.399 ft
RHt	= Ridge Height Of Roof	= 15.899 ft
B	= Horizontal Dimension Of Building Normal To Wind Direction	= 94.000 ft
L	= Horizontal Dimension Of building Parallel To Wind Direction	= 59.000 ft
L/B	= Ratio Of L/B used For Cp determination	= 0.628
h/L	= Ratio Of h/L used For Cp determination	= 0.249

Slope = Slope of Roof = 1.19 Deg
 OH_Bot_-Y = Overhang Bottom -Y (Windward Face Only) = 0.8, 0.8
 Roof = Roof Coeff (0 to h/2) (0.000 ft to 7.335 ft) = -0.18, -0.9
 Roof = Roof Coeff (h/2 to h) (7.335 ft to 14.670 ft) = -0.18, -0.9
 Roof = Roof Coeff (h to 2h) (14.670 ft to 29.340 ft) = -0.18, -0.5
 Roof = Roof Coeff (>2h) (>29.340 ft) = -0.18, -0.3

Cp_WW = Windward Wall Coefficient (All L/B Values) = 0.80
 Cp_LW = Leeward Wall Coefficient using L/B = -0.50
 Cp_SW = Side Wall Coefficient (All L/B values) = -0.70
 GCpn_WW = Parapet Combined Net Pressure Coefficient (Windward Parapet) = 1.50
 GCpn_LW = Parapet Combined Net Pressure Coefficient (Leeward Parapet) = -1.00

Wall Wind Pressures based On Positive Internal Pressure (+GCPi) - Normal to Ridge
All wind pressures include a load factor of 0.6

Elev	Kz	Kzt	qz	GCPi	GCPi	Windward	Leeward	Side	Total	Minimum
ft			psf	Windward	Leeward	Press	Press	Press	Press	Pressure*
						psf	psf	psf	psf	psf
18.17	3.097	1.000	53.48	Parapet	Parapet	80.21	-53.48	-31.81	133.69	9.60
15.90	3.097	1.000	53.47	0.18	Parapet	26.74	-53.47	-41.44	80.21	9.60
14.67	3.097	1.000	53.47	0.18	0.18	26.73	-32.35	-41.44	59.08	9.60

Wall Wind Pressures based on Negative Internal Pressure (-GCPi) - Normal to Ridge
All wind pressures include a load factor of 0.6

Elev	Kz	Kzt	qz	GCPi	GCPi	Windward	Leeward	Side	Total	Minimum
ft			psf	Windward	Leeward	Press	Press	Press	Press	Pressure*
						psf	psf	psf	psf	psf
18.17	3.097	1.000	53.48	Parapet	Parapet	80.21	-53.48	-31.81	133.69	9.60
15.90	3.097	1.000	53.47	-0.18	Parapet	45.98	-53.47	-22.19	99.45	9.60
14.67	3.097	1.000	53.47	-0.18	-0.18	45.98	-13.10	-22.19	59.08	9.60

Notes Wall Pressures:

Kz = Velocity Press Exp Coeff Kzt = Topographical Factor
 qz = $0.00256 * Kz * Kzt * Kd * V^2$ GCPi = Internal Press Coefficient
 Side = $q_h * G * Cp_{SW} - q_{ip} * +GCPi$ Windward = $q_z * G * Cp_{WW} - q_{ip} * +GCPi$
 Leeward = $q_h * G * Cp_{LW} - q_{ip} * +GCPi$ Total = Windward Press - Leeward Press
 Windward Parapet = $q_z * GCpn_{WW}$ Leeward Parapet = $q_z * GCpn_{LW}$
 * Minimum Pressure: Para 27.1.5 no less than 9.60 psf (Incl LF) applied to Walls
 + Pressures Acting TOWARD Surface - Pressures Acting AWAY from Surface

Roof Wind Pressures for Positive & Negative Internal Pressure (+/- GCPi) - Normal to Ridge
All wind pressures include a load factor of 0.6

Roof Var	Start	End	Cp_min	Cp_max	GCPi	Pressure	Pressure	Pressure	Pressure
	Dist	Dist				Pn_min*	Pp_min*	Pn_max	Pp_max
	ft	ft				psf	psf	psf	psf
OH_Bot_-Y	N/A	N/A	0.800	0.800	0.000	36.36	36.36	36.36	36.36
Roof (All)	0.000	7.335	-0.180	-0.900	0.180	1.44	-17.80	-31.28	-50.53
Roof (All)	7.335	14.670	-0.180	-0.900	0.180	1.44	-17.80	-31.28	-50.53
Roof (All)	14.670	29.340	-0.180	-0.500	0.180	1.44	-17.80	-13.10	-32.35
Roof (All)	29.340	59.000	-0.180	-0.300	0.180	1.44	-17.80	-4.01	-23.26

Notes Roof Pressures:

Start Dist = Start Dist from Windward Edge End Dist = End Dist from Windward Edge
 Cp_Max = Largest Coefficient Magnitude Cp_Min = Smallest Coefficient Magnitude
 Pp_max = $q_h * G * Cp_{max} - q_{ip} * (+GCPi)$ Pn_max = $q_h * G * Cp_{max} - q_{in} * (-GCPi)$
 Pp_min* = $q_h * G * Cp_{min} - q_{ip} * (+GCPi)$ Pn_min* = $q_h * G * Cp_{min} - q_{in} * (-GCPi)$
 OH = Overhang X = Dir along Ridge Y = Dir Perpendicular to Ridge Z = Vertical
 * The smaller uplift pressures due to Cp_Min can become critical when wind is combined
 with roof live load or snow load; load combinations are given in ASCE 7
 + Pressures Acting TOWARD Surface - Pressures Acting AWAY from Surface

MWFRS Wind Normal to Eave (Ref Fig 27.3-1)

h = Mean Roof Height Of Building = 14.670 ft
 hp = Height to the top of the Parapet = 19.399 ft
 RHt = Ridge Height Of Roof = 15.899 ft
 B = Horizontal Dimension Of Building Normal To Wind Direction = 94.000 ft
 L = Horizontal Dimension Of building Parallel To Wind Direction = 59.000 ft
 L/B = Ratio Of L/B used For Cp determination = 0.628
 h/L = Ratio Of h/L used For Cp determination = 0.249
 Slope = Slope of Roof = 1.19 Deg

OH_Bot_+Y = Overhang Bottom +Y (Windward Face Only) = 0.8, 0.8
 Roof = Roof Coeff (0 to h/2) (0.000 ft to 7.335 ft) = -0.18, -0.9
 Roof = Roof Coeff (h/2 to h) (7.335 ft to 14.670 ft) = -0.18, -0.9
 Roof = Roof Coeff (h to 2h) (14.670 ft to 29.340 ft) = -0.18, -0.5
 Roof = Roof Coeff (>2h) (>29.340 ft) = -0.18, -0.3

Cp_WW = Windward Wall Coefficient (All L/B Values) = 0.80
 Cp_LW = Leeward Wall Coefficient using L/B = -0.50
 Cp_SW = Side Wall Coefficient (All L/B values) = -0.70
 GCpn_WW = Parapet Combined Net Pressure Coefficient (Windward Parapet) = 1.50
 GCpn_LW = Parapet Combined Net Pressure Coefficient (Leeward Parapet) = -1.00

Wall Wind Pressures based On Positive Internal Pressure (+GCPi) - Normal to Eave
All wind pressures include a load factor of 0.6

Elev	Kz	Kzt	qz	GCPi	GCPi	Windward	Leeward	Side	Total	Minimum
ft			psf	Windward	Leeward	Press	Press	Press	Press	Pressure*
						psf	psf	psf	psf	psf
18.17	3.097	1.000	53.48	Parapet	Parapet	80.21	-53.48	-31.81	133.69	9.60
15.90	3.097	1.000	53.47	Parapet	0.18	80.20	-32.35	-31.81	112.55	9.60
14.67	3.097	1.000	53.47	0.18	0.18	26.73	-32.35	-41.44	59.08	9.60

Wall Wind Pressures based on Negative Internal Pressure (-GCPi) - Normal to Eave
All wind pressures include a load factor of 0.6

Elev	Kz	Kzt	qz	GCPi	GCPi	Windward	Leeward	Side	Total	Minimum
ft			psf	Windward	Leeward	Press	Press	Press	Press	Pressure*
						psf	psf	psf	psf	psf
18.17	3.097	1.000	53.48	Parapet	Parapet	80.21	-53.48	-31.81	133.69	9.60
15.90	3.097	1.000	53.47	Parapet	-0.18	80.20	-13.10	-31.81	93.30	9.60
14.67	3.097	1.000	53.47	-0.18	-0.18	45.98	-13.10	-22.19	59.08	9.60

Notes Wall Pressures:

Kz = Velocity Press Exp Coeff Kzt = Topographical Factor
 qz = $0.00256 \cdot Kz \cdot Kzt \cdot Kd \cdot V^2$ GCPi = Internal Press Coefficient
 Side = $qh \cdot G \cdot Cp_{SW} - qip \cdot +GCPi$ Windward = $qz \cdot G \cdot Cp_{WW} - qip \cdot +GCPi$
 Leeward = $qh \cdot G \cdot Cp_{LW} - qip \cdot +GCPi$ Total = Windward Press - Leeward Press
 Windward Parapet = $qz \cdot GCpn_{WW}$ Leeward Parapet = $qz \cdot GCpn_{LW}$
 * Minimum Pressure: Para 27.1.5 no less than 9.60 psf (Incl LF) applied to Walls
 + Pressures Acting TOWARD Surface - Pressures Acting AWAY from Surface

Roof Wind Pressures for Positive & Negative Internal Pressure (+/- GCPi) - Normal to Eave
All wind pressures include a load factor of 0.6

Roof Var	Start Dist	End Dist	Cp_min	Cp_max	GCPi	Pressure Pn_min*	Pressure Pp_min*	Pressure Pn_max	Pressure Pp_max
	ft	ft				psf	psf	psf	psf
OH_Bot_+Y	N/A	N/A	0.800	0.800	0.000	36.36	36.36	36.36	36.36
Roof (All)	0.000	7.335	-0.180	-0.900	0.180	1.44	-17.80	-31.28	-50.53
Roof (All)	7.335	14.670	-0.180	-0.900	0.180	1.44	-17.80	-31.28	-50.53
Roof (All)	14.670	29.340	-0.180	-0.500	0.180	1.44	-17.80	-13.10	-32.35
Roof (All)	29.340	59.000	-0.180	-0.300	0.180	1.44	-17.80	-4.01	-23.26

Notes Roof Pressures:

Start Dist = Start Dist from Windward Edge End Dist = End Dist from Windward Edge
 Cp_Max = Largest Coefficient Magnitude Cp_Min = Smallest Coefficient Magnitude
 Pp_max = $qh \cdot G \cdot Cp_{max} - qip \cdot (+GCPi)$ Pn_max = $qh \cdot G \cdot Cp_{max} - qin \cdot (-GCPi)$
 Pp_min* = $qh \cdot G \cdot Cp_{min} - qip \cdot (+GCPi)$ Pn_min* = $qh \cdot G \cdot Cp_{min} - qin \cdot (-GCPi)$
 OH = Overhang X = Dir along Ridge Y = Dir Perpendicular to Ridge Z = Vertical
 * The smaller uplift pressures due to Cp_Min can become critical when wind is combined with roof live load or snow load; load combinations are given in ASCE 7
 + Pressures Acting TOWARD Surface - Pressures Acting AWAY from Surface

MWFRS Wind Parallel to Ridge (Ref Fig 27.3-1)

h = Mean Roof Height Of Building = 14.670 ft
 hp = Height to the top of the Parapet = 19.399 ft
 RHt = Ridge Height Of Roof = 15.899 ft
 B = Horizontal Dimension Of Building Normal To Wind Direction = 59.000 ft
 L = Horizontal Dimension Of building Parallel To Wind Direction = 94.000 ft
 L/B = Ratio Of L/B used For Cp determination = 1.593
 h/L = Ratio Of h/L used For Cp determination = 0.156
 Slope = Slope of Roof = 1.19 Deg
 OH_Bot_-X = Overhang Bottom -X (Windward Face Only) = 0.8, 0.8

Roof	= Roof Coeff (0 to h/2) (0.000 ft to 7.335 ft)	= -0.18, -0.9
Roof	= Roof Coeff (h/2 to h) (7.335 ft to 14.670 ft)	= -0.18, -0.9
Roof	= Roof Coeff (h to 2h) (14.670 ft to 29.340 ft)	= -0.18, -0.5
Roof	= Roof Coeff (>2h) (>29.340 ft)	= -0.18, -0.3
Cp_WW	= Windward Wall Coefficient (All L/B Values)	= 0.80
Cp_LW	= Leeward Wall Coefficient using L/B	= -0.38
Cp_SW	= Side Wall Coefficient (All L/B values)	= -0.70
GCpn_WW	= Parapet Combined Net Pressure Coefficient (Windward Parapet)	= 1.50
GCpn_LW	= Parapet Combined Net Pressure Coefficient (Leeward Parapet)	= -1.00

Wall Wind Pressures based On Positive Internal Pressure (+GCPi) - Parallel to Ridge
All wind pressures include a load factor of 0.6

Elev	Kz	Kzt	qz	GCPI	GCPI	Windward	Leeward	Side	Total	Minimum
ft			psf	Windward	Leeward	Press	Press	Press	Press	Pressure*
						psf	psf	psf	psf	psf
18.17	3.097	1.000	53.48	Parapet	Parapet	80.21	-53.48	-31.81	133.69	9.60
15.90	3.097	1.000	53.47	Parapet	0.18	80.20	-26.96	-31.81	107.16	9.60
14.67	3.097	1.000	53.47	0.18	0.18	26.73	-26.96	-41.44	53.69	9.60

Wall Wind Pressures based on Negative Internal Pressure (-GCPi) - Parallel to Ridge
All wind pressures include a load factor of 0.6

Elev	Kz	Kzt	qz	GCPI	GCPI	Windward	Leeward	Side	Total	Minimum
ft			psf	Windward	Leeward	Press	Press	Press	Press	Pressure*
						psf	psf	psf	psf	psf
18.17	3.097	1.000	53.48	Parapet	Parapet	80.21	-53.48	-31.81	133.69	9.60
15.90	3.097	1.000	53.47	Parapet	-0.18	80.20	-7.71	-31.81	87.91	9.60
14.67	3.097	1.000	53.47	-0.18	-0.18	45.98	-7.71	-22.19	53.69	9.60

Notes Wall Pressures:

Kz	= Velocity Press Exp Coeff	Kzt	= Topographical Factor
qz	= $0.00256 * Kz * Kzt * Kd * V^2$	GCPi	= Internal Press Coefficient
Side	= $qh * G * Cp_{SW} - qip * +GCPi$	Windward	= $qz * G * Cp_{WW} - qip * +GCPi$
Leeward	= $qh * G * Cp_{LW} - qip * +GCPi$	Total	= Windward Press - Leeward Press
Windward Parapet	= $qz * GCpn_{WW}$	Leeward Parapet	= $qz * GCpn_{LW}$
* Minimum Pressure: Para 27.1.5 no less than 9.60 psf (Incl LF) applied to Walls			
+ Pressures Acting TOWARD Surface - Pressures Acting AWAY from Surface			

Roof Wind Pressures for Positive & Negative Internal Pressure (+/- GCPi) - Parallel to Ridge
All wind pressures include a load factor of 0.6

Roof Var	Start	End	Cp_min	Cp_max	GCPi	Pressure	Pressure	Pressure	Pressure
	Dist	Dist				Pn_min*	Pp_min*	Pn_max	Pp_max
	ft	ft				psf	psf	psf	psf
OH_Bot_-X	N/A	N/A	0.800	0.800	0.000	36.36	36.36	36.36	36.36
Roof (All)	0.000	7.335	-0.180	-0.900	0.180	1.44	-17.80	-31.28	-50.53
Roof (All)	7.335	14.670	-0.180	-0.900	0.180	1.44	-17.80	-31.28	-50.53
Roof (All)	14.670	29.340	-0.180	-0.500	0.180	1.44	-17.80	-13.10	-32.35
Roof (All)	29.340	94.000	-0.180	-0.300	0.180	1.44	-17.80	-4.01	-23.26

Notes Roof Pressures:

Start Dist	= Start Dist from Windward Edge	End Dist	= End Dist from Windward Edge
Cp_Max	= Largest Coefficient Magnitude	Cp_Min	= Smallest Coefficient Magnitude
Pp_max	= $qh * G * Cp_{max} - qip * (+GCPi)$	Pn_max	= $qh * G * Cp_{max} - qin * (-GCPi)$
Pp_min*	= $qh * G * Cp_{min} - qip * (+GCPi)$	Pn_min*	= $qh * G * Cp_{min} - qin * (-GCPi)$
OH = Overhang X = Dir along Ridge Y = Dir Perpendicular to Ridge Z = Vertical			
* The smaller uplift pressures due to Cp_Min can become critical when wind is combined with roof live load or snow load; load combinations are given in ASCE 7			
+ Pressures Acting TOWARD Surface - Pressures Acting AWAY from Surface			

Components and Cladding (C&C) Calculations per Ch 30 Part 1:

h/W	= Ratio of mean roof height to building width	= 0.249
h/L	= Ratio of mean roof height to building length	= 0.156
h	= Mean Roof Height above grade	= 5445.670 ft
Kh	= $15 \text{ ft } [4.572 \text{ m}] < Z < Z_g \rightarrow (2.01 * (Z/z_g)^{(2/\alpha)})$ {Table 26.10-1}	= 3.097
Kzt	= Topographic Factor is 1 since no Topographic feature specified	= 1.000
Kd	= Wind Directionality Factor per Table 26.6-1	= 0.85
GCPi	= Ref Table 26.13-1 for Enclosed Building	= +/-0.18
LF	= Load Factor based upon ASD Design	= 0.60
qh	= $(0.00256 * Kh * Kzt * Kd * Ke * V^2) * LF$	= 53.47 psf
LHD	= Least Horizontal Dimension: Min(B, L)	= 59.000 ft

$a1 = \text{Min}(0.1 * \text{LHD}, 0.4 * h) = 5.868 \text{ ft}$
 $a = \text{Max}(a1, 0.04 * \text{LHD}, 3 \text{ ft } [0.9 \text{ m}]) = 5.868 \text{ ft}$
 $h/B = \text{Ratio of mean roof height to least hor dim: } h / B = 0.249$

Wind Pressures for C&C Ch 30 Pt 1
All wind pressures include a load factor of 0.6

Description	Zone	Width	Span	Area	1/3 Rule	Ref Fig	GCp Max	GCp Min	p Max psf	p Min psf
ft		ft	ft	sq ft						
Zone 1	1	6.000	51.500	884.08	Yes	30.3-2A	0.200	-1.000	20.32	-63.09
Zone 1'	1'	3.600	51.500	884.08	Yes	30.3-2A	0.200	-0.427	20.32	-32.44
Zone 2	2	6.000	51.500	884.08	Yes	30.3-2A	0.630	-1.400	43.31	-84.48
Zone 3	3	6.000	51.500	884.08	Yes	30.3-2A	0.630	-1.400	43.31	-84.48
Zone 4	4	2.670	15.000	75.00	Yes	30.3-1	0.761	-0.851	50.31	-55.12
Zone 5	5	2.670	15.000	75.00	Yes	30.3-1	0.761	-0.982	50.31	-62.12

Area = Span Length x Effective Width
 1/3 Rule = Effective width need not be less than 1/3 of the span length
 GCp = External Pressure Coefficients taken from Figures 30.3-1 through 30.3-7
 $p = \text{Wind Pressure: } qh * (GCp - GCpi) \text{ [Eqn 30.3-1]}$
 * Per Para 30.2.2 the Minimum Pressure for C&C is 9.60 psf [0.460 kPa] {Includes LF}
 Since Roof Slope <= 10 Deg, the GCp value is reduced by 10%

Parapet Components and Cladding (C&C) Calculations per Ch 30 Part 6:

$hp = \text{Elevation of top of Parapet above grade: } Rht + Pht = 5449.17 \text{ ft}$
 $Kzt = \text{Topographic Factor is 1 since no Topographic feature specified} = 1.000$
 $Kd = \text{Wind Directionality Factor per Table 26.6-1} = 0.85$
 $GCpi = \text{Internal Pressure for Parapet: Solid} = 0.00$
 $LF = \text{Load Factor based upon ASD Design} = 0.60$
 $Kz = 15 \text{ ft } [4.572 \text{ m}] < Z < Zg \rightarrow (2.01 * (Z/zg))^{(2/\alpha)} \text{ (Table 26.10-1)} = 3.774$
 $qp = (0.00256 * Kz * Kzt * Kd * V^2 * I) * LF = 65.16 \text{ psf}$

Wind Pressures for Parapet C&C per Ch 30 Part 6 - Load Case A
All wind pressures include a load factor of 0.6

Description	Zone	Width	Span	Area	1/3 Rule	Roof Fig	GCp1	GCp2	P1	P2	Pnet
ft		ft	ft	ft					psf	psf	psf
Zone 4_P	4_P	2.670	3.500	9.345	No	30.3-2A	0.900	-2.300	58.64	-149.86	208.50
Zone 5_P	5_P	2.670	3.500	9.345	No	30.3-2A	0.900	-2.300	58.64	-149.86	208.50

GCp = External Pressure Coefficients taken from Figures 30.3-1 through 30.3-7
 $p = \text{Wind Pressure: } qp * (GCp - GCpi) \text{ [Eqn 30.9-1]}$
 Zone = 4_P (Edges) --> Wall Zone = 4 and Roof Zone = 2
 = 5_P (Corners) --> Wall Zone = 5 and Roof Zone = 3
 GCp1 & P1 = GCp and pressure for Windward size of Upwind Parapet (Load Case A)
 GCp based upon Positive Wall Pressure
 GCp2 & P2 = GCp and pressure for Leeward size of Upwind Parapet (Load Case A)
 GCp based upon Negative Roof Pressure
 Pnet = Net wind pressure on Parapet: $qp * (GCp1 - GCp2)$

Wind Pressures for Parapet C&C per Ch 30 Part 6 - Load Case B
All wind pressures include a load factor of 0.6

Description	Zone	Width	Span	Area	1/3 Rule	Roof Fig	GCp3	GCp4	P3	P4	Pnet
ft		ft	ft	ft					psf	psf	psf
Zone 4_P	4_P	2.670	3.500	9.345	No	30.3-2A	0.900	-0.990	58.64	-64.51	123.15
Zone 5_P	5_P	2.670	3.500	9.345	No	30.3-2A	0.900	-1.260	58.64	-82.10	140.74

GCp = External Pressure Coefficients taken from Figures 30.3-1 through 30.3-7
 $p = \text{Wind Pressure: } qp * (GCp - GCpi) \text{ [Eqn 30.9-1]}$
 Zone = 4_P (Edges) --> Wall Zone = 4 and Roof Zone = 2
 = 5_P (Corners) --> Wall Zone = 5 and Roof Zone = 3
 GCp3 & P3 = GCp and pressure for Windward size of Downwind Parapet (LC B)
 GCp based upon Positive Wall Pressure
 GCp4 & P4 = GCp and pressure for Leeward size of Downwind Parapet (LC B)
 GCp based upon Negative Wall Pressure
 Pnet = Net wind pressure on Parapet: $P3 - P4$

Components and Cladding (C&C) Zone Summary per Ch 30 Pt 1:

h/W	= Ratio of mean roof height to building width	= 0.249
h/L	= Ratio of mean roof height to building length	= 0.156
h	= Mean Roof Height above grade	= 5445.670 ft
Kh	= 15 ft [4.572 m] < Z < Zg --> (2.01*(Z/zg)^(2/Alpha) {Table 26.10-1}	= 3.097
Kzt	= Topographic Factor is 1 since no Topographic feature specified	= 1.000
Kd	= Wind Directionality Factor per Table 26.6-1	= 0.85
GCPi	= Ref Table 26.13-1 for Enclosed Building	= +/-0.18
LF	= Load Factor based upon ASD Design	= 0.60
qh	= (0.00256 * Kh * Kzt * Kd * Ke * V^2) * LF	= 53.47 psf
LHD	= Least Horizontal Dimension: Min(B, L)	= 59.000 ft
a1	= Min(0.1 * LHD, 0.4 * h)	= 5.868 ft
a	= Max(a1, 0.04 * LHD, 3 ft [0.9 m])	= 5.868 ft
h/B	= Ratio of mean roof height to least hor dim: h / B	= 0.249

Wind Pressure Summary for C&C Zones based Upon Areas Ch 30 Pt 1 (Table 1 of 2)

All wind pressures include a load factor of 0.6

Zone	Figure	A <= 10.00 sq ft psf	A = 20.00 sq ft psf	A = 50.00 sq ft psf	A = 100.00 sq ft psf
1	30.3-2A	25.66 -100.52	24.05 -93.89	21.93 -85.12	20.32 -78.49
1'	30.3-2A	25.66 -57.74	24.05 -57.74	21.93 -57.74	20.32 -57.74
1_OH	30.3-2A	9.60 -90.89	9.60 -89.28	9.60 -87.16	9.60 -85.55
1'_OH	30.3-2A	9.60 -90.89	9.60 -89.28	9.60 -87.16	9.60 -85.55
2	30.3-2A	57.74 -132.60	55.19 -124.07	51.80 -112.80	49.25 -104.27
2_OH	30.3-2A	9.60 -122.97	9.60 -111.60	9.60 -96.58	9.60 -85.21
3	30.3-2A	57.74 -132.60	55.19 -124.07	51.80 -112.80	49.25 -104.27
3_OH	30.3-2A	9.60 -171.09	9.60 -151.20	9.60 -124.90	9.60 -105.01
4	30.3-1	57.74 -62.56	55.19 -60.00	51.80 -56.62	49.25 -54.06
4_P (P1/P4)	30.3-2A	58.64 -64.51	55.52 -61.39	51.40 -57.27	48.29 -54.15
4_P (P3/P2)	30.3-2A	58.64 -149.86	55.52 -139.47	51.40 -125.74	48.29 -115.35
4_P (P1-P2) / (P3-P4)	30.3-2A	208.50 123.15	194.99 116.91	177.14 108.67	163.63 102.44
5	30.3-1	57.74 -76.99	55.19 -71.88	51.80 -65.11	49.25 -60.00
5_P (P1/P4)	30.3-2A	58.64 -82.10	55.52 -75.86	51.40 -67.62	48.29 -61.39
5_P (P3/P2)	30.3-2A	58.64 -149.86	55.52 -139.47	51.40 -125.74	48.29 -115.35
5_P (P1-P2) / (P3-P4)	30.3-2A	208.50 140.74	194.99 131.39	177.14 119.03	163.63 109.67

Wind Pressure Summary for C&C Zones based Upon Areas Ch 30 Pt 1 (Table 2 of 2)

All wind pressures include a load factor of 0.6

Zone	Figure	A = 200.00 sq ft psf	A = 500.00 sq ft psf	A > 1000.00 sq ft psf
1	30.3-2A	20.32 -71.86	20.32 -63.09	20.32 -63.09
1'	30.3-2A	20.32 -49.70	20.32 -39.06	20.32 -31.01
1_OH	30.3-2A	9.60 -71.73	9.60 -53.47	9.60 -53.47
1'_OH	30.3-2A	9.60 -71.73	9.60 -53.47	9.60 -53.47
2	30.3-2A	46.69 -95.75	43.31 -84.48	43.31 -84.48
2_OH	30.3-2A	9.60 -73.84	9.60 -58.81	9.60 -58.81
3	30.3-2A	46.69 -95.75	43.31 -84.48	43.31 -84.48
3_OH	30.3-2A	9.60 -85.11	9.60 -58.81	9.60 -58.81
4	30.3-1	46.69 -51.50	43.31 -48.12	43.31 -48.12
4_P (P1/P4)	30.3-2A	45.17 -51.03	41.05 -46.91	41.05 -46.91
4_P (P3/P2)	30.3-2A	45.17 -104.95	41.05 -91.22	41.05 -91.22
4_P (P1-P2) / (P3-P4)	30.3-2A	150.12 96.20	132.27 87.96	132.27 87.96
5	30.3-1	46.69 -54.88	43.31 -48.12	43.31 -48.12
5_P (P1/P4)	30.3-2A	45.17 -55.15	41.05 -46.91	41.05 -46.91
5_P (P3/P2)	30.3-2A	45.17 -104.95	41.05 -91.22	41.05 -91.22
5_P (P1-P2) / (P3-P4)	30.3-2A	150.12 100.32	132.27 87.96	132.27 87.96

* A is effective wind area for C&C: Span Length * Effective Width

* Effective width need not be less than 1/3 of the span length

* Maximum and minimum values of pressure shown.

* + Pressures acting toward surface, - Pressures acting away from surface

* Per Para 30.2.2 the Minimum Pressure for C&C is 9.60 psf [0.460 kPa] {Includes LF}

_P represents a zone on the parapet

Parapet C&C Surface (P1/P4) - Maximum Positive and Negative Pressures on Exterior Parapet Surfaces

Parapet C&C Surface (P3/P2) - Maximum Positive and Negative Pressures on Interior Parapet Surfaces

Parapet Net Pressure (P1-P2) - Net Pressure Acting on Upwind Parapet (Exterior + Interior)

Parapet Net Pressure (P3-P4) - Net Pressure Acting on Downwind Parapet (Exterior + Interior)

* Interpolation can be used for values of A that are between those values shown.

⚠ This is a beta release of the new ATC Hazards by Location website. Please [contact us](#) with feedback.

ℹ The ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)



Hazards by Location

Search Information

Address: 1001 SW Blue Pkwy, Lee's Summit, MO 64063, USA

Coordinates: 38.9119505, -94.3924249

Elevation: 1005 ft

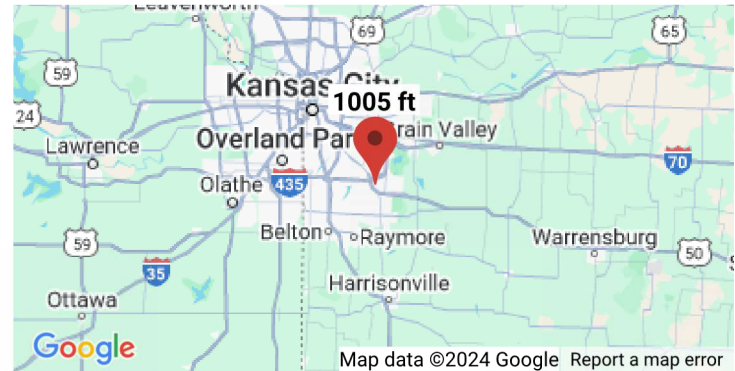
Timestamp: 2024-11-22T17:23:43.097Z

Hazard Type: Seismic

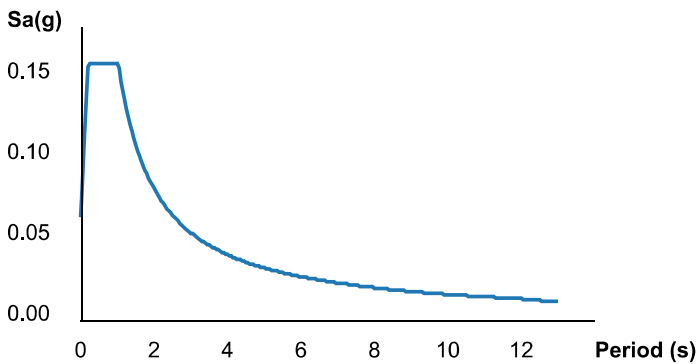
Reference Document: ASCE7-16

Risk Category: II

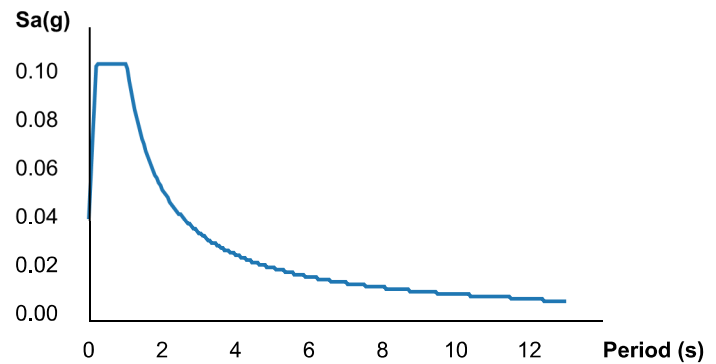
Site Class: D-default



MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.1	MCE _R ground motion (period=0.2s)
S_1	0.068	MCE _R ground motion (period=1.0s)
S_{MS}	0.159	Site-modified spectral acceleration value
S_{M1}	0.163	Site-modified spectral acceleration value
S_{DS}	0.106	Numeric seismic design value at 0.2s SA
S_{D1}	0.109	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	B	Seismic design category

F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s
CR_S	0.927	Coefficient of risk (0.2s)
CR_1	0.877	Coefficient of risk (1.0s)
PGA	0.047	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.075	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
$SsRT$	0.1	Probabilistic risk-targeted ground motion (0.2s)
$SsUH$	0.107	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
$S1RT$	0.068	Probabilistic risk-targeted ground motion (1.0s)
$S1UH$	0.078	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
$S1D$	0.6	Factored deterministic acceleration value (1.0s)
$PGAd$	0.5	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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QT #0183 @ Lees Summit, MO

Project No. 2024-2239

Seismic Criteria

From ATC: Site Class C; Risk Category II

$$S_s = 0.100$$

$$S_1 = 0.068$$

$$S_{DS} = 0.106$$

$$S_{D1} = 0.109$$

$$C_s = \frac{S_{DS}}{(R/I_e)} = \frac{0.106}{2} = 0.053$$

$$V = C_s W$$

Force to Roof Diaphragm =

$$\text{Wt. Roof} = 5105 \text{ SQ. FT.} \times 20 \text{ PSF} = 103\text{K}$$

Wt. Walls Above Mid-Ht =

$$93' \left[\frac{17}{2} + 4 \right] (2) \times .06 \text{KSF} = \underline{139.5\text{K}}$$

$$W_{\text{TOTAL}} = 242.5\text{K}$$

$$\text{Force to Roof Diaphragm} = 242.5(0.053) = 12.9 \text{ K}$$

Wind Controls

QT #0183 @ Lees Summit, MO

Project No. 2024-2239

Roof Diaphragm Chord @ Front Wall

Total Force = 39.2K

$39.2 / 93' = .426 \text{ KLF}$

T/C Force in Diaphragm Chord = $[\text{.426} (93^2)/8]/53' = 8.7\text{K}$

Table 4-11 AISC 15th ED =

$P_{\text{MAX}} = 25.3\text{K}$ OK By Inspection

$L3\frac{1}{2} \times 3\frac{1}{2} \times 5/16''$

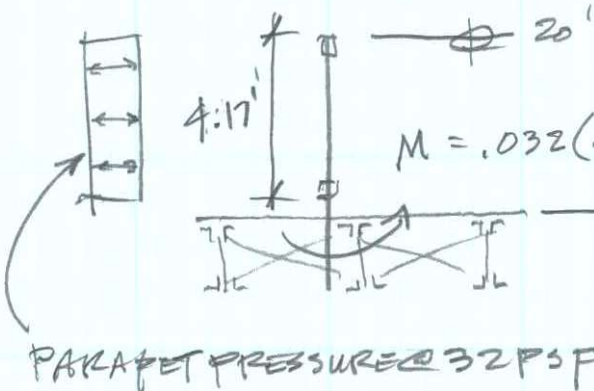
ROOF SCREEN

• POSTS @ 17' O.C. MAX (HSS 4x4x1/4)

$$S_x = 3.9 \text{ IN}^3$$

• HORIZ. T & B (HSS 4x4x3/16)

$$S_y = 3.1 \text{ IN}^3$$



$$M = .032(4.17')(2.4') = 0.32 \text{ k' / ft} \\ = 3.86 \text{ k" / ft}$$

$$f_b = \frac{3.86}{3.9} = 0.99 \text{ ksi / ft.}$$

@ 17' MAX. SPACING, $f_b = 17.2 \text{ ksi}$ O.K.

TOP & BOTT. TUBES:

$$M = .067 \text{ klf}(17') / 8 = 2.42 \text{ k' } = 29 \text{ k"}$$

$$f_b = 9.4 \text{ ksi O.K.}$$

WT. SCREEN MAT'L'S NEGLIGIBLE $\therefore$ COMBINED AXIAL + BENDING O.K.

FRONT ENTRY PARAPET:

STEEL STUDS 15'-20' ; HSS TOP HORIZ. RESTRAINT

WL @ 35 PSF; FOR 5' SPAN - RE: SSMA TABLE

600S162-43 OK

WL TO HSS: 2.5'(35 PSF) = .088 KLF

$$M_{(HSS)} = 4.4 K' = 53 K'' \quad f_b = 53 / 9.54 IN^3 = 5.6 KSI$$

OK

SIDE ENTRY PENTHOUSE:

SIDEWALL STUDS CANTILEVER ABOVE ROOF 3.5' :

$$M_w = .035(2)(3.5^2)/2 = .43 K' / STUD = 5.1 K''$$

8.46 > 5.1 OK
(SEE SSMA TABLE)

Project				Job Ref.	
Section				Sheet no./rev. 1	
Calc. by RS	Date 12/22/2021	Chk'd by	Date	App'd by	Date

MASONRY WALL PANEL DESIGN (TMS 402/602-16)

In accordance with allowable stress design method

Tedds calculation version 2.2.09

Masonry wall panel details

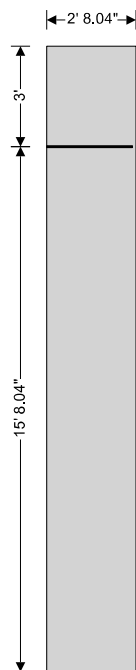
Reinforced single-wythe wall with a parapet, the wall is pinned at the top and at the bottom for out of plane loads

The wall is fixed at the bottom and free at the top for in plane loads

Panel length $L = 2.67$ ft

Panel height $h = 15.67$ ft

Parapet height $h_p = 3$ ft



Seismic properties

Seismic design category B

Seismic importance factor (ASCE7 Table 1.5-2) $I_e = 1$

Design spectral response acceleration parameter, short periods (IBC 1613.2.4 or ASCE7 11.4.5)

$S_{DS} = 0.273$

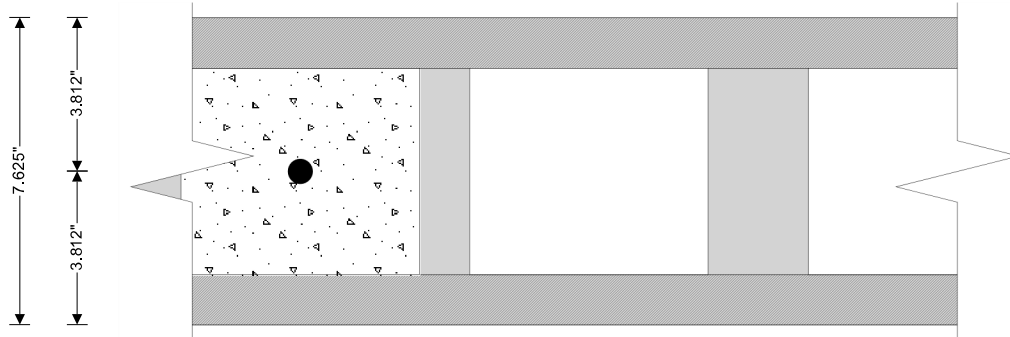
Seismic wall classification Nonparticipating

No prescriptive minimum seismic reinforcement

Redundancy factor, on out-of-plane load $\rho_E = 2.0$

Construction details

Wall thickness $t = 7.625$ in



Masonry details

Hollow clay units grouted at 32 in on center in running bond face bedded with PCL class S mortar

Compressive strength of unit $f'_{cu} = 3350$ psi

Density of masonry units $\gamma_{block} = 140$ lb/ft³

Height of masonry units $h_b = 7.625$ in

Length of masonry units $l_b = 15.625$ in

Number of internal webs $N_{web} = 1$

Number of end webs $N_{end} = 2$

Internal web thickness $t_{bw} = 1.25$ in

Face shell thickness $t_{bf} = 1.25$ in

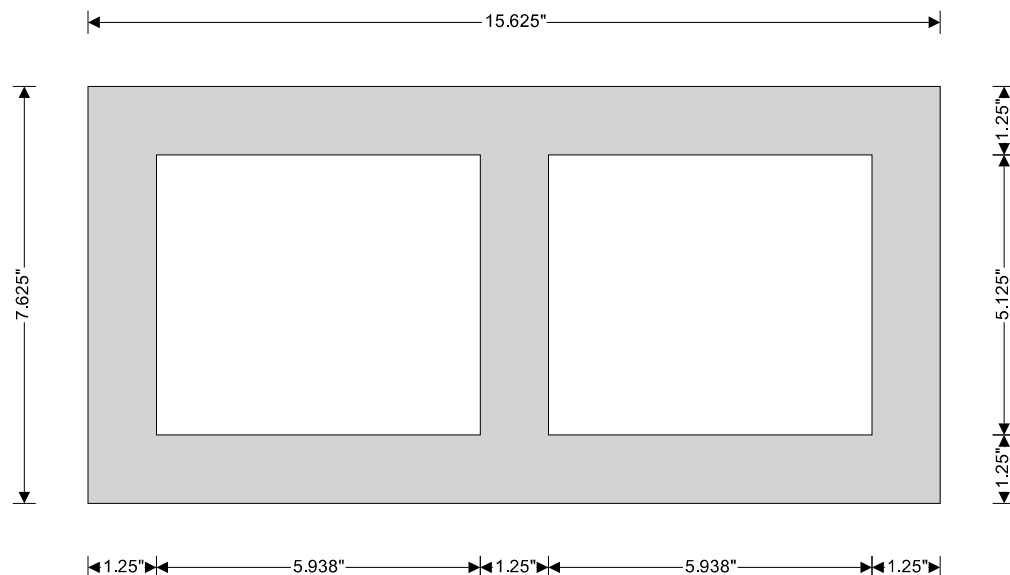
End web thickness $t_{be} = 1.25$ in

Area of block $A_{block} = [t \times l_b - (l_b - N_{web} \times t_{bw} - N_{end} \times t_{be}) \times (t - 2 \times t_{bf})] / l_b = 44.76$ in²/ft

Area of grout $A_{grout} = [0.25 \times (l_b - N_{web} \times t_{bw} - N_{end} \times t_{be}) \times (t - 2 \times t_{bf})] / l_b = 11.69$ in²/ft

Density of grout $\gamma_{grout} = 140$ lb/ft³

Self weight of wall $WSW = A_{block} \times \gamma_{block} + A_{grout} \times \gamma_{grout} = 54.88$ psf



Project				Job Ref.	
Section				Sheet no./rev. 3	
Calc. by RS	Date 12/22/2021	Chk'd by	Date	App'd by	Date

From TMS 602-16 Table 1 - Compressive strength of masonry

Net compressive strength of masonry	$f_m = 1500$ psi
Modulus of elasticity for masonry	$E_m = 700 \times f_m = 1050000$ psi
Shear modulus of masonry	$G_v = 0.4 \times E_m = 420000$ psi

From TMS 402 -16 Table 8.2.4.2 - Allowable flexural tensile stresses for clay and concrete masonry

Allowable flexural tensile stress normal to bed	$F_{t_norm} = 41$ psi
Allowable flexural tensile stress parallel to bed	$F_{t_para} = 66$ psi

Reinforcement details

Yield strength of reinforcement	$f_y = 60000$ psi
Allowable tensile stress in reinforcement	$F_s = 32000$ psi
Modulus of elasticity for reinforcement	$E_s = 29000000$ psi
Vertical reinforcement provided	No.5 bars at 32 in centers
Area of vertical reinforcement	$A_s = \pi \times Dia^2 / (4 \times s) = 0.12$ in ² /ft
Yield strength of horizontal reinforcement	$f_{yv} = 70000$ psi
Allowable tensile stress in horizontal reinforcement	$F_{sv} = 30000$ psi
Horizontal reinforcement provided	(2) W2.1 wires at 8 in centers
Area of horizontal reinforcement	$A_v = 2 \times \pi \times HDia^2 / (4 \times s_v) = 0.06$ in ² /ft
Minimum area of vertical reinf. (8.3.5.2.2)	$A_{s_min} = A_v / 3 = 0.02$ in ² /ft
PASS - Area of vertical reinforcement provided exceeds the minimum	

Lateral out-of-plane loads

Wind load on panel	$W = 20$ psf
Wind load on parapet	$W_p = 35$ psf
Seismic load factor (ASCE7 12.11.1)	$F_p = 0.4 \times S_{DS} \times I_e = 0.109$
Seismic load from wall	$E_{wall} = \max(F_p, 0.1) \times w_{sw} = 6$ psf
Additional seismic load	$E_{add} = 0$ psf
Seismic lateral load on panel	$E = E_{wall} + E_{add} = 6$ psf

Lateral in-plane loads

Vertical loading details

Dead load from above	$DL_{above} = 450$ lb/ft
Live load from above	$LL_{above} = 563$ lb/ft
Snow load from above	$SL_{above} = 1400$ lb/ft
Vertical seismic load factor applied to dead load	$F_{Ev} = 0.2 \times S_{DS} = 0.055$

From IBC 2018 cl.1605.3.1 - Basic load combinations (Utilization)

Load combination no.1	DL (0.131)
Load combination no.2	DL + LL (0.181)
Load combination no.3	DL + (LL _r or SL or RL) (0.255)
Load combination no.4	DL + 0.75 × LL + 0.75 × (LL _r or SL or RL) (0.262)

Properties of masonry section

Cross-sectional area	$A = [t \times l_b - 0.75 \times (l_b - N_{web} \times t_{bw} - N_{end} \times t_{be}) \times (t - 2 \times t_{br})] / l_b = 56.4$ in ² /ft
Net cross-sectional area	$A_n = 2 \times t_{br} + 0.25 \times (t - 2 \times t_{br}) \times (l_b - N_{end} \times t_{be} - N_{web} \times t_{bw}) / l_b = 41.7$ in ² /ft
Moment of inertia	$I = t^3 / 12 - 0.75 \times (l_b - N_{web} \times t_{bw} - N_{end} \times t_{be}) \times (t - 2 \times t_{br})^3 / (12 \times l_b) = 366.6$ in ⁴ /ft

Net moment of inertia

$$I_n = (t^3 - (t - 2 \times t_{bf})^3) / 12 + 0.25 \times (t - 2 \times t_{bf})^3 \times (I_b - N_{end} \times t_{be} - N_{web} \times t_{bw}) / (12 \times I_b) = \mathbf{334.3 \text{ in}^4/\text{ft}}$$

Section modulus

$$S = I / c = \mathbf{96.2 \text{ in}^3/\text{ft}}$$

Net section modulus

$$S_n = I_n / c = \mathbf{87.7 \text{ in}^3/\text{ft}}$$

Radius of gyration

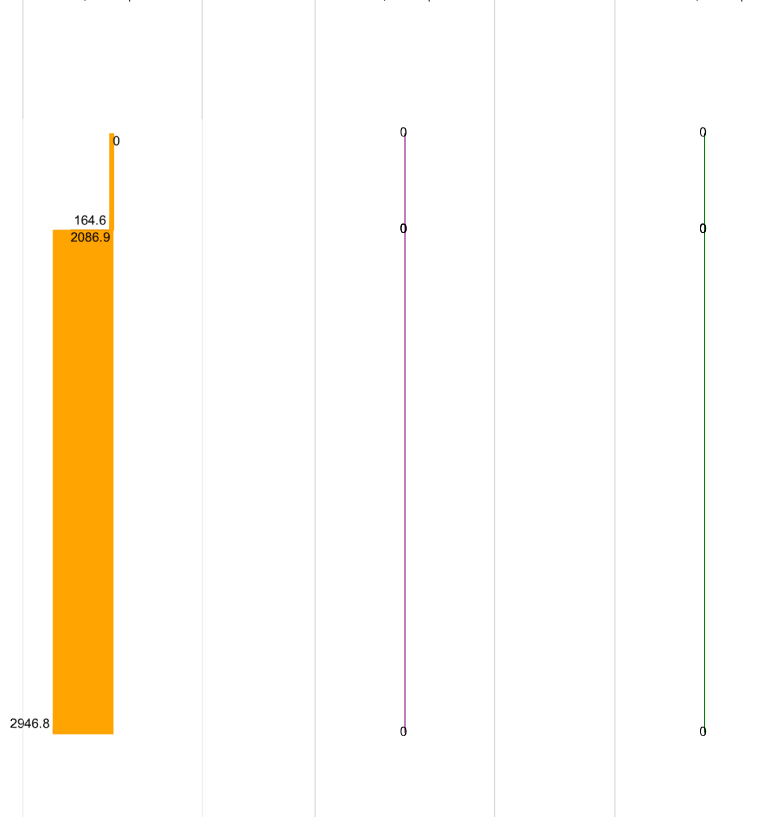
$$r = \sqrt{I / A} = \mathbf{2.5 \text{ in}}$$

Effective height factor

$$K = \mathbf{1}$$

Consider wall at bottom under load combination no.4

Axial force, out of plane - Combination No.4 - lbs/ft Shear force, out of plane - Combination No.4 - lbs/ft Moment force, out of plane - Combination No.4 - lb_in



Axial load at bottom of panel

$$P = \mathbf{2947 \text{ lb/ft}}$$

Compressive stress due to axial load

$$f_a = P / A_n = \mathbf{70.7 \text{ psi}}$$

Slenderness ratio

$$(K \times h) / r = \mathbf{73.785} < 99$$

Allowable compressive stress due to axial load

$$F_a = (1 / 4) \times f_m \times [1 - ((K \times h) / (140 \times r))^2] = \mathbf{270.8 \text{ psi}}$$

$$f_a / F_a = \mathbf{0.261}$$

PASS - Allowable compressive stress exceeds compressive stress due to axial loads

Allowable compressive force

$$P_a = 0.25 \times f_m \times (A_n - A_s) \times [1 - ((K \times h) / (140 \times r))^2] = \mathbf{11259 \text{ lb/ft}}$$

$$P / P_a = \mathbf{0.262}$$

PASS - Allowable compressive force exceeds axial load

Pole Footing Embedded in Soil

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DESCRIPTION: Site Light

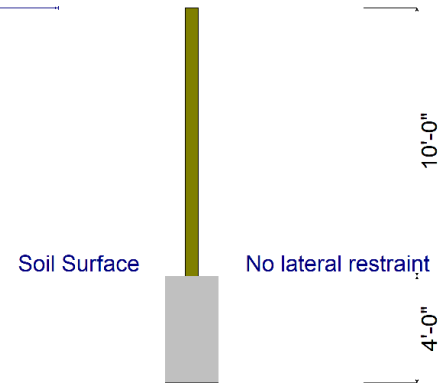
Code References

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16
 Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape Circular
 Pole Footing Diameter 24 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive 250.0 psf
 Max Passive 1,500.0 psf

Point Load



Controlling Values

Governing Load Combination : +0.60W
 Lateral Load 0.3030 k
 Moment 3.030 k-ft
NO Ground Surface Restraint
 Pressures at 1/3 Depth
 Actual 331.887 psf
 Allowable 332.318 psf

Minimum Required Depth 4.0 ft

Footing Base Area 3.142 ft²
 Maximum Soil Pressure 0.0 ksf

Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (klf)		Vertical Load (k)
D : Dead Load	k		k/ft	k
Lr : Roof Live	k		k/ft	k
L : Live	k		k/ft	k
S : Snow	k		k/ft	k
W : Wind	0.5050 k		k/ft	k
E : Earthquake	k		k/ft	k
H : Lateral Earth	k		k/ft	k
Load distance above ground surface	10.0 ft	TOP of Load above ground surface	ft	
		BOTTOM of Load above ground surface	ft	

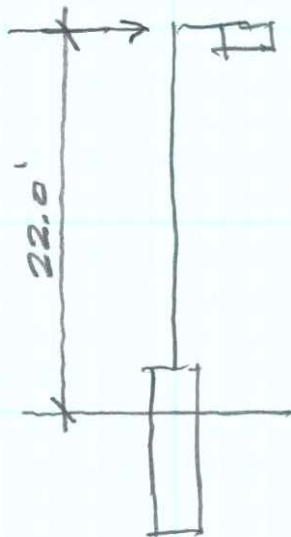
Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at 1/3 Depth		Soil Increase Factor
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)	
	0.000	0.000	0.13	0.0	0.0	1.000
+0.60W	0.303	3.030	4.00	331.9	332.3	1.000
+0.450W	0.227	2.273	3.63	298.9	299.2	1.000

LIGHT POLE BASE

DISTAL FIXTURE EPA = 3.4 (FOR 3 FIXTURES WORST CASE)

4' Ø POLES



$$M_{WL} = \overset{2.62}{.119}(22') + \overset{242}{.22}(11') \\ = 5.05 \text{ K}$$

FOR ENERCALC ANALYSIS,

USE POLE @ 10' W/ $P = .505 \text{ K}$

SEE ENERCALC PRINT

General Beam

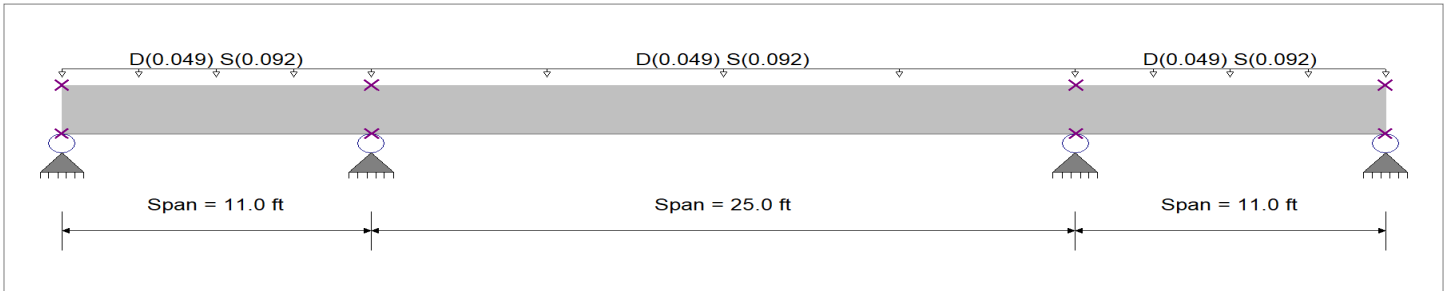
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DESCRIPTION: QT Front Canopy Channel

General Beam Properties

Elastic Modulus	29,000.0 ksi				
Span #1	Span Length =	11.0 ft	Area =	10.0 in ²	Moment of Inertia = 100.0 in ⁴
Span #2	Span Length =	25.0 ft	Area =	10.0 in ²	Moment of Inertia = 100.0 in ⁴
Span #3	Span Length =	11.0 ft	Area =	10.0 in ²	Moment of Inertia = 100.0 in ⁴



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1
Uniform Load : D = 0.0490, S = 0.0920 k/ft, Tributary Width = 1.0 ft

Load for Span Number 2
Uniform Load : D = 0.0490, S = 0.0920 k/ft, Tributary Width = 1.0 ft

Load for Span Number 3
Uniform Load : D = 0.0490, S = 0.0920 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

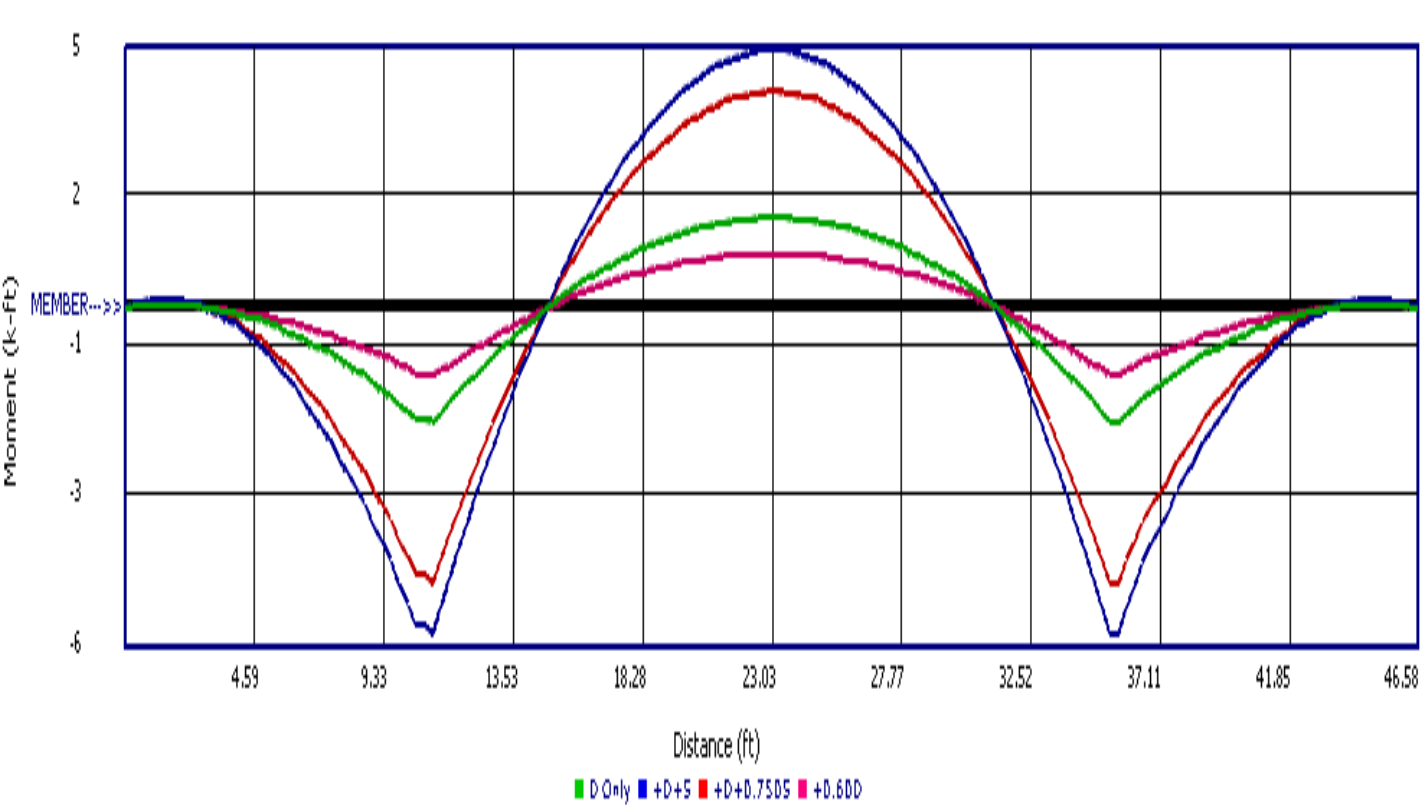
Maximum Bending =	6.162 k-ft	Maximum Shear =	1.763 k
Load Combination	+D+S	Load Combination	+D+S
Span # where maximum occurs	Span # 2	Span # where maximum occurs	Span # 1
Location of maximum on span	25.000 ft	Location of maximum on span	11.000 ft
Maximum Deflection			
Max Downward Transient Deflection	0.093 in	3239	
Max Upward Transient Deflection	-0.009 in	14325	
Max Downward Total Deflection	0.142 in	2113	
Max Upward Total Deflection	-0.014 in	9347	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values (k-ft)						Shear Values (k)			
			M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope														
Dsgn. L = 11.00 ft		1			0.16	-6.16	6.16					1.76		
Dsgn. L = 25.00 ft		2			4.85	-6.16	6.16					1.76		
Dsgn. L = 11.00 ft		3			0.16	-6.16	6.16					1.34		
D Only														
Dsgn. L = 11.00 ft		1			0.06	-2.14	2.14					0.61		
Dsgn. L = 25.00 ft		2			1.69	-2.14	2.14					0.61		
Dsgn. L = 11.00 ft		3			0.06	-2.14	2.14					0.46		
+D+S														
Dsgn. L = 11.00 ft		1			0.16	-6.16	6.16					1.76		
Dsgn. L = 25.00 ft		2			4.85	-6.16	6.16					1.76		
Dsgn. L = 11.00 ft		3			0.16	-6.16	6.16					1.34		
+D+0.750S														
Dsgn. L = 11.00 ft		1			0.14	-5.16	5.16					1.48		
Dsgn. L = 25.00 ft		2			4.06	-5.16	5.16					1.48		
Dsgn. L = 11.00 ft		3			0.14	-5.16	5.16					1.12		
+0.60D														
Dsgn. L = 11.00 ft		1			0.03	-1.28	1.28					0.37		
Dsgn. L = 25.00 ft		2			1.01	-1.28	1.28					0.37		
Dsgn. L = 11.00 ft		3			0.03	-1.28	1.28					0.28		

DESCRIPTION: QT Front Canopy Channel

Vertical Reactions		Support notation : Far left is #1			Values in KIPS
Load Combination	Support 1	Support 2	Support 3	Support 4	
Overall MAXimum	0.215	3.098	3.098	0.215	
Overall MINimum					
D Only	0.075	1.077	1.077	0.075	
+D+S	0.215	3.098	3.098	0.215	
+D+0.750S	0.180	2.593	2.593	0.180	
+0.60D	0.045	0.646	0.646	0.045	
S Only	0.141	2.021	2.021	0.141	

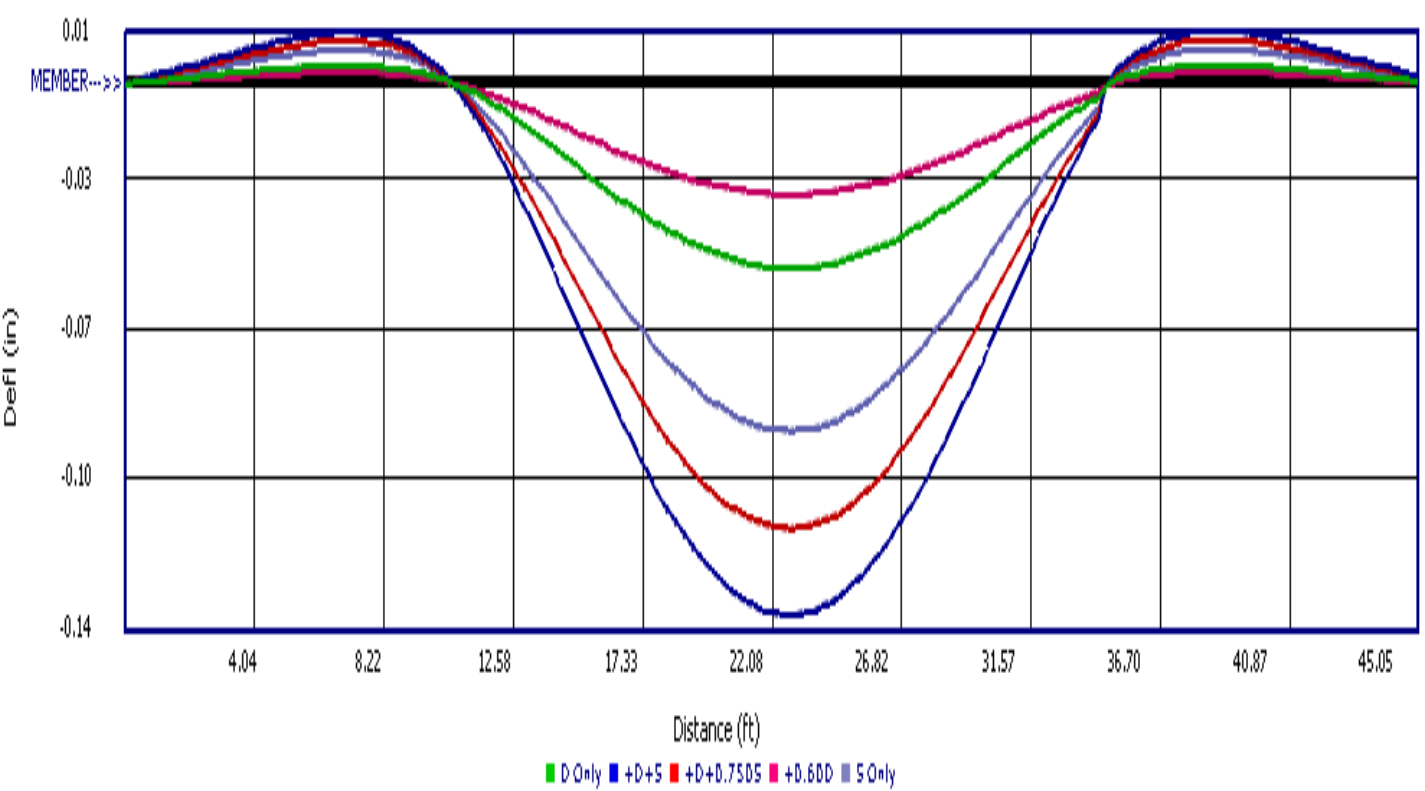
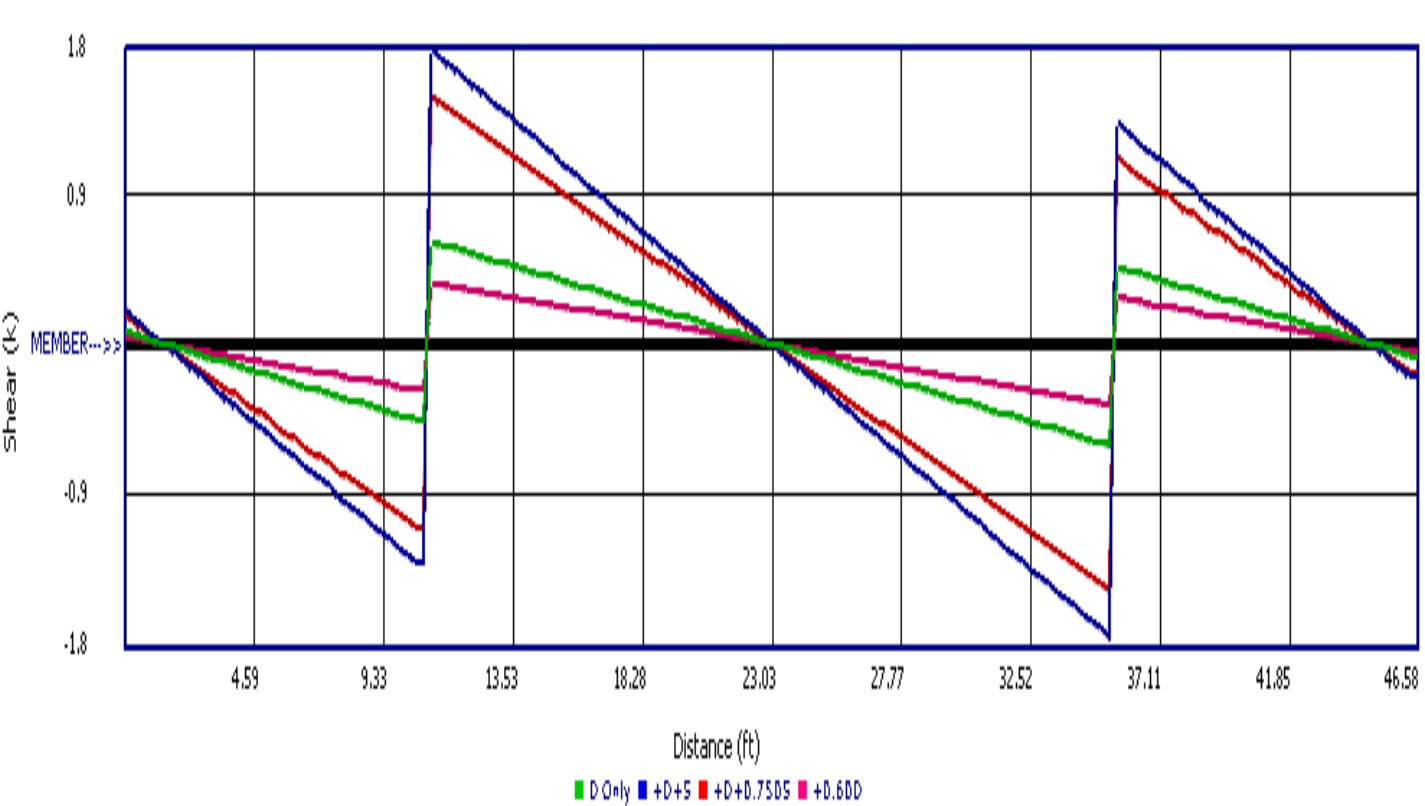


General Beam

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DESCRIPTION: QT Front Canopy Channel



Summary of Values per Beam Span

General Beam

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DESCRIPTION: QT Front Canopy Channel

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
Overall MAXimum Envelope	0.00	Span 1	0.215	0.000
Overall MAXimum Envelope	0.97	Span 1	0.078	0.143
Overall MAXimum Envelope	1.95	Span 1	-0.060	0.152
Overall MAXimum Envelope	2.92	Span 1	-0.197	0.027
Overall MAXimum Envelope	3.90	Span 1	-0.334	-0.232
Overall MAXimum Envelope	4.87	Span 1	-0.472	-0.625
Overall MAXimum Envelope	5.85	Span 1	-0.609	-1.152
Overall MAXimum Envelope	6.82	Span 1	-0.747	-1.813
Overall MAXimum Envelope	7.80	Span 1	-0.884	-2.607
Overall MAXimum Envelope	8.77	Span 1	-1.022	-3.536
Overall MAXimum Envelope	9.75	Span 1	-1.159	-4.599
Overall MAXimum Envelope	10.72	Span 1	-1.296	-5.795
Overall MAXimum Envelope	12.27	Span 2	1.584	-4.044
Overall MAXimum Envelope	14.48	Span 2	1.272	-0.881
Overall MAXimum Envelope	16.70	Span 2	0.959	1.590
Overall MAXimum Envelope	18.91	Span 2	0.647	3.369
Overall MAXimum Envelope	21.13	Span 2	0.335	4.457
Overall MAXimum Envelope	23.34	Span 2	0.022	4.852
Overall MAXimum Envelope	25.56	Span 2	-0.290	4.555
Overall MAXimum Envelope	27.77	Span 2	-0.602	3.567
Overall MAXimum Envelope	29.99	Span 2	-0.915	1.887
Overall MAXimum Envelope	32.20	Span 2	-1.227	-0.485
Overall MAXimum Envelope	34.42	Span 2	-1.539	-3.550
Overall MAXimum Envelope	36.14	Span 3	1.316	-5.977
Overall MAXimum Envelope	37.11	Span 3	1.179	-4.761
Overall MAXimum Envelope	38.09	Span 3	1.041	-3.680
Overall MAXimum Envelope	39.06	Span 3	0.904	-2.732
Overall MAXimum Envelope	40.04	Span 3	0.766	-1.918
Overall MAXimum Envelope	41.01	Span 3	0.629	-1.238
Overall MAXimum Envelope	41.99	Span 3	0.491	-0.692
Overall MAXimum Envelope	42.96	Span 3	0.354	-0.280
Overall MAXimum Envelope	43.94	Span 3	0.217	-0.002
Overall MAXimum Envelope	44.91	Span 3	0.079	0.142
Overall MAXimum Envelope	45.89	Span 3	-0.058	0.152
Overall MAXimum Envelope	46.86	Span 3	-0.196	0.029
Overall MAXimum Envelope	47.00	Span 3	-0.215	0.000
D Only	0.00	Span 1	0.075	0.000
D Only	0.97	Span 1	0.027	0.050
D Only	1.95	Span 1	-0.021	0.053
D Only	2.92	Span 1	-0.068	0.009
D Only	3.90	Span 1	-0.116	-0.081
D Only	4.87	Span 1	-0.164	-0.217
D Only	5.85	Span 1	-0.212	-0.400
D Only	6.82	Span 1	-0.259	-0.630
D Only	7.80	Span 1	-0.307	-0.906
D Only	8.77	Span 1	-0.355	-1.229
D Only	9.75	Span 1 ³	-0.403	-1.598
D Only	10.72	Span 1	-0.451	-2.014

General Beam

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DESCRIPTION: QT Front Canopy Channel

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
D Only	12.27	Span 2	0.550	-1.405
D Only	14.48	Span 2	0.442	-0.306
D Only	16.70	Span 2	0.333	0.553
D Only	18.91	Span 2	0.225	1.171
D Only	21.13	Span 2	0.116	1.549
D Only	23.34	Span 2	0.008	1.686
D Only	25.56	Span 2	-0.101	1.583
D Only	27.77	Span 2	-0.209	1.240
D Only	29.99	Span 2	-0.318	0.656
D Only	32.20	Span 2	-0.426	-0.169
D Only	34.42	Span 2	-0.535	-1.234
D Only	36.14	Span 3	0.457	-2.077
D Only	37.11	Span 3	0.410	-1.655
D Only	38.09	Span 3	0.362	-1.279
D Only	39.06	Span 3	0.314	-0.949
D Only	40.04	Span 3	0.266	-0.667
D Only	41.01	Span 3	0.219	-0.430
D Only	41.99	Span 3	0.171	-0.240
D Only	42.96	Span 3	0.123	-0.097
D Only	43.94	Span 3	0.075	-0.001
D Only	44.91	Span 3	0.028	0.049
D Only	45.89	Span 3	-0.020	0.053
D Only	46.86	Span 3	-0.068	0.010
D Only	47.00	Span 3	-0.075	0.000
+D+S	0.00	Span 1	0.215	0.000
+D+S	0.97	Span 1	0.078	0.143
+D+S	1.95	Span 1	-0.060	0.152
+D+S	2.92	Span 1	-0.197	0.027
+D+S	3.90	Span 1	-0.334	-0.232
+D+S	4.87	Span 1	-0.472	-0.625
+D+S	5.85	Span 1	-0.609	-1.152
+D+S	6.82	Span 1	-0.747	-1.813
+D+S	7.80	Span 1	-0.884	-2.607
+D+S	8.77	Span 1	-1.022	-3.536
+D+S	9.75	Span 1	-1.159	-4.599
+D+S	10.72	Span 1	-1.296	-5.795
+D+S	12.27	Span 2	1.584	-4.044
+D+S	14.48	Span 2	1.272	-0.881
+D+S	16.70	Span 2	0.959	1.590
+D+S	18.91	Span 2	0.647	3.369
+D+S	21.13	Span 2	0.335	4.457
+D+S	23.34	Span 2	0.022	4.852
+D+S	25.56	Span 2	-0.290	4.555
+D+S	27.77	Span 2	-0.602	3.567
+D+S	29.99	Span 2	-0.915	1.887
+D+S	32.20	Span 2	-1.227	-0.485
+D+S	34.42	Span 2 ⁵⁴	-1.539	-3.550
+D+S	36.14	Span 3	1.316	-5.977

General Beam

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DESCRIPTION: QT Front Canopy Channel

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+D+S	37.11	Span 3	1.179	-4.761
+D+S	38.09	Span 3	1.041	-3.680
+D+S	39.06	Span 3	0.904	-2.732
+D+S	40.04	Span 3	0.766	-1.918
+D+S	41.01	Span 3	0.629	-1.238
+D+S	41.99	Span 3	0.491	-0.692
+D+S	42.96	Span 3	0.354	-0.280
+D+S	43.94	Span 3	0.217	-0.002
+D+S	44.91	Span 3	0.079	0.142
+D+S	45.89	Span 3	-0.058	0.152
+D+S	46.86	Span 3	-0.196	0.029
+D+S	47.00	Span 3	-0.215	0.000
+D+0.750S	0.00	Span 1	0.180	0.000
+D+0.750S	0.97	Span 1	0.065	0.120
+D+0.750S	1.95	Span 1	-0.050	0.127
+D+0.750S	2.92	Span 1	-0.165	0.022
+D+0.750S	3.90	Span 1	-0.280	-0.194
+D+0.750S	4.87	Span 1	-0.395	-0.523
+D+0.750S	5.85	Span 1	-0.510	-0.964
+D+0.750S	6.82	Span 1	-0.625	-1.517
+D+0.750S	7.80	Span 1	-0.740	-2.182
+D+0.750S	8.77	Span 1	-0.855	-2.959
+D+0.750S	9.75	Span 1	-0.970	-3.849
+D+0.750S	10.72	Span 1	-1.085	-4.850
+D+0.750S	12.27	Span 2	1.326	-3.384
+D+0.750S	14.48	Span 2	1.064	-0.737
+D+0.750S	16.70	Span 2	0.803	1.331
+D+0.750S	18.91	Span 2	0.541	2.820
+D+0.750S	21.13	Span 2	0.280	3.730
+D+0.750S	23.34	Span 2	0.019	4.061
+D+0.750S	25.56	Span 2	-0.243	3.812
+D+0.750S	27.77	Span 2	-0.504	2.985
+D+0.750S	29.99	Span 2	-0.766	1.579
+D+0.750S	32.20	Span 2	-1.027	-0.406
+D+0.750S	34.42	Span 2	-1.288	-2.971
+D+0.750S	36.14	Span 3	1.101	-5.002
+D+0.750S	37.11	Span 3	0.986	-3.985
+D+0.750S	38.09	Span 3	0.871	-3.079
+D+0.750S	39.06	Span 3	0.756	-2.286
+D+0.750S	40.04	Span 3	0.641	-1.605
+D+0.750S	41.01	Span 3	0.526	-1.036
+D+0.750S	41.99	Span 3	0.411	-0.579
+D+0.750S	42.96	Span 3	0.296	-0.234
+D+0.750S	43.94	Span 3	0.181	-0.002
+D+0.750S	44.91	Span 3	0.066	0.119
+D+0.750S	45.89	Span 3	-0.049	0.128
+D+0.750S	46.86	Span 3	-0.164	0.024
+D+0.750S	47.00	Span 3	-0.180	0.000

General Beam

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+0.60D	0.00	Span 1	0.045	0.000
+0.60D	0.97	Span 1	0.016	0.030
+0.60D	1.95	Span 1	-0.012	0.032
+0.60D	2.92	Span 1	-0.041	0.006
+0.60D	3.90	Span 1	-0.070	-0.048
+0.60D	4.87	Span 1	-0.098	-0.130
+0.60D	5.85	Span 1	-0.127	-0.240
+0.60D	6.82	Span 1	-0.156	-0.378
+0.60D	7.80	Span 1	-0.184	-0.544
+0.60D	8.77	Span 1	-0.213	-0.737
+0.60D	9.75	Span 1	-0.242	-0.959
+0.60D	10.72	Span 1	-0.270	-1.208
+0.60D	12.27	Span 2	0.330	-0.843
+0.60D	14.48	Span 2	0.265	-0.184
+0.60D	16.70	Span 2	0.200	0.332
+0.60D	18.91	Span 2	0.135	0.703
+0.60D	21.13	Span 2	0.070	0.929
+0.60D	23.34	Span 2	0.005	1.012
+0.60D	25.56	Span 2	-0.060	0.950
+0.60D	27.77	Span 2	-0.126	0.744
+0.60D	29.99	Span 2	-0.191	0.393
+0.60D	32.20	Span 2	-0.256	-0.101
+0.60D	34.42	Span 2	-0.321	-0.740
+0.60D	36.14	Span 3	0.274	-1.246
+0.60D	37.11	Span 3	0.246	-0.993
+0.60D	38.09	Span 3	0.217	-0.767
+0.60D	39.06	Span 3	0.188	-0.570
+0.60D	40.04	Span 3	0.160	-0.400
+0.60D	41.01	Span 3	0.131	-0.258
+0.60D	41.99	Span 3	0.102	-0.144
+0.60D	42.96	Span 3	0.074	-0.058
+0.60D	43.94	Span 3	0.045	-0.000
+0.60D	44.91	Span 3	0.017	0.030
+0.60D	45.89	Span 3	-0.012	0.032
+0.60D	46.86	Span 3	-0.041	0.006
+0.60D	47.00	Span 3	-0.045	0.000

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	0.00	Span 1	0.000
Overall MAXimum Envelope	1.25	Span 1	-0.003
Overall MAXimum Envelope	2.51	Span 1	-0.005
Overall MAXimum Envelope	3.76	Span 1	-0.008
Overall MAXimum Envelope	5.01	Span 1	-0.011
Overall MAXimum Envelope	6.27	Span 1	-0.013
Overall MAXimum Envelope	7.52	Span 1	-0.014
Overall MAXimum Envelope	8.77	Span 1	-0.012
Overall MAXimum Envelope	10.03	Span 1	-0.007
Overall MAXimum Envelope	11.32	Span 2 ⁵⁶	0.003

General Beam

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 NORTON & SCHMIDT

Lic. # : KW-06000335

DESCRIPTION: QT Front Canopy Channel

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	14.16	Span 2	0.040
Overall MAXimum Envelope	17.01	Span 2	0.085
Overall MAXimum Envelope	19.86	Span 2	0.122
Overall MAXimum Envelope	22.71	Span 2	0.141
Overall MAXimum Envelope	25.56	Span 2	0.137
Overall MAXimum Envelope	28.41	Span 2	0.111
Overall MAXimum Envelope	31.25	Span 2	0.070
Overall MAXimum Envelope	34.10	Span 2	0.026
Overall MAXimum Envelope	36.28	Span 3	-0.002
Overall MAXimum Envelope	37.53	Span 3	-0.010
Overall MAXimum Envelope	38.78	Span 3	-0.013
Overall MAXimum Envelope	40.04	Span 3	-0.014
Overall MAXimum Envelope	41.29	Span 3	-0.013
Overall MAXimum Envelope	42.54	Span 3	-0.011
Overall MAXimum Envelope	43.80	Span 3	-0.008
Overall MAXimum Envelope	45.05	Span 3	-0.005
Overall MAXimum Envelope	46.30	Span 3	-0.002
Overall MAXimum Envelope	47.00	Span 3	-0.001
D Only	0.00	Span 1	0.000
D Only	1.25	Span 1	-0.001
D Only	2.51	Span 1	-0.002
D Only	3.76	Span 1	-0.003
D Only	5.01	Span 1	-0.004
D Only	6.27	Span 1	-0.004
D Only	7.52	Span 1	-0.005
D Only	8.77	Span 1	-0.004
D Only	10.03	Span 1	-0.003
D Only	11.32	Span 2	0.001
D Only	14.16	Span 2	0.014
D Only	17.01	Span 2	0.029
D Only	19.86	Span 2	0.042
D Only	22.71	Span 2	0.049
D Only	25.56	Span 2	0.048
D Only	28.41	Span 2	0.039
D Only	31.25	Span 2	0.024
D Only	34.10	Span 2	0.009
D Only	36.28	Span 3	-0.001
D Only	37.53	Span 3	-0.003
D Only	38.78	Span 3	-0.005
D Only	40.04	Span 3	-0.005
D Only	41.29	Span 3	-0.004
D Only	42.54	Span 3	-0.004
D Only	43.80	Span 3	-0.003

General Beam

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Lic. # : KW-06000335

DESCRIPTION: QT Front Canopy Channel

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
D Only	45.05	Span 3	-0.002
D Only	46.30	Span 3	-0.001
D Only	47.00	Span 3	-0.000
+D+S	0.00	Span 1	0.000
+D+S	1.25	Span 1	-0.003
+D+S	2.51	Span 1	-0.005
+D+S	3.76	Span 1	-0.008
+D+S	5.01	Span 1	-0.011
+D+S	6.27	Span 1	-0.013
+D+S	7.52	Span 1	-0.014
+D+S	8.77	Span 1	-0.012
+D+S	10.03	Span 1	-0.007
+D+S	11.32	Span 2	0.003
+D+S	14.16	Span 2	0.040
+D+S	17.01	Span 2	0.085
+D+S	19.86	Span 2	0.122
+D+S	22.71	Span 2	0.141
+D+S	25.56	Span 2	0.137
+D+S	28.41	Span 2	0.111
+D+S	31.25	Span 2	0.070
+D+S	34.10	Span 2	0.026
+D+S	36.28	Span 3	-0.002
+D+S	37.53	Span 3	-0.010
+D+S	38.78	Span 3	-0.013
+D+S	40.04	Span 3	-0.014
+D+S	41.29	Span 3	-0.013
+D+S	42.54	Span 3	-0.011
+D+S	43.80	Span 3	-0.008
+D+S	45.05	Span 3	-0.005
+D+S	46.30	Span 3	-0.002
+D+S	47.00	Span 3	-0.001
+D+0.750S	0.00	Span 1	0.000
+D+0.750S	1.25	Span 1	-0.002
+D+0.750S	2.51	Span 1	-0.005
+D+0.750S	3.76	Span 1	-0.007
+D+0.750S	5.01	Span 1	-0.009
+D+0.750S	6.27	Span 1	-0.011
+D+0.750S	7.52	Span 1	-0.011
+D+0.750S	8.77	Span 1	-0.010
+D+0.750S	10.03	Span 1	-0.006
+D+0.750S	11.32	Span 2	0.002
+D+0.750S	14.16	Span 2	0.033

General Beam

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DESCRIPTION: QT Front Canopy Channel

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
+D+0.750S	17.01	Span 2	0.071
+D+0.750S	19.86	Span 2	0.102
+D+0.750S	22.71	Span 2	0.118
+D+0.750S	25.56	Span 2	0.114
+D+0.750S	28.41	Span 2	0.093
+D+0.750S	31.25	Span 2	0.059
+D+0.750S	34.10	Span 2	0.022
+D+0.750S	36.28	Span 3	-0.002
+D+0.750S	37.53	Span 3	-0.008
+D+0.750S	38.78	Span 3	-0.011
+D+0.750S	40.04	Span 3	-0.012
+D+0.750S	41.29	Span 3	-0.011
+D+0.750S	42.54	Span 3	-0.009
+D+0.750S	43.80	Span 3	-0.006
+D+0.750S	45.05	Span 3	-0.004
+D+0.750S	46.30	Span 3	-0.002
+D+0.750S	47.00	Span 3	-0.001
+0.60D	0.00	Span 1	0.000
+0.60D	1.25	Span 1	-0.001
+0.60D	2.51	Span 1	-0.001
+0.60D	3.76	Span 1	-0.002
+0.60D	5.01	Span 1	-0.002
+0.60D	6.27	Span 1	-0.003
+0.60D	7.52	Span 1	-0.003
+0.60D	8.77	Span 1	-0.003
+0.60D	10.03	Span 1	-0.002
+0.60D	11.32	Span 2	0.001
+0.60D	14.16	Span 2	0.008
+0.60D	17.01	Span 2	0.018
+0.60D	19.86	Span 2	0.025
+0.60D	22.71	Span 2	0.029
+0.60D	25.56	Span 2	0.029
+0.60D	28.41	Span 2	0.023
+0.60D	31.25	Span 2	0.015
+0.60D	34.10	Span 2	0.005
+0.60D	36.28	Span 3	-0.000
+0.60D	37.53	Span 3	-0.002
+0.60D	38.78	Span 3	-0.003
+0.60D	40.04	Span 3	-0.003
+0.60D	41.29	Span 3	-0.003
+0.60D	42.54	Span 3	-0.002
+0.60D	43.80	Span 3	-0.002
+0.60D	45.05	Span 3	-0.001

General Beam

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DESCRIPTION: QT Front Canopy Channel

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
+0.60D	46.30	Span 3	-0.000
+0.60D	47.00	Span 3	-0.000
S Only	0.00	Span 1	0.000
S Only	1.25	Span 1	-0.002
S Only	2.51	Span 1	-0.004
S Only	3.76	Span 1	-0.005
S Only	5.01	Span 1	-0.007
S Only	6.27	Span 1	-0.008
S Only	7.52	Span 1	-0.009
S Only	8.77	Span 1	-0.008
S Only	10.03	Span 1	-0.005
S Only	11.32	Span 2	0.002
S Only	14.16	Span 2	0.026
S Only	17.01	Span 2	0.055
S Only	19.86	Span 2	0.079
S Only	22.71	Span 2	0.092
S Only	25.56	Span 2	0.089
S Only	28.41	Span 2	0.073
S Only	31.25	Span 2	0.046
S Only	34.10	Span 2	0.017
S Only	36.28	Span 3	-0.002
S Only	37.53	Span 3	-0.007
S Only	38.78	Span 3	-0.009
S Only	40.04	Span 3	-0.009
S Only	41.29	Span 3	-0.008
S Only	42.54	Span 3	-0.007
S Only	43.80	Span 3	-0.005
S Only	45.05	Span 3	-0.003
S Only	46.30	Span 3	-0.001
S Only	47.00	Span 3	-0.000

Steel Beam with Torsional Loads

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DESCRIPTION: Front Canopy Channel

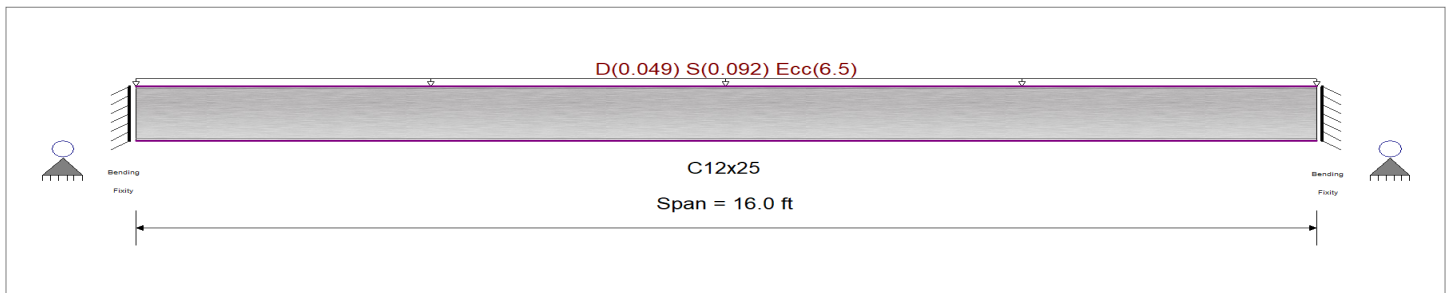
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Analysis Settings

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending
Load Combination ASCE 7-16

Fy : Steel Yield : 36.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 0

Uniform Load : D = 0.0490, S = 0.0920 k/ft, Tributary Width = 1.0 ft, Tors Ecc. = 6.50 in

DESIGN SUMMARY

Design OK

Max. Flange Normal Stress Ratio =	0.176 : 1	Maximum Shear Stress Ratio =	0.412 : 1
Flange Normal Stress	4.65 ksi	Flange Shear Stress	5.33 ksi
Phi vn : Flange Normal Stress (Phi Mn/Sxx)	26.41 ksi	Web Shear Stress	4.20 ksi
Max Mu : Applied	3.01 k-ft	Vn/Omega : Allowable	12.93 ksi
Section used for this span	C12x25	Section used for this span	C12x25
Load Combination	+D+S	Load Combination	+D+S
Maximum Deflection		Maximum Rotation =	2.9134 deg at 8.00 ft
Max Download Transient Load Deflection	0.006 in	Max Downward Total Deflection	0.010 in
Ratio =	29551	Ratio =	19281
Max Upward Transient Load Deflection	0.000 in	Max Upward Total Deflection	0.000 in
Ratio =	0 < 240	Ratio =	0 < 240

Maximum Forces & Stresses for Load Combinations

Load Combination	Max Stress Ratio	Bending Max		Flange Normal (ksi)			Flange Shear (ksi)			Web Shear (ksi)		
		Mu (kft)	Vu (k)	Total	Allow	Ratio	Total	Allow	Ratio	Total	Allow	Ratio
D Only	0.143	1.05	0.39	1.617	26.407	0.061	1.853	12.934	0.143	1.460	12.934	0.113
+D+S	0.412	3.01	1.13	4.654	26.407	0.176	5.332	12.934	0.412	4.202	12.934	0.325
+D+0.750S	0.345	2.52	0.94	3.895	26.407	0.147	4.462	12.934	0.345	3.517	12.934	0.272
+0.60D	0.086	0.63	0.24	0.970	26.407	0.037	1.112	12.934	0.086	0.876	12.934	0.068

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
span_1	1	0.0100	8.064		0.0000	0.000

Vertical Reactions - Unfactored

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.128	1.128
D Only	0.392	0.392
+D+S	1.128	1.128
+D+0.750S	0.944	0.944
+0.60D	0.235	0.235
S Only	0.736	0.736

Steel Beam with Torsional Loads

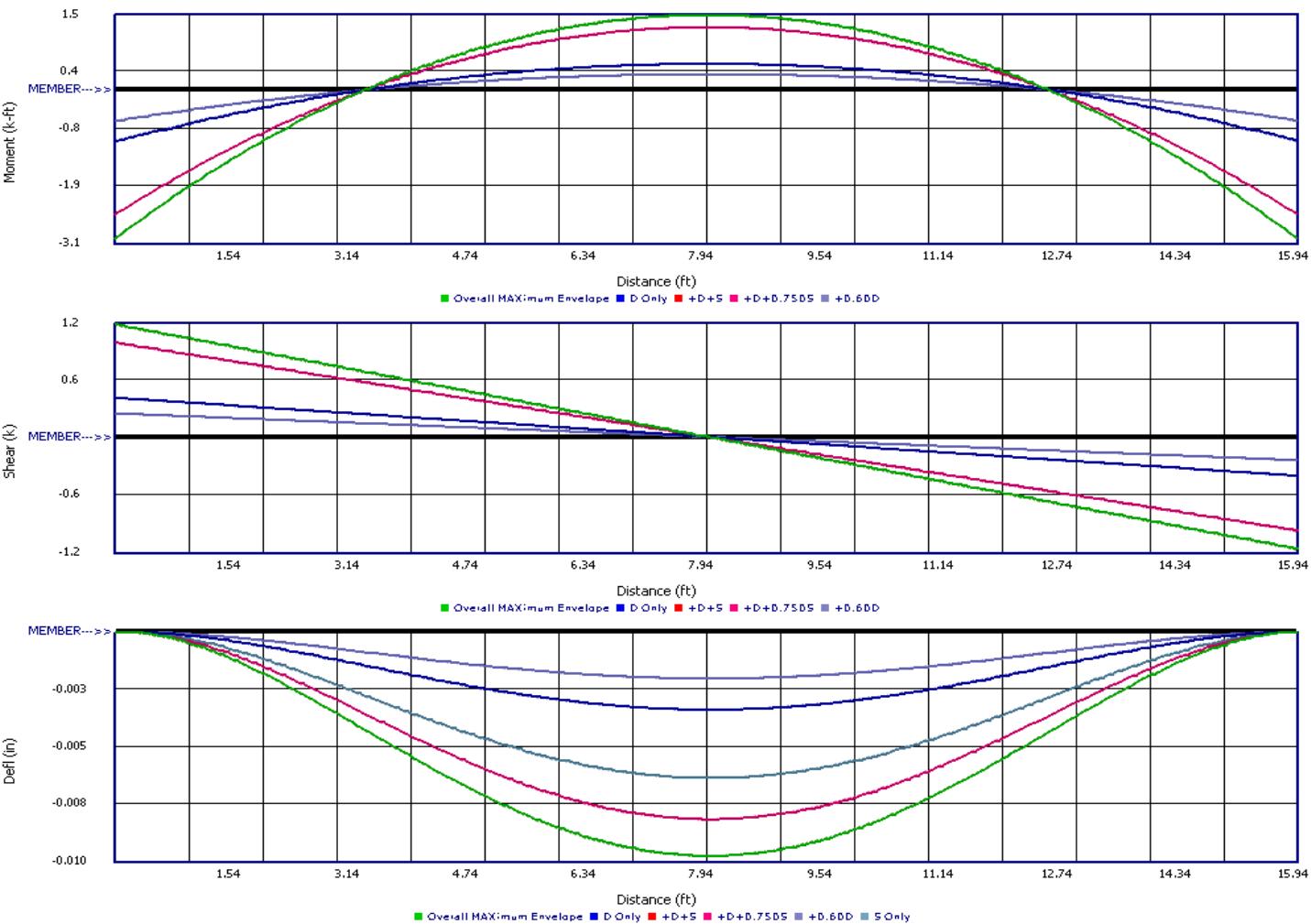
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DESCRIPTION: Front Canopy Channel

Steel Section Properties : C12x25

Depth	=	12.000 in	I _{xx}	=	144.00 in ⁴	J	=	0.538 in ⁴
Web Thick	=	0.387 in	S _{xx}	=	24.00 in ³	C _w	=	130.00 in ⁶
Flange Width	=	3.050 in	R _{xx}	=	4.430 in	R _o	=	4.720 in
Flange Thick	=	0.501 in	Z _x	=	29.400 in ³	H	=	0.909 in
Area	=	7.340 in ²	I _{yy}	=	4.450 in ⁴	W _{no}	=	11.000 in ²
Weight	=	25.000 plf	S _{yy}	=	1.870 in ³	S _w	=	5.290 in ⁴
Kdesign	=	1.130 in	R _{yy}	=	0.779 in	Q _f	=	7.670 in ³
			Z _y	=	3.820 in ³	Q _w	=	14.600 in ³
rts	=	1.000 in				W _{n2}	=	5.400
Ycg	=	6.000 in				S _{w2}	=	4.020
Xcg	=	0.674 in				S _{w3}	=	0.990 in ²
Xp	=	0.306 in						
Eo	=	0.746 in						

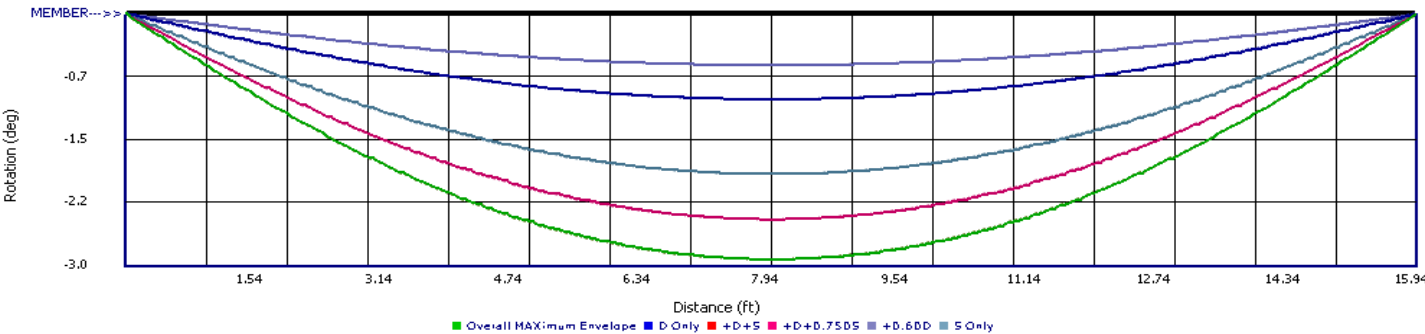


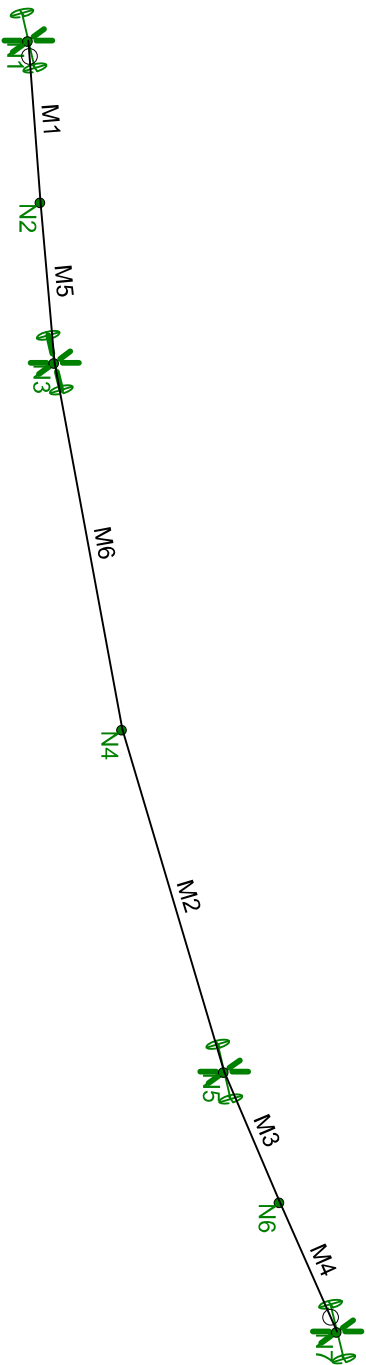
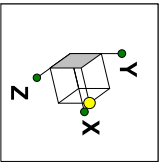
Steel Beam with Torsional Loads

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NORTON & SCHMIDT

DESCRIPTION: Front Canopy Channel





Norton & Schmidt Consulting Engrs ...

QT #4221

Boundary Conditions

Canopy Channel.r3d

NORTON & SCHMIDT
Consulting Engineers, LLC
311 E. 11th Avenue
North Kansas City, MO 64116
Phone: (816) 421-4232 Fax: (816) 421-1956

Project _____
Job No. _____
Calculated by _____ Date _____
Checked by _____ Sheet No. _____ of _____

ROOFED CONN. @ FRONT CANOPY CHANNEL

MAX REACTIONS $R_y = 3.6 \text{ K}$
 $M_x = 1.6 \text{ K'}$

FOR $M_x = 1.6 \text{ K'}$, SHEAR FORCE ON BOLT =
 $19.2 \text{ K"}/5" = 3.9 \text{ K}$

COMBINED SHEAR ON BOLT = $\frac{3.6}{2} + 3.9 = 5.7 \text{ K} < 10.6 \text{ K}$
OK



Company : Norton & Schmidt Consulting Engrs., LLC
Designer :
Job Number :
Model Name : QT #4221

Checked By: _____

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaphragm
1	N1	0	0	0	0	
2	N2	5.33	0	1.42	0	
3	N3	10.67	0	2.75	0	
4	N4	23.67	0	3.83	0	
5	N5	36.67	0	2.75	0	
6	N6	42	0	1.42	0	
7	N7	47.34	0	0	0	



Company : Norton & Schmidt Consulting Engrs., LLC
Designer :
Job Number :
Model Name : QT #4221

Checked By: _____

Member Primary Data

Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N1	N2		C12X25	Beam	Channel	A992	Typical
2	M2	N4	N5		C12X25	Beam	Channel	A992	Typical
3	M3	N5	N6		C12X25	Beam	Channel	A992	Typical
4	M4	N6	N7		C12X25	Beam	Channel	A992	Typical
5	M5	N2	N3		C12X25	Beam	Channel	A992	Typical
6	M6	N3	N4		C12X25	Beam	Channel	A992	Typical



Company : Norton & Schmidt Consulting Engrs., LLC
Designer :
Job Number :
Model Name : QT #4221

Checked By: _____

Member Distributed Loads (BLC 1 : DL)

	Member Label	Direction	Start Magnitude[k/ft, F, ksf]	End Magnitude[k/ft, F, ksf]	Start Location[ft, %]	End Location[ft, %]
1	M1	Y	-049	-049	0	0
2	M5	Y	-049	-049	0	0
3	M6	Y	-049	-049	0	0
4	M2	Y	-049	-049	0	0
5	M3	Y	-049	-049	0	0
6	M4	Y	-049	-049	0	0

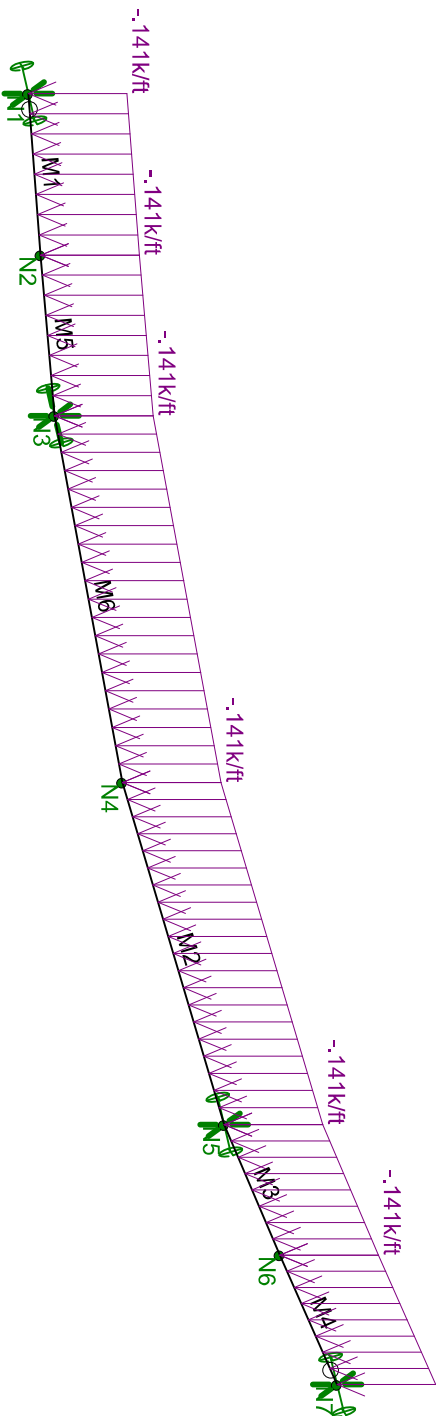
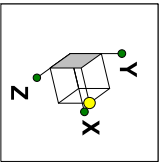


Company : Norton & Schmidt Consulting Engrs., LLC
Designer :
Job Number :
Model Name : QT #4221

Checked By: _____

Member Distributed Loads (BLC 2 : SL)

	Member Label	Direction	Start Magnitude[k/ft, F, ksf]	End Magnitude[k/ft, F, ksf]	Start Location[ft, %]	End Location[ft, %]
1	M1	Y	-.092	-.092	0	0
2	M5	Y	-.092	-.092	0	0
3	M6	Y	-.092	-.092	0	0
4	M2	Y	-.092	-.092	0	0
5	M4	Y	-.092	-.092	0	0
6	M3	Y	-.092	-.092	0	0



Loads: LC 1, DL+SL

Norton & Schmidt Consulting Engrs ...

QT #4221

DL + LL

Canopy Channel.r3d



Company : Norton & Schmidt Consulting Engrs., LLC
Designer :
Job Number :
Model Name : QT #4221

Checked By: _____

Joint Reactions (By Combination)

LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N1	0	-174	0	LOCKED	0
2	1	N3	0	3.566	1.587	0	0
3	1	N5	0	3.567	1.59	0	0
4	1	N7	0	-174	0	LOCKED	0
5	1	Totals:	0	6.786			
6	1	COG (ft):	X: 23.67	Y: 0	Z: 2.423		

MecaWind v2400

Software Developer: Meca Enterprises Inc., www.meca.biz, Copyright © 2020

Calculations Prepared by:

RW Sommer Engr., Inc.
PO Box 1032
Kearney, MO, 64060
Date: Dec 30, 2021

Basic Wind Parameters

Wind Load Standard	= ASCE 7-16	Exposure Category	= C
Wind Design Speed	= 115.0 mph	Risk Category	= I
Structure Type	= Other	Other Structure Type	= Freestanding Wall

General Wind Settings

Incl_LF	= Include ASD Load Factor of 0.6 in Pressures	= True
DynType	= Dynamic Type of Structure	= Rigid
Zg	= Altitude (Ground Elevation) above Sea Level	= 5431.000 ft
Bdist	= Base Elevation of Structure	= 0.000 ft
Reacs	= Show the Base Reactions in the output	= False
MMFRSType	= MMFRS Method Selected	= Ch 29

Topographic Factor per Fig 26.8-1

Topo	= Topographic Feature	= None
Kzt	= Topographic Factor	= 1.000

Freestanding Wall Inputs

h	: Height to Top of Wall	= 8.000 ft	B	: Horizontal Width of Wall	= 12.670 ft
Lr	: Dimension of return corner	= 0.000 ft	s	: Vertical Height of Wall	= 8.000 ft
e	: Solidity Ratio	= 1.000	t	: Thickness of Wall	= 0.67 ft
Dbl	: Double Faced & all sides enclosed	= False	Iscol	: Is the Wall Supported on Columns	= False

Exposure Constants per Table 26.11-1:

Alpha:	Table 26.11-1 Const	= 9.500	Zg:	Table 26.11-1 Const	= 900.000 ft
At:	Table 26.11-1 Const	= 0.105	Bt:	Table 26.11-1 Const	= 1.000
Am:	Table 26.11-1 Const	= 0.154	Bm:	Table 26.11-1 Const	= 0.650
C:	Table 26.11-1 Const	= 0.200	Eps:	Table 26.11-1 Const	= 0.200

Gust Factor Calculation:

Gust Factor Category I Rigid Structures - Simplified Method		
G1	= For Rigid Structures (Nat. Freq.>1 Hz) use 0.85	= 0.85
Gust Factor Category II Rigid Structures - Complete Analysis		
Zm	= Max(0.6 * Ht, Zmin)	= 15.000 ft
Izm	= Cc * (33 / Zm) ^ 0.167	= 0.228
Lzm	= L * (Zm / 33) ^ Eps	= 427.057

$$\begin{aligned} Q &= (1 / (1 + 0.63 * ((B + Ht) / Lzm)^{0.63}))^{0.5} &= 0.975 \\ G2 &= 0.925 * ((1 + 0.7 * Izm * 3.4 * Q) / (1 + 0.7 * 3.4 * Izm)) &= 0.912 \\ \text{Gust Factor Used in Analysis} & & \\ G &= \text{Lessor Of G1 Or G2} &= 0.850 \end{aligned}$$

Main Wind Force Resisting System (MMFRS) Calculations for Freestanding Wall per Ch 29:

$$\begin{aligned} LF &= \text{Load Factor based upon ASD Design} &= 0.60 \\ hs &= \text{Overall height of structure} &= 8.000 \text{ ft} \\ h &= \text{Mean Roof Height above grade} &= 8.000 \text{ ft} \\ Kh &= Z < 15 \text{ ft [4.572 m]} \rightarrow (2.01 * (15/zg)^{(2/Alpha)}) \{Table 26.10-1\} &= 0.849 \\ Kzt &= \text{Topographic Factor is 1 since no Topographic feature specified} &= 1.000 \\ Kd &= \text{Wind Directionality Factor per Table 26.6-1} &= 0.85 \\ qh &= (0.00256 * Kh * Kzt * Kd * Ke * V^2) * LF &= 12.04 \text{ psf} \end{aligned}$$

MMFRS Pressures on Freestanding Wall per Fig 29.3-1:

$$\begin{aligned} R &= \text{Reduction factor to account for openings: } (1 - (1 - e)^{1.5}) &= 1.000 \\ Rc &= \text{Reduction factor for Case C since } s/h > 0.8: (1.8 - s/h) &= 0.800 \\ As &= \text{Gross Area of Wall: } B * s &= 101.36 \text{ sq ft} \\ B/s &= \text{Aspect Ratio: } B / s &= 1.584 \\ s/h &= \text{Clearance Ratio: } s / h &= 1.000 \\ Cf &= \text{Net Force Coefficient for Case A and B per Fig 29.3-1} &= 1.420 \\ e &= \text{Not Double Faced, Case B eccentricity is 0.2} &= 0.2 \end{aligned}$$

$$\begin{aligned} \text{Case A:} & \text{Resultant force acts normal to face through geometric center} \\ & \text{and since } s/h = 1 \text{ then consider force acting } 0.05*s \text{ above the geometric center} \end{aligned}$$

$$\begin{aligned} 0.05*s &= \text{Since } s/h=1, \text{ load applied at vertical offset from geom center} &= 0.400 \text{ ft} \\ F &= \text{Design Wind force: } qh * G * Cf * As * R &= 1473 \text{ lb} \end{aligned}$$

$$\begin{aligned} \text{Case B:} & \text{Resultant force acts normal to face at a distance from the geometric} \\ & \text{center toward the windward edge equal to } e \text{ times the average width} \\ & \text{and since } s/h = 1 \text{ then consider force acting } 0.05*s \text{ above the geometric center} \end{aligned}$$

$$\begin{aligned} 0.05*s &= \text{Since } s/h=1, \text{ load applied at vertical offset from geom center} &= 0.400 \text{ ft} \\ Dx &= \text{Force Offset from Center toward windward edge: } e * B &= 2.534 \text{ ft} \\ F &= \text{Design Wind force: } qh * G * Cf * As * R &= 1473 \text{ lb} \end{aligned}$$

$$\text{Case C: Since } B/s < 2 \text{ then Case C need not be considered}$$

MASONRY WALL PANEL DESIGN (TMS 402/602-16)

In accordance with allowable stress design method

Tedds calculation version 2.2.09

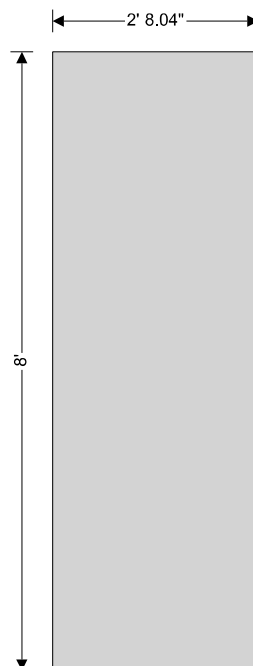
Masonry wall panel details

Reinforced single-wythe wall, the wall is free at the top and fixed at the bottom for out of plane loads

The wall is fixed at the bottom and free at the top for in plane loads

Panel length $L = 2.67$ ft

Panel height $h = 8$ ft



Seismic properties

Seismic design category B

Seismic importance factor (ASCE7 Table 1.5-2) $I_e = 1$

Design spectral response acceleration parameter, short periods (IBC 1613.2.4 or ASCE7 11.4.5)

$S_{DS} = 0.221$

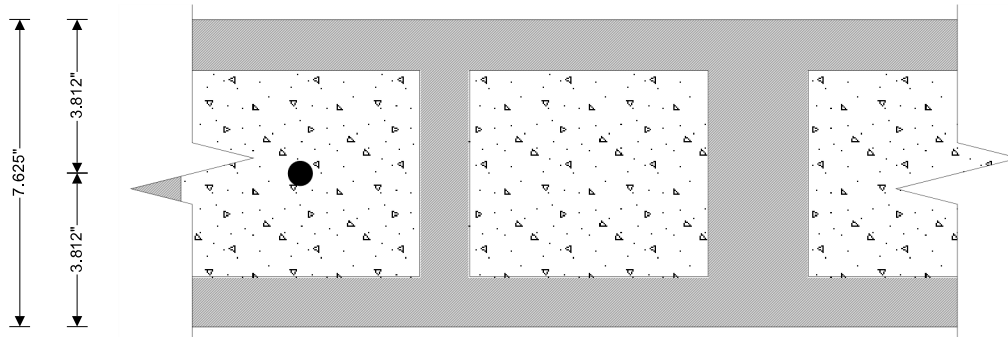
Seismic wall classification Nonparticipating

No prescriptive minimum seismic reinforcement

Redundancy factor, on out-of-plane load $\rho_E = 1.0$

Construction details

Wall thickness $t = 7.625$ in



Masonry details

Hollow clay units fully grouted in running bond fully bedded with PCL class M mortar

Compressive strength of unit

$$f_{cu} = 3350 \text{ psi}$$

Density of masonry units

$$\gamma_{block} = 115 \text{ lb/ft}^3$$

Height of masonry units

$$h_b = 4 \text{ in}$$

Length of masonry units

$$l_b = 15.625 \text{ in}$$

Number of internal webs

$$N_{web} = 1$$

Number of end webs

$$N_{end} = 2$$

Internal web thickness

$$t_{bw} = 1.25 \text{ in}$$

Face shell thickness

$$t_{bf} = 1.25 \text{ in}$$

End web thickness

$$t_{be} = 1.25 \text{ in}$$

Area of block

$$A_{block} = [t \times l_b - (l_b - N_{web} \times t_{bw} - N_{end} \times t_{be}) \times (t - 2 \times t_{bf})] / l_b = 44.76 \text{ in}^2/\text{ft}$$

Area of grout

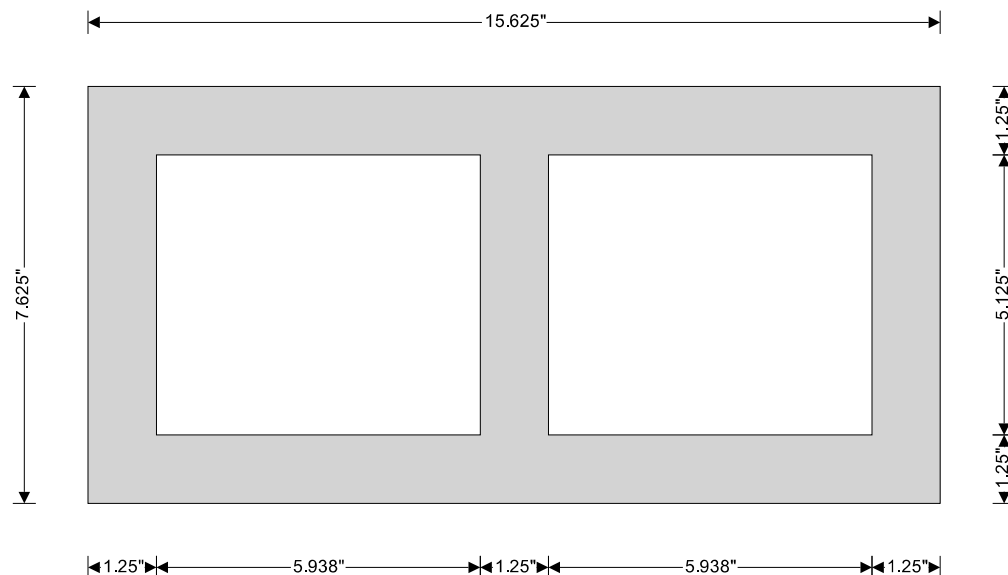
$$A_{grout} = [(l_b - N_{web} \times t_{bw} - N_{end} \times t_{be}) \times (t - 2 \times t_{bf})] / l_b = 46.74 \text{ in}^2/\text{ft}$$

Density of grout

$$\gamma_{grout} = 140 \text{ lb/ft}^3$$

Self weight of wall

$$WSW = A_{block} \times \gamma_{block} + A_{grout} \times \gamma_{grout} = 81.19 \text{ psf}$$



From TMS 602-16 Table 1 - Compressive strength of masonry

Net compressive strength of masonry $f_m = 1500$ psi
Modulus of elasticity for masonry $E_m = 700 \times f_m = 1050000$ psi
Shear modulus of masonry $G_v = 0.4 \times E_m = 420000$ psi

From TMS 402 -16 Table 8.2.4.2 - Allowable flexural tensile stresses for clay and concrete masonry

Allowable flexural tensile stress normal to bed $F_{t_norm} = 65$ psi
Allowable flexural tensile stress parallel to bed $F_{t_para} = 106$ psi

Reinforcement details

Yield strength of reinforcement $f_y = 60000$ psi
Allowable tensile stress in reinforcement $F_s = 32000$ psi
Modulus of elasticity for reinforcement $E_s = 29000000$ psi
Vertical reinforcement provided No.5 bars at 32 in centers
Area of vertical reinforcement $A_s = \pi \times \text{Dia}^2 / (4 \times s) = 0.12$ in²/ft
Yield strength of horizontal reinforcement $f_{yv} = 70000$ psi
Allowable tensile stress in horizontal reinforcement $F_{sv} = 30000$ psi
Horizontal reinforcement provided (2) W2.8 wires at 9 in centers
Area of horizontal reinforcement $A_v = 2 \times \pi \times \text{HDia}^2 / (4 \times s_v) = 0.07$ in²/ft
Minimum area of vertical reinf. (8.3.5.2.2) $A_{s_min} = A_v / 3 = 0.02$ in²/ft

PASS - Area of vertical reinforcement provided exceeds the minimum

Lateral out-of-plane loads

Wind load on panel $W = 20$ psf
Wind load on parapet $W_p = 18$ psf
Seismic load factor (ASCE7 12.11.1) $F_p = 0.4 \times S_{DS} \times I_e = 0.088$
Seismic load from wall $E_{wall} = \max(F_p, 0.1) \times w_{sw} = 8.1$ psf
Additional seismic load $E_{add} = 0$ psf
Seismic lateral load on panel $E = E_{wall} + E_{add} = 8.1$ psf

Lateral in-plane loads

Vertical loading details

Vertical seismic load factor applied to dead load $F_{Ev} = 0.2 \times S_{DS} = 0.044$

From IBC 2018 cl.1605.3.1 - Basic load combinations (Utilization)

Load combination no.5 $DL + 0.6 \times W$ (0.314)
Load combination no.6 $DL + 0.7 \times E_h + 0.7 \times E_v$ (0.148)
Load combination no.7 $DL + 0.45 \times W + 0.75 \times LL + 0.75 \times (LL_r \text{ or } SL \text{ or } RL)$ (0.235)
Load combination no.8 $DL + 0.525 \times E_h + 0.525 \times E_v + 0.75 \times LL + 0.75 \times SL$ (0.111)
Load combination no.9 $0.6 \times DL + 0.6 \times W$ (0.333)
Load combination no.10 $0.6 \times DL + 0.7 \times E_h - 0.7 \times E_v$ (0.158)

Properties of masonry section

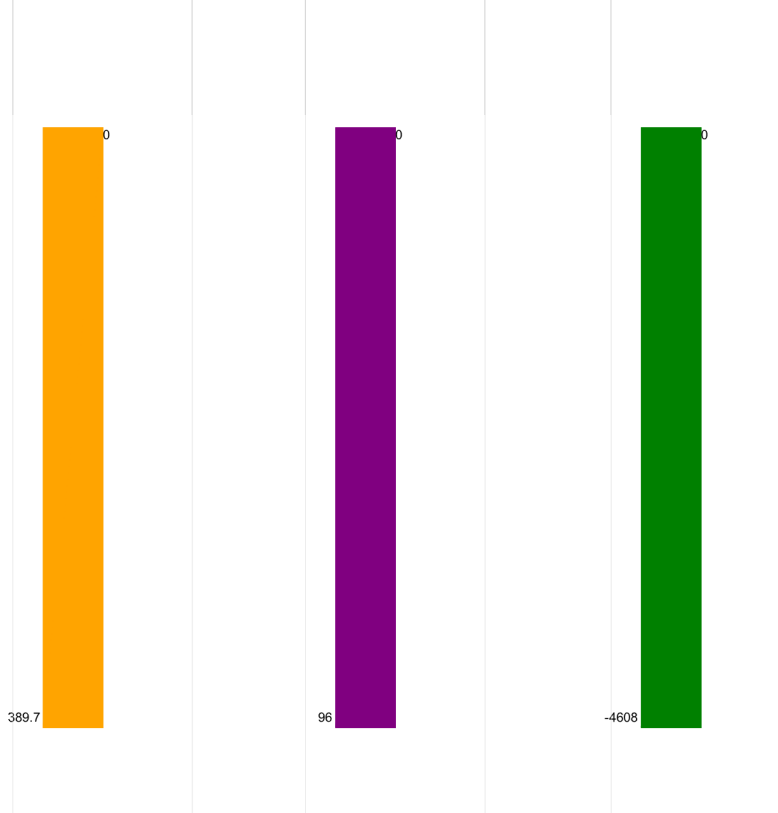
Cross-sectional area $A = t = 91.5$ in²/ft
Properties for walls loaded out-of-plane:
Moment of inertia $I = t^3 / 12 = 443.3$ in⁴/ft
Section modulus $S = I / c = 116.3$ in³/ft
Radius of gyration $r = \sqrt{I / A} = 2.201$ in

Effective height factor

$K = 1$

Consider wall at bottom under load combination no.9

Axial force, out of plane - Combination No.9 - lbs/ft Shear force, out of plane - Combination No.9 - lbs/ft Moment force, out of plane - Combination No.9 - lb_in



Axial load at bottom of panel

$P = 390 \text{ lb/ft}$

Compressive stress due to axial load

$f_a = P / A = 4.3 \text{ psi}$

Slenderness ratio

$(K \times h) / r = 43.614 < 99$

Allowable compressive stress due to axial load

$F_a = (1 / 4) \times f'_m \times [1 - ((K \times h) / (140 \times r))^2] = 338.6 \text{ psi}$

$f_a / F_a = 0.013$

PASS - Allowable compressive stress exceeds compressive stress due to axial loads

Allowable compressive force

$P_a = 0.25 \times f'_m \times (A - A_s) \times [1 - ((K \times h) / (140 \times r))^2] = 30944 \text{ lb/ft}$

$P / P_a = 0.013$

PASS - Allowable compressive force exceeds axial load

Bending moment at bottom of panel

$M = 4608 \text{ lb_in/ft}$

Depth of reinforcement

$d = 3.813 \text{ in}$

Effective width per bar

$b_{eff} = \min(s, 6 \times t_{nom}, 72 \text{ in}) = 32 \text{ in}$

Modular ratio

$n = E_s / E_m = 27.619$

Allowable compressive stress due to flexural load

$F_b = (0.45) \times f'_m = 675 \text{ psi}$

Balance point

$k_{bal} = n / (F_s / F_b + n) = 0.368$

Tensile strain in reinforcement

$\epsilon_s = F_s / E_s = 0.001103$

Compressive strain in masonry

$\epsilon_m = \epsilon_s \times k_{bal} / (1 - k_{bal}) = 0.000643$

Compressive stress at balance point

$$f_{bal} = \epsilon_m \times E_m = \mathbf{675 \text{ psi}}$$

Tension at balance point

$$T_{bal} = A_s \times F_s = \mathbf{3682 \text{ lb/ft}}$$

Compression at balance point

$$C_{bal} = k_{bal} \times d \times f_{bal} / 2 = \mathbf{5684 \text{ lb/ft}}$$

Axial load at balance point

$$P_{bal} = C_{bal} - T_{bal} = \mathbf{2003 \text{ lb/ft}}$$

Moment at balance point

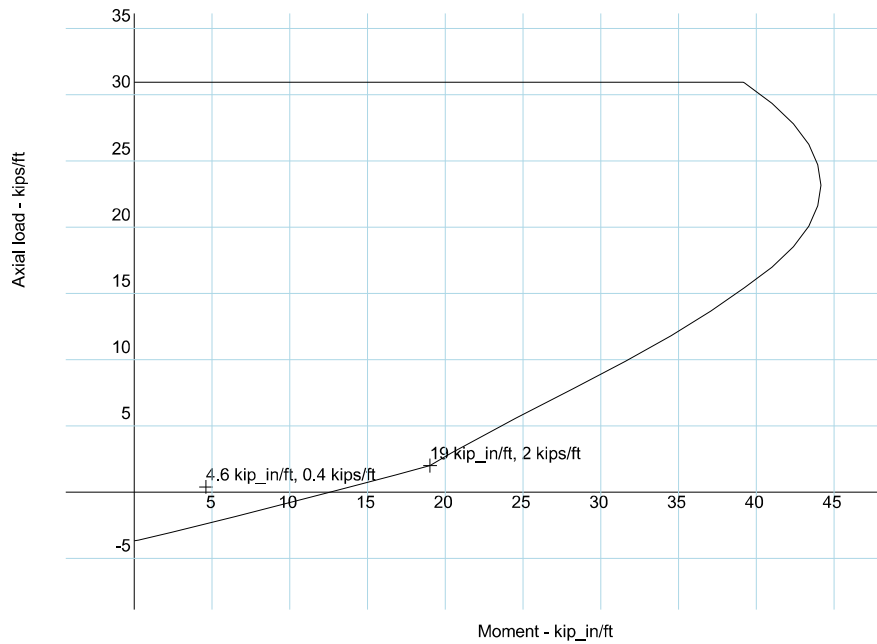
$$M_{bal} = T_{bal} \times (d - t / 2) + C_{bal} \times (t / 2 - k_{bal} \times d / 3) = \mathbf{19011 \text{ lb_in/ft}}$$

Maximum moment from interaction diagram

$$M_c = \mathbf{13837 \text{ lb_in/ft}}$$

$$M / M_c = \mathbf{0.333}$$

PASS - Combination of applied axial load and flexure is acceptable



Allowable stress interaction diagram

Consider wall at bottom under load combination no.9

Shear force

$$V = \mathbf{96 \text{ lb/ft}}$$

Net shear area

$$A_{nv} = d = \mathbf{45.8 \text{ in}^2/\text{ft}}$$

Shear stress

$$f_v = V / A_{nv} = \mathbf{2.1 \text{ psi}}$$

Compressive force

$$N_v = 0.60 \times P_{DL,b,out} / 1 \text{ ft} = \mathbf{389.7 \text{ lb/ft}}$$

Moment

$$M = \mathbf{4608 \text{ lb_in/ft}}$$

Allowable masonry shear stress

$$F_{vm} = 0.5 \times [4 - 1.75 \times \min((M / (V \times d)), 1.0)] \times \sqrt{(f_m \times 1 \text{ psi})} + 0.25 \times N_v / A = \mathbf{44.6 \text{ psi}}$$

Allowable shear stress

$$F_v = \min(F_{vm}, 2 \times \sqrt{(f_m \times 1 \text{ psi})}) = \mathbf{44.6 \text{ psi}}$$

Shear utilization

$$f_v / F_v = \mathbf{0.047}$$

PASS - Allowable shear stress exceeds applied shear stress