Eastern
Engineering Group

3401 NW 82nd Avenue
Ste. 370 Doral, FL 33122
(305) 599-8133
info@easterneg.com
www.easterneg.com

PINECREST EIGHT
Eastern Engineering Group

Job. No: 24-0609

13100 SW 80 AVE TERRACE, MIAMI, FLORIDA

STRUCTURAL CALCULATION

RAISSA R. LOPEZ
LICENSE
No 59399
STATE OF FLORIDA
PROFESSIONAL ENGINEER

Raissa R Lopez
2024.12.23 11:25:31-05'00'

Prepared By:
☐ Raissa Lopez, PE
Lic. No. 59399
CAN # 26655

3401 NW 82nd Ave, Suite 370, Miami, Florida 33122
Telf. (305) 599–8133 / Email: info@easterneg.com

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DESIGN CRITERIA:

Calculations based on:

1. 2023 Florida Building Code
2. Minimum Design Loads for Buildings and Other Structures ASCE 7-22
3. Building Code Requirements for Structural Concrete ACI 318-19
4. American Institute of Steel Construction AISC-16ed
5. Aluminum Design Manual 2015
6. Specifications for the Design of Cold-Formed Stainless Steel Structural Members SEI/ASCE8-02

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X.	Parapet Design	124-127
		Total Pages = 127

CALCULATION STATEMENT:

To the best of my knowledge, ability, belief and professional judgment, I hereby attest that the manual calculations and computer-generated calculations are in compliance with the existing governing codes.

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WIND ANALYSIS

MecaWind v2439

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Calculations Prepared by:
Date: May 16, 2024
File Location: N:\EEG ACTIVE\Work in Progress\2024\24 0609 P8\Strc\24 0609-P8.wnd

General:

Wind Load Standard	=	ASCE 7-22	Basic Wind Speed	=	175.0 mph
Exposure Classification	=	C	Risk Category	=	II
Structure Type	=	Building	Design Basis for Wind Pressures	=	ASD
MWFRS Analysis Method	=	Ch 27	C&C Analysis Method	=	Ch 30 Pt 1
Dynamic Type of Structure	=	Rigid	Show Advanced Options	=	False

Building:

Roof	=	Roof Type	=	Flat	Encl	=	Enclosure Classification	=	Enclosed
Help	=	Help on Building Roof Type	=	Help	RfHt	=	Roof Height	=	25.000 ft
W	=	Building Width	=	67.000 ft	L	=	Building Length	=	111.000 ft
OH	=	Type of Overhang	=	All Overhang	Par	=	Parapet	=	Solid
P_{ht}	=	Parapet Height	=	2 ft	HT_{over}	=	Override Mean Roof Height	=	True
Ht_{man}	=	Mean Roof Height	=	25.000 ft	RA_{over}	=	Override Roof Area	=	False
IsElev	=	Building is Elevated	=	False		=			

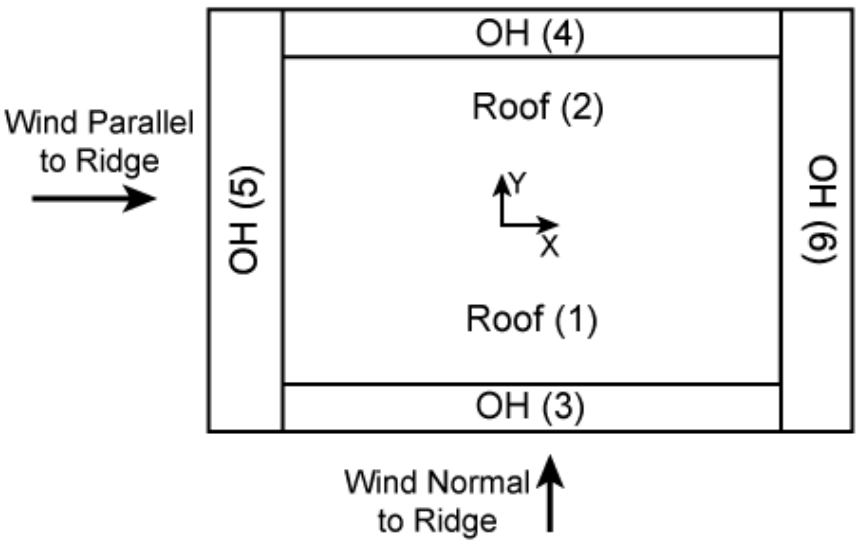
Exposure Constants [Tbl 26.11-1]:

α = 3-s Gust-speed exponent	=	9.800	Z_g= Nominal Ht of Boundary Layer	=	2460.000 ft
â = Reciprocol of α	=	0.102	b = 3 sec gust speed factor	=	1.000
α_m= Mean hourly Wind-Speed Exponent	=	0.156	b_m= Mean hourly Windspeed Exponent	=	0.660
c = Turbulence Intensity Factor	=	0.200	ε = Integral Length Scale Exponent	=	0.2000

Overhang Inputs:

Std	=	Overhangs on all sides are the same	=	True
OHType	=	Type of Roof Wall Intersections	=	Overhang
OH	=	Overhang of Roof Beyond Wall	=	4.000 ft

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



h	=	Mean structure height	=	25.000 ft
K_h	=	$2.41 \cdot (Z/Z_g)^{2/\alpha}$ [Tbl 26.10-1]	=	0.945
K_{zt}	=	No Topographic feature specified	=	1.000
K_d	=	Wind Directionality Factor per Tbl 26.6-1	=	0.85
$+GC_{pi}$	=	Enclosed Positive Internal Pressure Tbl 26.13-1	=	+0.18
$-GC_{pi}$	=	Enclosed Negative Internal Pressure Tbl 26.13-1	=	-0.18
LF	=	Load Factor based upon ASD Design	=	0.60
K_e	=	Ground Elev Factor [Tbl 26.10-1]	=	1.000
q_h	=	$0.00256 \cdot K_h \cdot K_{zt} \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1]	=	44.44 psf
RA	=	Roof Area	=	8925.00 ft^2
q_h	=	$0.00256 \cdot K_h \cdot K_{zt} \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1]	=	44.44 psf
q_p	=	$0.00256 \cdot K_z \cdot K_{zt} \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1]	=	45.14 psf
q_{in}	=	Negative Internal Pressure: $q_h \cdot LF$	=	44.44 psf

q_{ip} = Positive Internal Pressure: $q_h \cdot LF$ = 44.44 psf

MWFRS Wind Loads [Normal to Ridge]

h = Mean Roof Height Of Building = 25.000 ft
hp = Height To the top Of the Parapet = 27.000 ft
RHt = Ridge Height Of Roof = 25.000 ft
B = Horizontal Dimension Of Building Normal To Wind Direction = 111.000 ft
L = Horizontal Dimension Of building Parallel To Wind Direction = 67.000 ft
L/B = Ratio Of L/B used For Cp determination = 0.604
h/L = Ratio Of h/L used For Cp determination = 0.373
Slope = Slope Of Roof = 0.0 Deg

Gust Factor Calculation for Wind: [Normal to Ridge]

Gust Factor Category I Rigid Structures - Simplified Method

G_1 = Simplified: For Rigid Structures can use 0.85 = 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Z_m = Equiv Struc Height: Max(0.6•h, Z_{min}) = 15.000 ft
I_{zm} = Turbulence Intensity: $c \cdot (33/Z_m)^{1/6}$ [Eq 26.11-7] = 0.228
L_{zm} = Turbulence Integral Length Scale: $\ell \cdot (Z_m/33)^{\varepsilon}$ [Eq 26.11-9] = 427.057 ft
B = Building Width Width Normal to Wind Direction = 111.000 ft
Q = $1/(1+0.63 \cdot [(B+h)/L_{zm}]^{0.63})$ [Eq 26.11-8] = 0.875
G_2 = Detailed: $0.925 \cdot [(1+1.7 \cdot g_q \cdot I_{zm} \cdot Q)/(1+1.7 \cdot g_v \cdot I_{zm})]$ [Eq 26.11-6] = 0.859

Gust Factor Used in Analysis

G = Gust Factor: Min(G_1, G_2) = 0.850

Cp_{WW} = Windward Wall Coefficient (All L/B Values) = 0.800
Cp_{LW} = Leeward Wall Coefficient using L/B = -0.500
Cp_{SW} = Side Wall Coefficient (All L/B values) = -0.700
GC_{pn_ww} = Parapet Combined Net Pressure Coefficient (Windward Parapet) = 1.500
GC_{pn_lw} = Parapet Combined Net Pressure Coefficient (Leeward Parapet) = -1.000

Wind Pressures [Normal to Ridge]
All wind pressures include a Load Factor (LF) of 0.6

Elev ft	GC_{pi}	q_i psf	K_z	K_{zt}	q_z psf	Windward Press psf	Leeward Press psf	Side Press psf	Total Press psf	Minimum Pressure* psf
27.000	Parapet	44.44	0.960	1.000	45.14	57.55	-38.37	0.00	95.92	9.60
25.000	+0.18	44.44	0.945	1.000	44.44	18.89	-22.85	-29.27	41.74	9.60
27.000	Parapet	44.44	0.960	1.000	45.14	57.55	-38.37	0.00	95.92	9.60
25.000	-0.18	44.44	0.945	1.000	44.44	32.48	-9.25	-15.68	41.74	9.60

K_z = $2.41 \cdot (Z/Z_g)^{2/\alpha}$
GC_{pi} = Enclosed Internal Pressure Tbl 26.13-1
q_{ip} = Positive Internal Pressure: $q_h \cdot LF$
Side = $q_h \cdot K_d \cdot G \cdot Cp_{SW} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ 27.3-1
Windward = $q_z \cdot K_d \cdot G \cdot Cp_{WW} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ 27.3-1
p_p = $q_h \cdot K_d \cdot (GC_{pn\_ww})$ MecaLibrary.RefEntry 27.3-3

K_{zt} = No Topographic feature specified
q_z = $0.00256 \cdot K_z \cdot K_{zt} \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1]
q_{in} = Negative Internal Pressure: $q_h \cdot LF$
Leeward = $q_h \cdot K_d \cdot G \cdot Cp_{LW} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ 27.3-1
Total = Windward - Leeward
p_p = $q_h \cdot K_d \cdot (GC_{pn\_lw})$ MecaLibrary.RefEntry 27.3-3

- *Minimum Pressure: § 27.1.5 no less than 9.60 psf (Incl LF) applied to Walls*
- *Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface*

Roof Wind Pressures for Positive & Negative Internal Pressure ($\pm GC_{pi}$) [Normal to Ridge]
All wind pressures include a Load Factor (LF) of 0.6

Reference	Description	Location	Start Dist ft	End Dist ft	C_p Min	C_p Max	GC_{pi}	Pressure Min psf	Pressure Max psf
OH_Bot	Overhang Bottom	3	All	All	0.800	0.800	+0.00/-0.00	25.68	25.68
OH_Top	Overhang Top (0 to h)	3,5,6	0.000	25.000	-0.900	-0.180	+0.00/-0.00	-28.90	-5.78
OH_Top	Overhang Top (h to 2*h)	5,6	25.000	50.000	-0.500	-0.180	+0.00/-0.00	-16.05	-5.78
OH_Top	Overhang Top (>= 2*h)	4,5,6	50.000	75.000	-0.300	-0.180	+0.00/-0.00	-9.63	-5.78
Roof	Roof (0 to h)	All	4.000	25.000	-0.900	-0.180	+0.18/-0.18	-35.69	1.02
Roof	Roof (h to 2*h)	All	25.000	50.000	-0.500	-0.180	+0.18/-0.18	-22.85	1.02
Roof	Roof (>= 2*h)	All	50.000	71.000	-0.300	-0.180	+0.18/-0.18	-16.43	1.02

Roof Pressures based upon Ch 27:
Start = Start Dist from Windward Edge
C_{p_min} = Smallest Coefficient Magnitude
$Press_{Min}$ = $q_h \cdot K_d \cdot G \cdot C_{p\_min} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ 27.3-1
End = End Dist from Windward Edge
C_{p_max} = Largest Coefficient Magnitude
$Press_{Max}$ = $q_h \cdot K_d \cdot G \cdot C_{p\_max} - q_{in} \cdot K_d \cdot (-GC_{pi})$ 27.3-1

- *No reduction factor was applicable*
- *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*
- *Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface*

MWFRS Wind Loads [Parallel to Ridge]

h	=	Mean Roof Height Of Building	=	25.000 ft
hp	=	Height To the top Of the Parapet	=	27.000 ft
RHt	=	Ridge Height Of Roof	=	25.000 ft
B	=	Horizontal Dimension Of Building Normal To Wind Direction	=	67.000 ft
L	=	Horizontal Dimension Of building Parallel To Wind Direction	=	111.000 ft
L/B	=	Ratio Of L/B used For Cp determination	=	1.657
h/L	=	Ratio Of h/L used For Cp determination	=	0.225
Slope	=	Slope Of Roof	=	0.0 Deg

Gust Factor Calculation for Wind: [Parallel to Ridge]

Gust Factor Category I Rigid Structures - Simplified Method

G_1	=	Simplified: For Rigid Structures can use 0.85	=	0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Z_m	=	Equiv Struc Height: Max(0.6•h, Z_{min})	=	15.000 ft
I_{zm}	=	Turbulence Intensity: $c•(33/Z_m)^{1/6}$[Eq 26.11-7]	=	0.228
L_{zm}	=	Turbulence Integral Length Scale: $\ell•(Z_m/33)^{\varepsilon}$[Eq 26.11-9]	=	427.057 ft
B	=	Building Width Width Normal to Wind Direction	=	67.000 ft
Q	=	$1/(1+0.63•[(B+h)/L_{zm}]^{0.63})$ [Eq 26.11-8]	=	0.898
G_2	=	Detailed: $0.925•[(1+1.7•g_q•I_{zm}•Q)/(1+1.7•g_v•I_{zm})]$ [Eq 26.11-6]	=	0.871

Gust Factor Used in Analysis

G	=	Gust Factor: Min(G_1, G_2)	=	0.850

Cp_{WW}	=	Windward Wall Coefficient (All L/B Values)	=	0.800
Cp_{LW}	=	Leeward Wall Coefficient using L/B	=	-0.369
Cp_{SW}	=	Side Wall Coefficient (All L/B values)	=	-0.700
GC_{pn_ww}	=	Parapet Combined Net Pressure Coefficient (Windward Parapet)	=	1.500
GC_{pn_lw}	=	Parapet Combined Net Pressure Coefficient (Leeward Parapet)	=	-1.000

Wind Pressures [Parallel to Ridge]
All wind pressures include a Load Factor (LF) of 0.6

Elev ft	GC_{pi}	q_i psf	K_z	K_{zt}	q_z psf	Windward Press psf	Leeward Press psf	Side Press psf	Total Press psf	Minimum Pressure* psf
27.000	Parapet	44.44	0.960	1.000	45.14	57.55	-38.37	0.00	95.92	9.60
25.000	+0.18	44.44	0.945	1.000	44.44	18.89	-18.64	-29.27	37.52	9.60
27.000	Parapet	44.44	0.960	1.000	45.14	57.55	-38.37	0.00	95.92	9.60
25.000	-0.18	44.44	0.945	1.000	44.44	32.48	-5.04	-15.68	37.52	9.60

K_z = $2.41•(Z/Z_g)^{2/\alpha}$
GC_{pi} = Enclosed Internal Pressure Tbl 26.13-1
q_{ip} = Positive Internal Pressure: $q_h•LF$
Side = $q_h•K_d•G•Cp_{SW}-q_{ip}•K_d•(+GC_{pi})$ 27.3-1
Windward = $q_z•K_d•G•Cp_{WW}-q_{ip}•K_d•(+GC_{pi})$ 27.3-1
p_p = $q_h•K_d•(GC_{pn\_ww})$ MecaLibrary.RefEntry 27.3-3

K_{zt} = No Topographic feature specified
q_z = $0.00256•K_z•K_{zt}•K_e•V^2*LF$ [Eq 26.10-1]
q_{in} = Negative Internal Pressure: $q_h•LF$
Leeward = $q_h•K_d•G•Cp_{LW}-q_{ip}•K_d•(+GC_{pi})$ 27.3-1
Total = Windward - Leeward
p_p = $q_h•K_d•(GC_{pn\_lw})$ MecaLibrary.RefEntry 27.3-3

- *Minimum Pressure: § 27.1.5 no less than 9.60 psf (Incl LF) applied to Walls*
- *Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface*

Roof Wind Pressures for Positive & Negative Internal Pressure ($\pm GC_{pi}$) [Parallel to Ridge]
All wind pressures include a Load Factor (LF) of 0.6

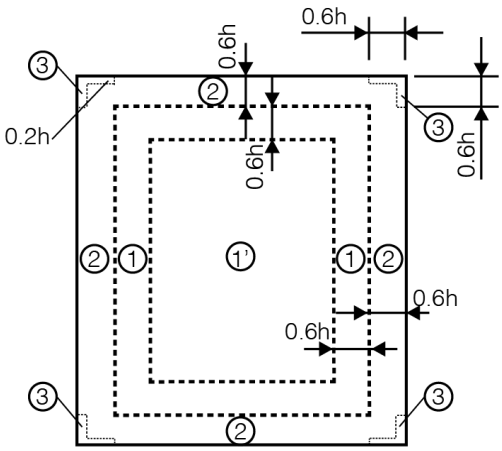
Reference	Description	Location	Start Dist ft	End Dist ft	C_p Min	C_p Max	GC_{pi}	Pressure Min psf	Pressure Max psf
OH_Bot	Overhang Bottom	5	All	All	0.800	0.800	+0.00/-0.00	25.68	25.68
OH_Top	Overhang Top (0 to h)	3,4,5	0.000	25.000	-0.900	-0.180	+0.00/-0.00	-28.90	-5.78
OH_Top	Overhang Top (h to 2*h)	3,4	25.000	50.000	-0.500	-0.180	+0.00/-0.00	-16.05	-5.78
OH_Top	Overhang Top (>= 2*h)	3,4,6	50.000	119.000	-0.300	-0.180	+0.00/-0.00	-9.63	-5.78
Roof	Roof (0 to h)	All	4.000	25.000	-0.900	-0.180	+0.18/-0.18	-35.69	1.02
Roof	Roof (h to 2*h)	All	25.000	50.000	-0.500	-0.180	+0.18/-0.18	-22.85	1.02
Roof	Roof (>= 2*h)	All	50.000	115.000	-0.300	-0.180	+0.18/-0.18	-16.43	1.02

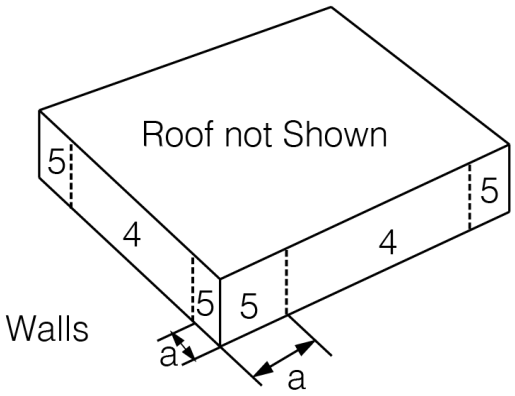
Roof Pressures based upon Ch 27:
Start = Start Dist from Windward Edge
C_{p_min} = Smallest Coefficient Magnitude
$Press_{Min}$ = $q_h•K_d•G•C_{p\_min}-q_{ip}•K_d•(+GC_{pi})$ 27.3-1
End = End Dist from Windward Edge
C_{p_max} = Largest Coefficient Magnitude
$Press_{Max}$ = $q_h•K_d•G•C_{p\_max}-q_{in}•K_d•(-GC_{pi})$ 27.3-1

- *No reduction factor was applicable*
- *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*
- *Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface*

Components and Cladding (C&C) Wind Roof & Wall Summary per Ch 30 Pt 1:

h/W	=	Ratio of mean roof height to building width	=	0.373
h/L	=	Ratio of mean roof height to building length	=	0.225
h	=	Mean structure height	=	25.000 ft
K_h	=	$2.41 \cdot (Z/Z_g)^{2/\alpha}$	=	0.945
K_{zt}	=	No Topographic feature specified	=	1.000
K_d	=	Wind Directionality Factor per Tbl 26.6-1	=	0.85
$+GC_{pi}$	=	Enclosed Positive Internal Pressure Tbl 26.13-1	=	+0.18
$-GC_{pi}$	=	Enclosed Negative Internal Pressure Tbl 26.13-1	=	-0.18
LF	=	Load Factor based upon ASD Design	=	0.60
K_e	=	Ground Elev Factor [Tbl 26.10-1]	=	1.000
q_h	=	$0.00256 \cdot K_h \cdot K_{zt} \cdot K_e \cdot V^2 * LF$ [Eq 26.10-1]	=	44.44 psf
LHD	=	Least Horizontal Dimension: Min(B, L)	=	67.000 ft
a_1	=	Min(0.1•LHD, 0.4•h)	=	6.700 ft
a	=	Max(a_1, 0.04•LHD, 3 ft [0.9 m])	=	6.700 ft
h/B	=	Ratio of mean roof height to least horizontal dim: h/B	=	0.373
0.2*h	=	Parameter used to define Zone 3	=	5.000 ft
0.6*h	=	Parameter used to define Zones 1 and 2	=	15.000 ft





Wind Pressure Summary for C&C Roof & Wall based Upon Areas Ch 30 Pt 1 (Table 1 of 2)
All wind pressures include a Load Factor (LF) of 0.6

Zone	Figure	A ≤ 10.00 ft² psf	A = 20.00 ft² psf	A = 50.00 ft² psf	A = 100.00 ft² psf
1	30.3-2A	18.13 - 71.01	16.99 - 66.33	15.49 - 60.13	14.35 - 55.45
1'	30.3-2A	18.13 - 40.79	16.99 - 40.79	15.49 - 40.79	14.35 - 40.79
2	30.3-2A	18.13 - 93.67	16.99 - 87.65	15.49 - 79.69	14.35 - 73.67
3	30.3-2A	18.13 - 127.67	16.99 - 115.62	15.49 - 99.70	14.35 - 87.65
4	30.3-1	40.79 - 44.19	38.99 - 42.39	36.60 - 40.00	34.79 - 38.19
4_P (P1/P4)	30.3-1/30.3-2A	34.53 - 37.99	32.70 - 36.15	30.27 - 33.72	28.44 - 31.89
4_P (P3/P2)	30.3-1/30.3-2A	34.53 - 88.25	32.70 - 82.13	30.27 - 74.04	28.44 - 67.92
4_P (P1-P2)/(P3-P4)	30.3-1/30.3-2A	122.78 72.52	114.83 68.85	104.31 63.99	96.36 60.32
5	30.3-1	40.79 - 54.39	38.99 - 50.78	36.60 - 46.00	34.79 - 42.39
5_P (P1/P4)	30.3-1/30.3-2A	34.53 - 48.35	32.70 - 44.67	30.27 - 39.82	28.44 - 36.15
5_P (P3/P2)	30.3-1/30.3-2A	34.53 - 122.78	32.70 - 110.55	30.27 - 94.37	28.44 - 82.13
5_P (P1-P2)/(P3-P4)	30.3-1/30.3-2A	157.32 82.88	143.24 77.37	124.64 70.09	110.57 64.59
1_OH	30.3-2A	9.60 - 64.21	9.60 - 63.08	9.60 - 61.57	9.60 - 60.44
1'_OH	30.3-2A	9.60 - 64.21	9.60 - 63.08	9.60 - 61.57	9.60 - 60.44
2_OH	30.3-2A	9.60 - 86.88	9.60 - 78.84	9.60 - 68.23	9.60 - 60.20
3_OH	30.3-2A	9.60 - 120.87	9.60 - 106.82	9.60 - 88.24	9.60 - 74.18

Wind Pressure Summary for C&C Roof & Wall based Upon Areas Ch 30 Pt 1 (Table 2 of 2)
All wind pressures include a Load Factor (LF) of 0.6

Zone	Figure	A = 200.00 ft² psf	A = 500.00 ft² psf	A > 1000.00 ft² psf
1	30.3-2A	14.35 -50.76	14.35 -44.57	14.35 -44.57
1'	30.3-2A	14.35 -35.11	14.35 -27.59	14.35 -21.91
2	30.3-2A	14.35 -67.64	14.35 -59.68	14.35 -59.68
3	30.3-2A	14.35 -75.60	14.35 -59.68	14.35 -59.68
4	30.3-1	32.98 -36.38	30.60 -33.99	30.60 -33.99
4_P (P1/P4)	30.3-1/30.3-2A	26.60 -30.05	24.17 -27.63	24.17 -27.63
4_P (P3/P2)	30.3-1/30.3-2A	26.60 -61.81	24.17 -53.72	24.17 -53.72
4_P (P1-P2)/(P3-P4)	30.3-1/30.3-2A	88.41 56.65	77.89 51.80	77.89 51.80
5	30.3-1	32.98 -38.77	30.60 -33.99	30.60 -33.99
5_P (P1/P4)	30.3-1/30.3-2A	26.60 -32.48	24.17 -27.63	24.17 -27.63
5_P (P3/P2)	30.3-1/30.3-2A	26.60 -69.89	24.17 -53.72	24.17 -53.72
5_P (P1-P2)/(P3-P4)	30.3-1/30.3-2A	96.49 59.08	77.89 51.80	77.89 51.80
1_OH	30.3-2A	9.60 -50.67	9.60 -37.77	9.60 -37.77
1'_OH	30.3-2A	9.60 -50.67	9.60 -37.77	9.60 -37.77
2_OH	30.3-2A	9.60 -52.17	9.60 -41.55	9.60 -41.55
3_OH	30.3-2A	9.60 -60.13	9.60 -41.55	9.60 -41.55

** 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 § 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.*

Eastern
Engineering Group

3401 NW 82nd Avenue
Ste. 370 Doral, FL 33122
(305) 599-8133
info@easterneg.com
www.easterneg.com

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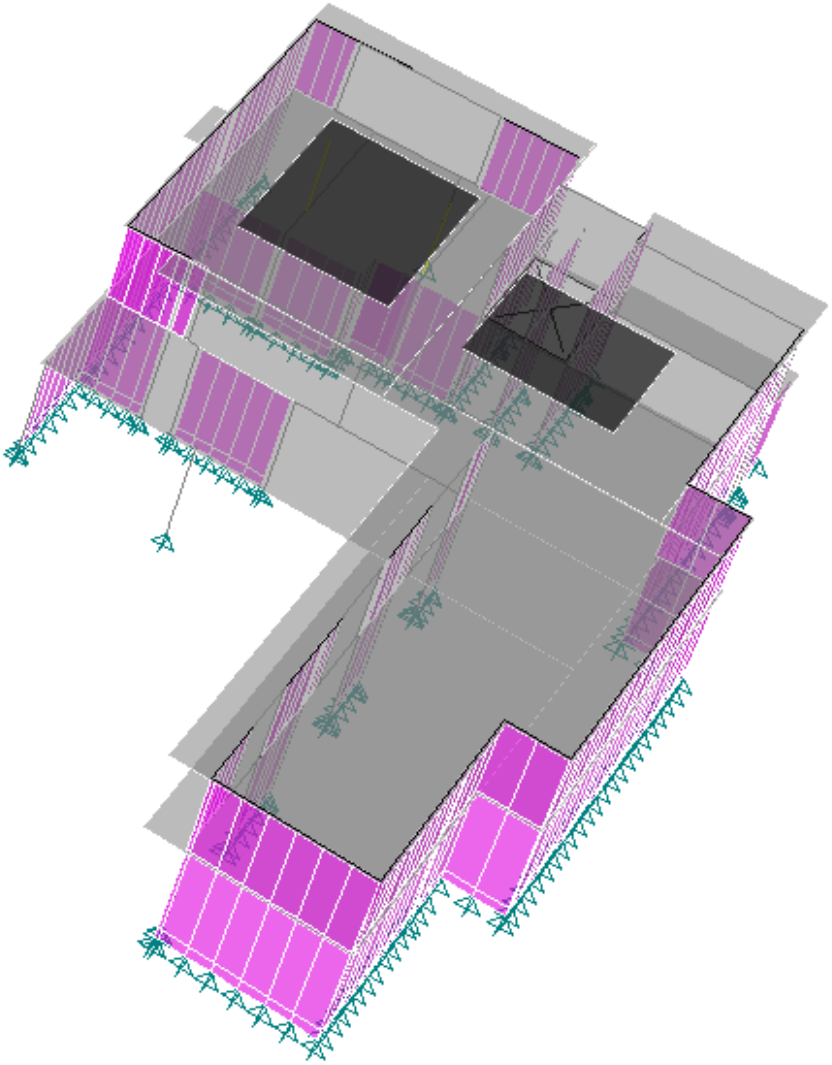


24-0609 Pincrest 8 - 100% CDs Structural

Model File: Templete_Basic Loads, Revision 0
9/14/2017

1 Structure Data

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity.

1.1 Story Data

Table 1.1 - Story Definitions

Tower	Name	Height ft	Master Story	Similar To	Splice Story	Color
T1	Roof	11.1667	No	None	No	Green
T1	2nd Floor	12.5	No	None	No	Cyan
T1	1st Floor	1.5	No	None	No	Red

1.2 Grid Data

Table 1.2 - Grid Definitions - General

Tower	Name	Type	Ux ft	Uy ft	Rz deg	Story Range	Bubble Size in	Color
T1	G1	Cartesian	0	0	0	Default	30	Gray6

Table 1.3 - Grid Definitions - Grid Lines

Name	Grid Line Type	ID	X1 ft	Y1 ft	X2 ft	Y2 ft	Bubble Location	Visible
G1	General (Cartesian)	A	182.6218	103.7467	60.4194	103.7467	End	Yes
G1	General (Cartesian)	1	64.7627	35	64.7627	110.245	End	Yes
G1	General (Cartesian)	4	129.3592	35	129.3592	110.245	End	Yes
G1	General (Cartesian)	8	166.6909	35	166.6909	110.245	End	Yes
G1	General (Cartesian)	9	174.618	35	174.618	110.245	End	Yes
G1	General (Cartesian)	G	182.6218	44.5053	60.4176	44.5053	End	Yes
G1	General (Cartesian)	5	136.3356	35	136.3356	110.245	End	Yes
G1	General (Cartesian)	B	182.6148	86.1605	60.4124	86.1756	End	Yes
G1	General (Cartesian)	2	92.6585	35	92.6585	110.245	End	Yes
G1	General (Cartesian)	3	115.4432	35	115.4432	110.245	End	Yes
G1	General (Cartesian)	6	152.3356	35	152.3356	110.245	End	Yes
G1	General (Cartesian)	1'	66.721	35	66.721	110.245	End	Yes
G1	General (Cartesian)	C	182.6218	84.9905	60.7354	84.9905	End	Yes
G1	General (Cartesian)	A'	182.6218	93.9134	61.0062	93.9134	End	Yes
G1	General (Cartesian)	D	182.6218	72.604	60.8549	72.604	End	Yes
G1	General (Cartesian)	E	182.6218	62.932	61.21	62.932	End	Yes
G1	General (Cartesian)	6'	155.566	35	155.566	108.8348	End	Yes
G1	General (Cartesian)	7"	163.2522	35	163.2522	109.83	End	Yes
G1	General (Cartesian)	8'	169.0411	35	169.0411	110.245	End	Yes
G1	General (Cartesian)	D'	182.6218	67.768	61.148	67.768	End	Yes
G1	General (Cartesian)	1"	80.051	35	80.051	110.245	End	Yes
G1	General (Cartesian)	1"'	90.6968	35	90.6968	110.245	End	Yes
G1	General (Cartesian)	2'	104.0439	35	104.0439	110.245	End	Yes
G1	General (Cartesian)	2"	111.273	35	111.273	110.245	End	Yes
G1	General (Cartesian)	3'	124.596	35	124.596	110.245	End	Yes

Table 1.3 - Grid Definitions - Grid Lines (continued)

Name	Grid Line Type	ID	X1 ft	Y1 ft	X2 ft	Y2 ft	Bubble Location	Visible
G1	General (Cartesian)	H	182.6218	37.6824	60.4176	37.6824	End	Yes
G1	General (Cartesian)	F	182.6218	62.0885	60.4176	62.0885	End	Yes
G1	General (Cartesian)	7	155.7652	35	155.7652	110.245	End	Yes
G1	General (Cartesian)	7'	157.5074	35	157.5074	110.245	End	Yes
G1	General (Cartesian)	C'	182.6218	80.0834	60.4176	80.0834	End	Yes

2 Properties

This chapter provides property information for materials, frame sections, shell sections, and links.

2.1 Materials

Table 2.1 - Material Properties - General

Material	Type	SymType	Grade	Color	Notes
4000Psi	Concrete	Isotropic	Unknown	Gray8Dark	
A416Gr270	Tendon	Uniaxial	Unknown	Green	
A615Gr60	Rebar	Uniaxial	Unknown	Blue	
A992Fy50	Steel	Isotropic	Unknown	Yellow	
M1500Psi	Masonry	Isotropic	Unknown	Magenta	

2.2 Frame Sections

Table 2.2 - Frame Section Property Definitions - Summary (Part 1 of 3)

Name	Material	Shape	Color	Area in2	J in4	I33 in4	I22 in4	As2 in2	As3 in2	S33Pos in3
B-12x12 (4)	4000Psi	Concrete Rectangular	Cyan	144	2920.32	1728	1728	120	120	288
B-12x24 (4)	4000Psi	Concrete Rectangular	Magenta	288	9492.12	13824	3456	240	240	1152
B-8x12 (4)	4000Psi	Concrete Rectangular	Blue	96	1202	1152	512	80	80	192
B-8x16 (4)	4000Psi	Concrete Rectangular	Gray8Dark	128	1874.99	2730.67	682.67	106.67	106.67	341.33
B-8x24 (4)	4000Psi	Concrete Rectangular	Green	192	3236.72	9216	1024	160	160	768
B-8x30 (4)	4000Psi	Concrete Rectangular	Cyan	240	4260.2	18000	1280	200	200	1200
B-8x33 (4)	4000Psi	Concrete Rectangular	Green	264	4772.09	23958	1408	220	220	1452
C-15x15 (4)	4000Psi	Concrete Rectangular	Magenta	256	9229.65	5461.33	5461.33	213.33	213.33	682.67
C-16x16 (4)	4000Psi	Concrete Rectangular	Cyan	256	9229.65	5461.33	5461.33	213.33	213.33	682.67
C-8x12 (4)	4000Psi	Concrete Rectangular	Magenta	96	1202	512	1152	80	80	128
C-8x16 (4)	4000Psi	Concrete Rectangular	Magenta	128	1874.99	682.67	2730.67	106.67	106.67	170.67
C-8x17 (4)	4000Psi	Concrete Rectangular	Yellow	136	2044.69	725.33	3275.33	113.33	113.33	181.33
C-8x21 (4)	4000Psi	Concrete Rectangular	Blue	168	2725.35	896	6174	140	140	224
C-8x24 (4)	4000Psi	Concrete Rectangular	Gray8Dark	192	3236.72	1024	9216	160	160	256
C-8x25 (4)	4000Psi	Concrete Rectangular	Blue	200	3407.26	1066.67	10416.67	166.67	166.67	266.67
C-8x29 (4)	4000Psi	Concrete Rectangular	Magenta	232	4089.59	1237.33	16259.33	193.33	193.33	309.33
HSS6X4X1/4	A992Fy50	Steel Tube	Cyan	4.3	23.6	20.9	11.1	2.8	1.86	6.97

Table 2.2 - Frame Section Property Definitions - Summary (Part 2 of 3)

Name	S33Neg in3	S22Pos in3	S22Neg in3	Z33 in3	Z22 in3	R33 in	R22 in	Cw in6	CG Offset 3 in	CG Offset 2 in	PNA Offset 3 in	PNA Offset 2 in
B-12x12 (4)	288	288	288	432	432	3.4641	3.4641		0	0	0	0
B-12x24 (4)	1152	576	576	1728	864	6.9282	3.4641		0	0	0	0
B-8x12 (4)	192	128	128	288	192	3.4641	2.3094		0	0	0	0
B-8x16 (4)	341.33	170.67	170.67	512	256	4.6188	2.3094		0	0	0	0
B-8x24 (4)	768	256	256	1152	384	6.9282	2.3094		0	0	0	0
B-8x30 (4)	1200	320	320	1800	480	8.6603	2.3094		0	0	0	0
B-8x33 (4)	1452	352	352	2178	528	9.5263	2.3094		0	0	0	0

Table 2.2 - Frame Section Property Definitions - Summary (Part 2 of 3, continued)

Name	S33Neg in3	S22Pos in3	S22Neg in3	Z33 in3	Z22 in3	R33 in	R22 in	Cw in6	CG Offset 3 in	CG Offset 2 in	PNA Offset 3 in	PNA Offset 2 in
C-15x15 (4)	682.67	682.67	682.67	1024	1024	4.6188	4.6188		0	0	0	0
C-16x16 (4)	682.67	682.67	682.67	1024	1024	4.6188	4.6188		0	0	0	0
C-8x12 (4)	128	192	192	192	288	2.3094	3.4641		0	0	0	0
C-8x16 (4)	170.67	341.33	341.33	256	512	2.3094	4.6188		0	0	0	0
C-8x17 (4)	181.33	385.33	385.33	272	578	2.3094	4.9075		0	0	0	0
C-8x21 (4)	224	588	588	336	882	2.3094	6.0622		0	0	0	0
C-8x24 (4)	256	768	768	384	1152	2.3094	6.9282		0	0	0	0
C-8x25 (4)	266.67	833.33	833.33	400	1250	2.3094	7.2169		0	0	0	0
C-8x29 (4)	309.33	1121.33	1121.33	464	1682	2.3094	8.3716		0	0	0	0
HSS6X4X1/4	6.97	5.55	5.55	8.53	6.45	2.2046	1.6067		0	0	0	0

Table 2.2 - Frame Section Property Definitions - Summary (Part 3 of 3)

Name	As2 Modifier	As3 Modifier	J Modifier	I33 Modifier	I22 Modifier	Mass Modifier	Weight Modifier
B-12x12 (4)	1	1	1	1	1	1	1
B-12x24 (4)	1	1	1	1	1	1	1
B-8x12 (4)	1	1	1	1	1	1	1
B-8x16 (4)	1	1	1	1	1	1	1
B-8x24 (4)	1	1	1	1	1	1	1
B-8x30 (4)	1	1	1	1	1	1	1
B-8x33 (4)	1	1	1	1	1	1	1
C-15x15 (4)	1	1	1	1	1	1	1
C-16x16 (4)	1	1	1	1	1	1	1
C-8x12 (4)	1	1	1	1	1	1	1
C-8x16 (4)	1	1	1	1	1	1	1
C-8x17 (4)	1	1	1	1	1	1	1
C-8x21 (4)	1	1	1	1	1	1	1
C-8x24 (4)	1	1	1	1	1	1	1
C-8x25 (4)	1	1	1	1	1	1	1
C-8x29 (4)	1	1	1	1	1	1	1
HSS6X4X1/4	1	1	1	1	1	1	1

2.3 Shell Sections

Table 2.3 - Area Section Property Definitions - Summary

Name	Type	Element Type	Material	Total Thickness in	Deck Material	Deck Depth in
MW 8 (1.5)	Wall	Shell-Thin	M1500Psi	8		
Slab 10 (4)	Slab	Shell-Thin	4000Psi	10		
Slab 7 (4)	Slab	Shell-Thin	4000Psi	7		
Slab 8 (4)	Slab	Shell-Thin	4000Psi	8		
Slab 9 (4)	Slab	Shell-Thin	4000Psi	9		
SW 8 (4)	Wall	Shell-Thin	4000Psi	8		

3 Loads

This chapter provides loading information as applied to the model.

3.1 Load Patterns

Table 3.1 - Load Pattern Definitions

Name	Is Auto Load	Type	Self Weight Multiplier	Auto Load
~LLRF	Yes	Other	0	
Dead	No	Dead	1	
Flood	No	Other	0	
Live	No	Live	0	
Reducible Live	No	Reducible Live	0	
Roof Live	No	Roof Live	0	
Super Dead	No	Super Dead	0	
Wind	No	Wind	0	ASCE 7-22
Wind(1/12)	Yes	Wind	0	ASCE 7-22
Wind(10/12)	Yes	Wind	0	ASCE 7-22
Wind(11/12)	Yes	Wind	0	ASCE 7-22
Wind(12/12)	Yes	Wind	0	ASCE 7-22
Wind(2/12)	Yes	Wind	0	ASCE 7-22
Wind(3/12)	Yes	Wind	0	ASCE 7-22
Wind(4/12)	Yes	Wind	0	ASCE 7-22
Wind(5/12)	Yes	Wind	0	ASCE 7-22
Wind(6/12)	Yes	Wind	0	ASCE 7-22
Wind(7/12)	Yes	Wind	0	ASCE 7-22
Wind(8/12)	Yes	Wind	0	ASCE 7-22
Wind(9/12)	Yes	Wind	0	ASCE 7-22

3.2 Auto Wind Loading

Table 3.2 - Load Pattern Definitions - Auto Wind - ASCE 7-22 (Part 1 of 3)

Name	Is Auto Load	Exposure Source	Top Story	Bottom Story	Include Parapet	Parapet Height ft	User Cp?	ASCE Case	e1 Ratio	e2 Ratio	Wind Speed mph
Wind	No	Diaphragms	Roof	1st Floor	Yes	2	No	Create All	0.15	0.15	175
Wind	No										
Wind	No										
Wind(1/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	1x	0	0	175
Wind(1/12)	Yes										
Wind(1/12)	Yes										
Wind(10/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	4x(-e1, -e2)	-0.15	-0.15	175
Wind(10/12)	Yes										
Wind(10/12)	Yes										
Wind(11/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	4y(+e1, +e2)	0.15	0.15	175
Wind(11/12)	Yes										
Wind(11/12)	Yes										
Wind(12/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	4y(-e1, -e2)	-0.15	-0.15	175
Wind(12/12)	Yes										

Table 3.2 - Load Pattern Definitions - Auto Wind - ASCE 7-22 (Part 1 of 3, continued)

Name	Is Auto Load	Exposure Source	Top Story	Bottom Story	Include Parapet	Parapet Height ft	User Cp?	ASCE Case	e1 Ratio	e2 Ratio	Wind Speed mph
Wind(12/12)	Yes										
Wind(2/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	1y	0	0	175
Wind(2/12)	Yes										
Wind(2/12)	Yes										
Wind(3/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	2x(+e1)	0.15	0	175
Wind(3/12)	Yes										
Wind(3/12)	Yes										
Wind(4/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	2x(-e1)	-0.15	0	175
Wind(4/12)	Yes										
Wind(4/12)	Yes										
Wind(5/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	2y(+e1)	0.15	0	175
Wind(5/12)	Yes										
Wind(5/12)	Yes										
Wind(6/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	2y(-e1)	-0.15	0	175
Wind(6/12)	Yes										
Wind(6/12)	Yes										
Wind(7/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	3x	0	0	175
Wind(7/12)	Yes										
Wind(7/12)	Yes										
Wind(8/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	3y	0	0	175
Wind(8/12)	Yes										
Wind(8/12)	Yes										
Wind(9/12)	Yes	Diaphragms	Roof	1st Floor	Yes	2	No	4x(+e1, +e2)	0.15	0.15	175
Wind(9/12)	Yes										
Wind(9/12)	Yes										

Table 3.2 - Load Pattern Definitions - Auto Wind - ASCE 7-22 (Part 2 of 3)

Name	Exposure Type	Ground Elev Factor	kzt	Gust Factor	Kd	Width Type	Direction Angle deg	Story	Diaphragm	Width ft
Wind	C	1	1	0.85	0.85	Auto	0	Roof	D1	68.4134
Wind								2nd Floor	D1	66.7308
Wind								1st Floor	D1	0
Wind(1/12)	C	1	1	0.85	0.85	Auto	0	Roof	D1	68.4134
Wind(1/12)								2nd Floor	D1	66.7308
Wind(1/12)								1st Floor	D1	0
Wind(10/12)	C	1	1	0.85	0.85	Auto	0	Roof	D1	68.4134
Wind(10/12)								2nd Floor	D1	66.7308
Wind(10/12)								1st Floor	D1	0
Wind(11/12)	C	1	1	0.85	0.85	Auto	90	Roof	D1	113.6145
Wind(11/12)								2nd Floor	D1	110.5186
Wind(11/12)								1st Floor	D1	0
Wind(12/12)	C	1	1	0.85	0.85	Auto	90	Roof	D1	113.6145
Wind(12/12)								2nd Floor	D1	110.5186
Wind(12/12)								1st Floor	D1	0

Table 3.2 - Load Pattern Definitions - Auto Wind - ASCE 7-22 (Part 2 of 3, continued)

Name	Exposure Type	Ground Elev Factor	kzt	Gust Factor	Kd	Width Type	Direction Angle deg	Story	Diaphragm	Width ft
Wind(2/12)	C	1	1	0.85	0.85	Auto	90	Roof	D1	113.6145
Wind(2/12)								2nd Floor	D1	110.5186
Wind(2/12)								1st Floor	D1	0
Wind(3/12)	C	1	1	0.85	0.85	Auto	0	Roof	D1	68.4134
Wind(3/12)								2nd Floor	D1	66.7308
Wind(3/12)								1st Floor	D1	0
Wind(4/12)	C	1	1	0.85	0.85	Auto	0	Roof	D1	68.4134
Wind(4/12)								2nd Floor	D1	66.7308
Wind(4/12)								1st Floor	D1	0
Wind(5/12)	C	1	1	0.85	0.85	Auto	90	Roof	D1	113.6145
Wind(5/12)								2nd Floor	D1	110.5186
Wind(5/12)								1st Floor	D1	0
Wind(6/12)	C	1	1	0.85	0.85	Auto	90	Roof	D1	113.6145
Wind(6/12)								2nd Floor	D1	110.5186
Wind(6/12)								1st Floor	D1	0
Wind(7/12)	C	1	1	0.85	0.85	Auto	0	Roof	D1	68.4134
Wind(7/12)								2nd Floor	D1	66.7308
Wind(7/12)								1st Floor	D1	0
Wind(8/12)	C	1	1	0.85	0.85	Auto	90	Roof	D1	113.6145
Wind(8/12)								2nd Floor	D1	110.5186
Wind(8/12)								1st Floor	D1	0
Wind(9/12)	C	1	1	0.85	0.85	Auto	0	Roof	D1	68.4134
Wind(9/12)								2nd Floor	D1	66.7308
Wind(9/12)								1st Floor	D1	0

Table 3.2 - Load Pattern Definitions - Auto Wind - ASCE 7-22 (Part 3 of 3)

Name	X ft	Y ft
Wind	121.2274	71.54
Wind	119.692	70.7178
Wind	119.6903	70.7172
Wind(1/12)	121.2274	71.54
Wind(1/12)	119.692	70.7178
Wind(1/12)	119.6903	70.7172
Wind(10/12)	121.2274	71.54
Wind(10/12)	119.692	70.7178
Wind(10/12)	119.6903	70.7172
Wind(11/12)	121.2274	71.54
Wind(11/12)	119.692	70.7178
Wind(11/12)	119.6903	70.7172
Wind(12/12)	121.2274	71.54
Wind(12/12)	119.692	70.7178
Wind(12/12)	119.6903	70.7172
Wind(2/12)	121.2274	71.54

Table 3.2 - Load Pattern Definitions - Auto Wind - ASCE 7-22 (Part 3 of 3, continued)

Name	X ft	Y ft
Wind(2/12)	119.692	70.7178
Wind(2/12)	119.6903	70.7172
Wind(3/12)	121.2274	71.54
Wind(3/12)	119.692	70.7178
Wind(3/12)	119.6903	70.7172
Wind(4/12)	121.2274	71.54
Wind(4/12)	119.692	70.7178
Wind(4/12)	119.6903	70.7172
Wind(5/12)	121.2274	71.54
Wind(5/12)	119.692	70.7178
Wind(5/12)	119.6903	70.7172
Wind(6/12)	121.2274	71.54
Wind(6/12)	119.692	70.7178
Wind(6/12)	119.6903	70.7172
Wind(7/12)	121.2274	71.54
Wind(7/12)	119.692	70.7178
Wind(7/12)	119.6903	70.7172
Wind(8/12)	121.2274	71.54
Wind(8/12)	119.692	70.7178
Wind(8/12)	119.6903	70.7172
Wind(9/12)	121.2274	71.54
Wind(9/12)	119.692	70.7178
Wind(9/12)	119.6903	70.7172

ASCE 7-22 Auto Wind Load Calculation

This calculation presents the automatically generated lateral wind loads for load pattern Wind according to ASCE 7-22, as calculated by ETABS.

Exposure Parameters

Exposure From = Diaphragms

Exposure Category = C

Wind Direction = 0 degrees

Basic Wind Speed, V [ASCE 26.5.1]		$V = 175\ mph$
Windward Coefficient, $C_{px,wind}$ [ASCE 27.4.1]		$C_{p,wind} = 0.8$
Leeward Coefficient, $C_{px,lee}$ [ASCE 27.4.1]		$C_{p,lee} = 0.368763$
Windward Coefficient, $C_{py,wind}$ [ASCE 27.4.1]		$C_{p,wind} = 0.8$
Leeward Coefficient, $C_{py,lee}$ [ASCE 27.4.1]		$C_{p,lee} = 0.5$

Wind Case = Create All

Top Story = Roof

Bottom Story = 1st Floor

Include Parapet = Yes, Parapet Height = 2

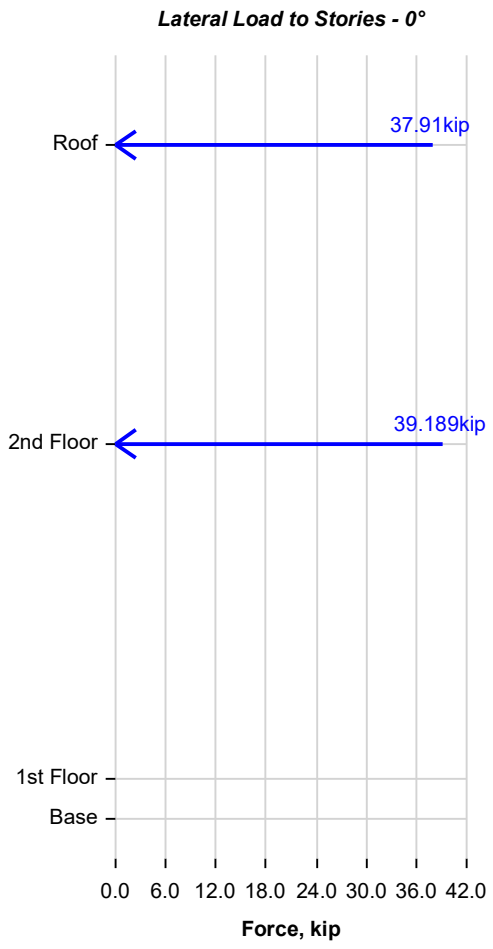
Factors and Coefficients

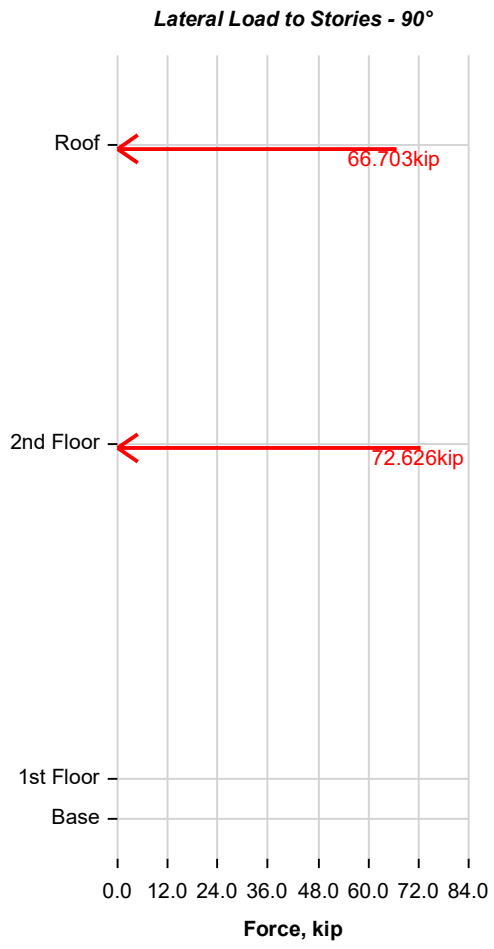
Gradient Height, z_g [ASCE Table 26.9-1]		$z_g = 900$
Emperical Exponent, α [ASCE Table 26.9-1]		$\alpha = 9.5$
Velocity Pressure Exposure Coefficient, K_z; [ASCE Table 27.3-1]	$K_z = 2.01 \left(\frac{z}{z_g}\right)^{\frac{2}{\alpha}}$ for $15ft \le z \le z_g$ $K_z = 2.01 \left(\frac{15}{z_g}\right)^{\frac{2}{\alpha}}$ for $z < 15ft$	
Topographical Factor, K_{zt} [ASCE 26.8.2]		$K_{zt} = 1$
Directionality Factor, K_d [ASCE 26.6]		$K_d = 0.85$
Gust Effect Factor, G [ASCE 26.9]		$G = 0.85$

Lateral Loading

Velocity Pressure, q_z [ASCE 27.3.2 Eq. 27.3-1]	$q_z = 0.00256\ K_z K_{zt} K_d V^2$
Design Wind Pressure, p [ASCE 27.4.2 Eq. 27.4-2]	$p = qG\ C_{p,wind} + q_h\ (G\ C_{p,lee})$

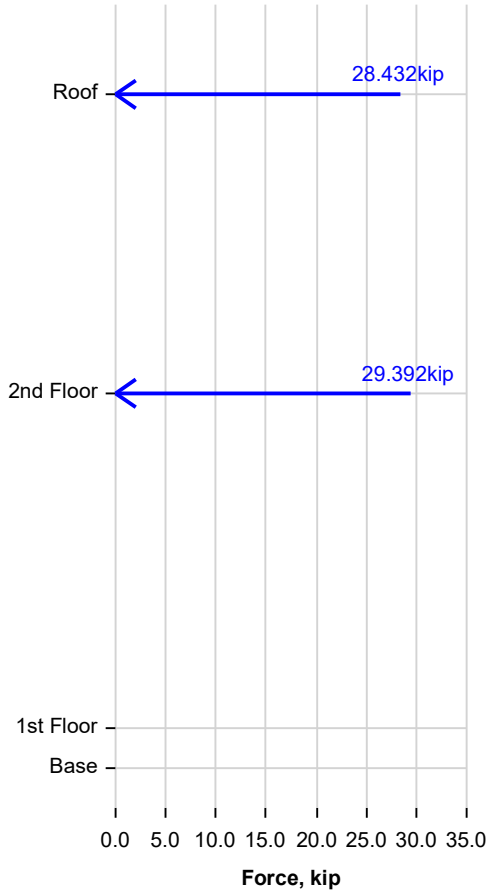
Applied Story Forces


Lateral Load to Stories - 0°
Roof
2nd Floor
1st Floor
Base
37.91kip
39.189kip
0.0 6.0 12.0 18.0 24.0 30.0 36.0 42.0
Force, kip


Lateral Load to Stories - 90°
Roof
2nd Floor
1st Floor
Base
66.703kip
72.626kip
0.0 12.0 24.0 36.0 48.0 60.0 72.0 84.0
Force, kip

Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	37.91	0
2nd Floor	12.5	39.189	0
1st Floor	0	0	0
Base	-1.5	0	0

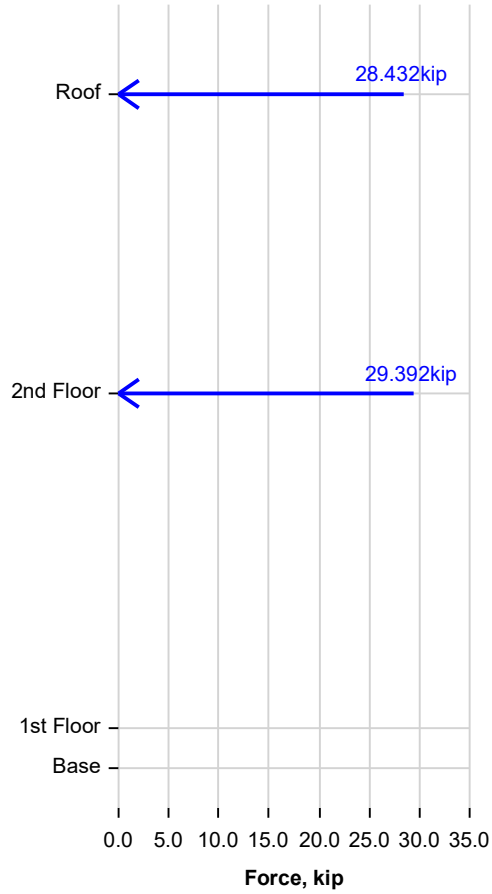
Lateral Load to Stories - 0°



Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	28.432	0
2nd Floor	12.5	29.392	0
1st Floor	0	0	0
Base	-1.5	0	0

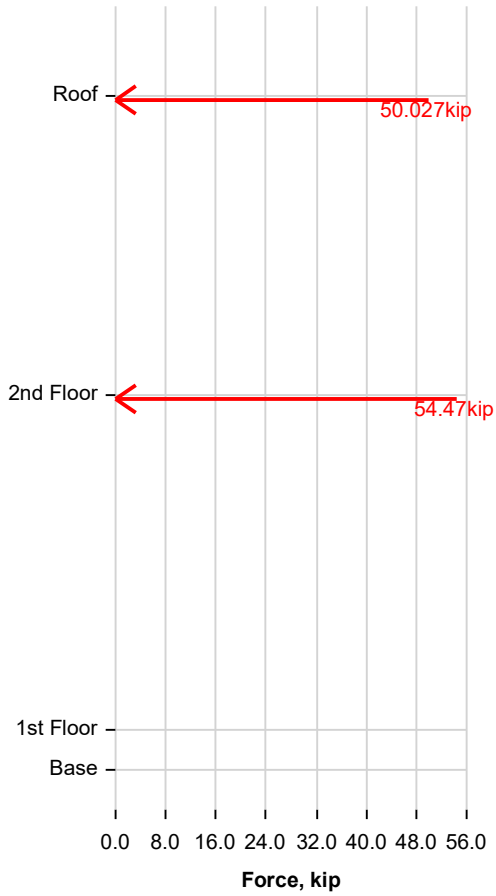
Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	0	66.703
2nd Floor	12.5	0	72.626
1st Floor	0	0	0
Base	-1.5	0	0

Lateral Load to Stories - 0°



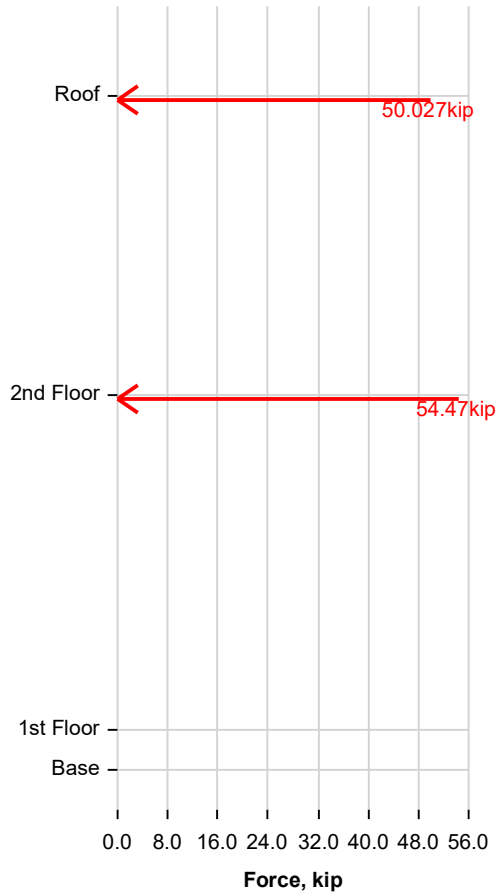
Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	28.432	0
2nd Floor	12.5	29.392	0
1st Floor	0	0	0
Base	-1.5	0	0

Lateral Load to Stories - 90°



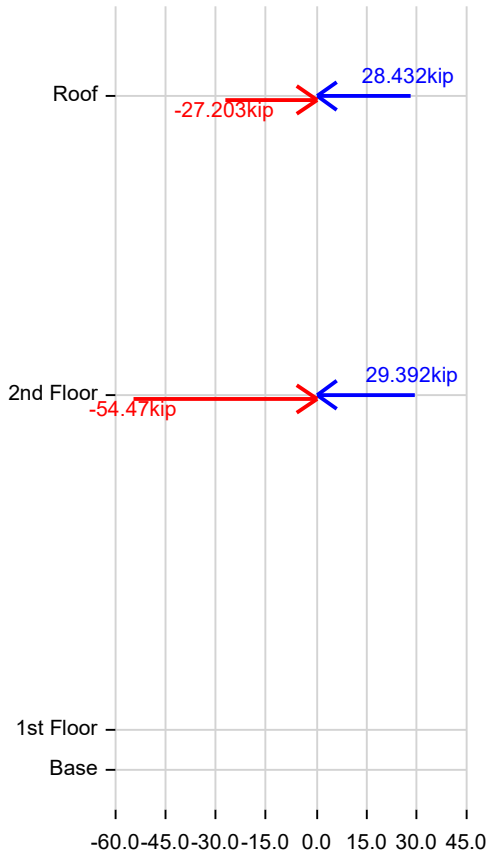
Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	0	50.027
2nd Floor	12.5	0	54.47
1st Floor	0	0	0
Base	-1.5	0	0

Lateral Load to Stories - 90°



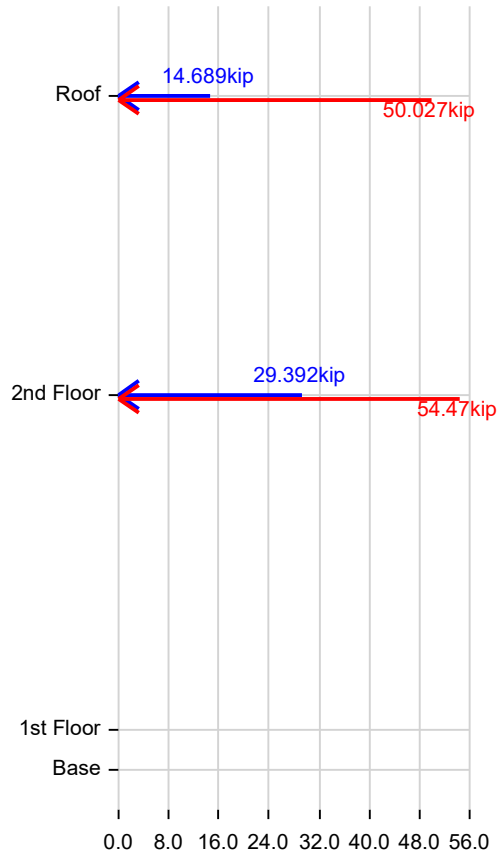
Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	0	50.027
2nd Floor	12.5	0	54.47
1st Floor	0	0	0
Base	-1.5	0	0

Lateral Load to Stories - 0°



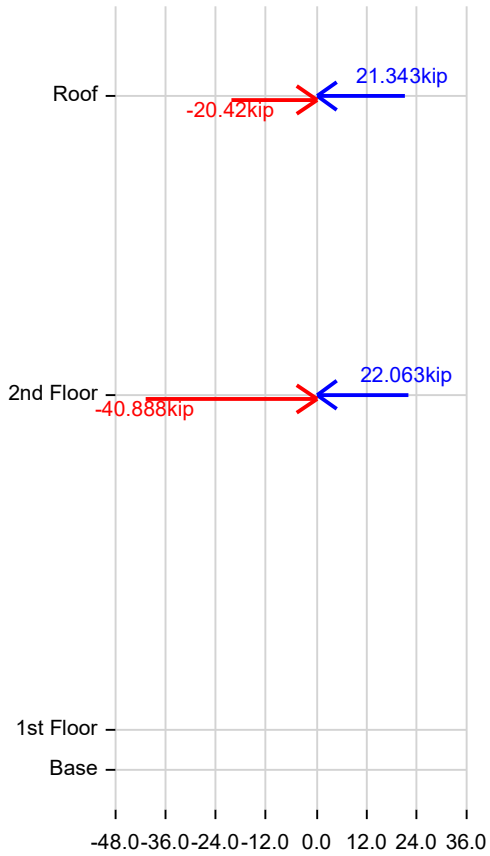
Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	28.432	-27.203
2nd Floor	12.5	29.392	-54.47
1st Floor	0	0	0
Base	-1.5	0	0

Lateral Load to Stories - 90°



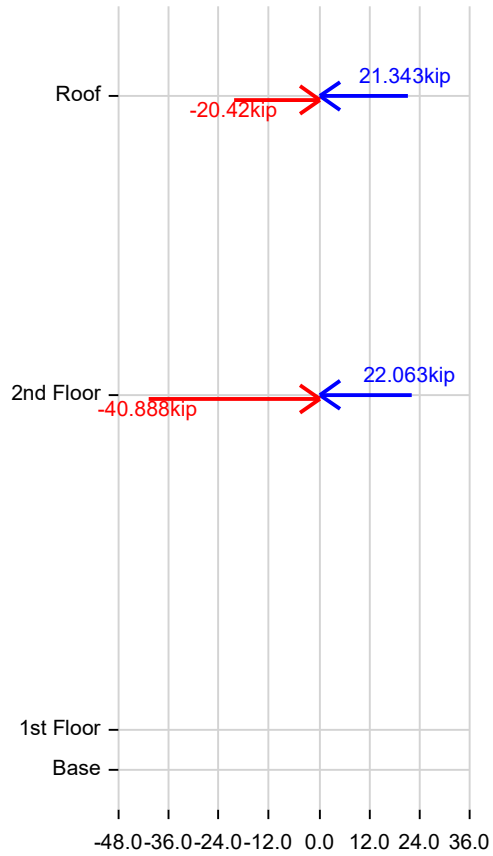
Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	14.689	50.027
2nd Floor	12.5	29.392	54.47
1st Floor	0	0	0
Base	-1.5	0	0

Lateral Load to Stories - 0°



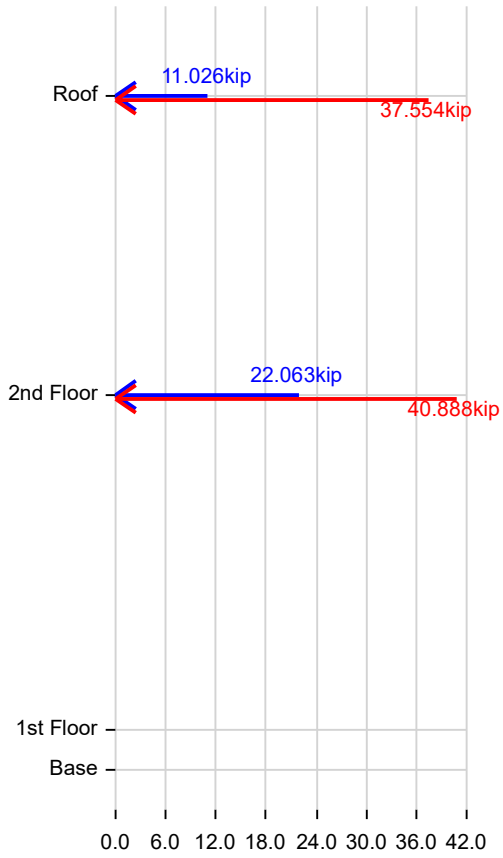
Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	21.343	-20.42
2nd Floor	12.5	22.063	-40.888
1st Floor	0	0	0
Base	-1.5	0	0

Lateral Load to Stories - 0°



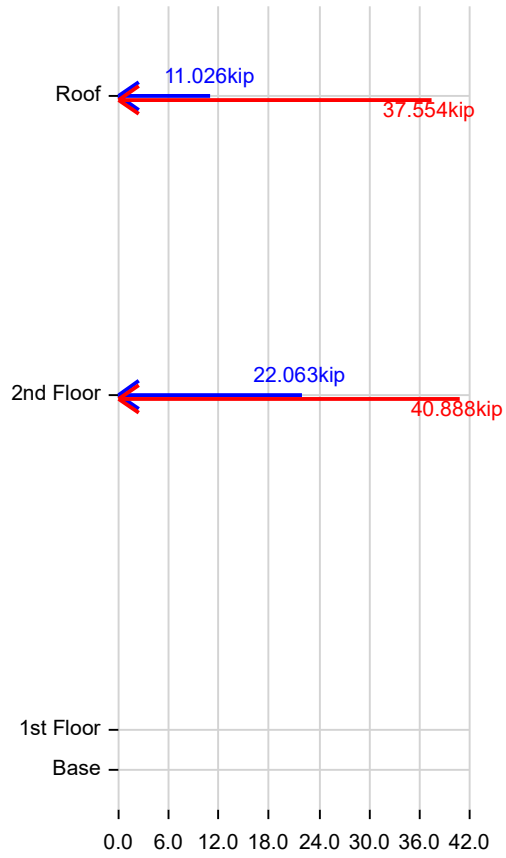
Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	21.343	-20.42
2nd Floor	12.5	22.063	-40.888
1st Floor	0	0	0
Base	-1.5	0	0

Lateral Load to Stories - 90°



Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	11.026	37.554
2nd Floor	12.5	22.063	40.888
1st Floor	0	0	0
Base	-1.5	0	0

Lateral Load to Stories - 90°



Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Roof	23.6667	11.026	37.554
2nd Floor	12.5	22.063	40.888
1st Floor	0	0	0
Base	-1.5	0	0

3.3 Load Cases

Table 3.4 - Load Case Definitions - Summary

Name	Type
Modal	Modal - Eigen
Dead	Linear Static
Live	Linear Static
Roof Live	Linear Static
Wind	Linear Static
Flood	Linear Static
Reducible Live	Linear Static

3.4 Load Combinations

Table 3.5 - Load Combination Definitions (Part 1 of 2)

Name	Type	Is Auto	Load Name	SF
ASD1 D	Linear Add	No	Dead	1
ASD2 D+L	Linear Add	No	Dead	1
ASD2 D+L			Live	1
ASD2 D+L			Reducible Live	1
ASD3 D+Lr	Linear Add	No	Dead	1
ASD3 D+Lr			Roof Live	1
ASD4 D+0.75L+0.75Lr	Linear Add	No	Dead	1
ASD4 D+0.75L+0.75Lr			Live	0.75
ASD4 D+0.75L+0.75Lr			Roof Live	0.75
ASD4 D+0.75L+0.75Lr			Reducible Live	0.75
ASD5a-1 D+0.6W	Linear Add	No	Dead	1
ASD5a-1 D+0.6W			Wind	0.6
ASD5a-2 D-0.6W	Linear Add	No	Dead	1
ASD5a-2 D-0.6W			Wind	-0.6
ASD5b-1 D+0.75Fa+0.6W	Linear Add	No	Dead	1
ASD5b-1 D+0.75Fa+0.6W			Flood	0.75
ASD5b-1 D+0.75Fa+0.6W			Wind	0.6
ASD5b-2 D+0.75Fa-0.6W	Linear Add	No	Dead	1
ASD5b-2 D+0.75Fa-0.6W			Flood	0.75
ASD5b-2 D+0.75Fa-0.6W			Wind	-0.6
ASD6a-1 D+0.75L+0.75Lr+0.45W	Linear Add	No	Dead	1
ASD6a-1 D+0.75L+0.75Lr+0.45W			Live	0.75
ASD6a-1 D+0.75L+0.75Lr+0.45W			Roof Live	0.75
ASD6a-1 D+0.75L+0.75Lr+0.45W			Wind	0.45
ASD6a-1 D+0.75L+0.75Lr+0.45W			Reducible Live	0.75
ASD6a-2 D+0.75L+0.75Lr-0.45W	Linear Add	No	Dead	1
ASD6a-2 D+0.75L+0.75Lr-0.45W			Live	0.75
ASD6a-2 D+0.75L+0.75Lr-0.45W			Roof Live	0.75
ASD6a-2 D+0.75L+0.75Lr-0.45W			Wind	-0.45
ASD6a-2 D+0.75L+0.75Lr-0.45W			Reducible Live	0.75
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	Linear Add	No	Dead	1
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W			Live	0.75
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W			Roof Live	0.75

Table 3.5 - Load Combination Definitions (Part 1 of 2, continued)

Name	Type	Is Auto	Load Name	SF
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W			Flood	0.75
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W			Wind	0.45
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W			Reducible Live	0.75
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	Linear Add	No	Dead	1
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W			Live	0.75
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W			Roof Live	0.75
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W			Flood	0.75
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W			Wind	-0.45
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W			Reducible Live	0.75
ASD7a-1 0.6D+0.6W	Linear Add	No	Dead	0.6
ASD7a-1 0.6D+0.6W			Wind	0.6
ASD7a-2 0.6D-0.6W	Linear Add	No	Dead	0.6
ASD7a-2 0.6D-0.6W			Wind	-0.6
ASD7b-1 0.6D+0.75Fa+0.6W	Linear Add	No	Dead	0.6
ASD7b-1 0.6D+0.75Fa+0.6W			Flood	0.75
ASD7b-1 0.6D+0.75Fa+0.6W			Wind	0.6
ASD7b-2 0.6D+0.75Fa-0.6W	Linear Add	No	Dead	0.6
ASD7b-2 0.6D+0.75Fa-0.6W			Flood	0.75
ASD7b-2 0.6D+0.75Fa-0.6W			Wind	-0.6
ASD_{Env}	Envelope	No	Wind	0.6
ASD Envelope	Envelope	No	ASD1 D	1
ASD Envelope			ASD2 D+L	1
ASD Envelope			ASD3 D+Lr	1
ASD Envelope			ASD4 D+0.75L+0.75Lr	1
ASD Envelope			ASD5a-1 D+0.6W	1
ASD Envelope			ASD5a-2 D-0.6W	1
ASD Envelope			ASD6a-1 D+0.75L+0.75Lr+0.45W	1
ASD Envelope			ASD6a-2 D+0.75L+0.75Lr-0.45W	1
ASD Envelope			ASD7a-1 0.6D+0.6W	1
ASD Envelope			ASD7a-2 0.6D-0.6W	1
ASD Envelope			ASD5b-1 D+0.75Fa+0.6W	1
ASD Envelope			ASD5b-2 D+0.75Fa-0.6W	1
ASD Envelope			ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	1
ASD Envelope			ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	1
ASD Envelope			ASD7b-1 0.6D+0.75Fa+0.6W	1
ASD Envelope			ASD7b-2 0.6D+0.75Fa-0.6W	1
DCmpC1	Linear Add	Yes	Dead	1.4
DCmpC2	Linear Add	Yes	Dead	1.2
DCmpD1	Linear Add	Yes	Dead	1
DCmpD2	Linear Add	Yes	Dead	1
DCmpD2			Live	1
DCmpD2			Reducible Live	1
DCmpS1	Linear Add	Yes	Dead	1.4
DCmpS2	Linear Add	Yes	Dead	1.2
DCmpS2			Live	1.6
DCmpS2			Reducible Live	1.6

Table 3.5 - Load Combination Definitions (Part 1 of 2, continued)

Name	Type	Is Auto	Load Name	SF
DCmpS3	Linear Add	Yes	Dead	1.2
DCmpS3			Live	1.6
DCmpS3			Roof Live	0.5
DCmpS3			Reducible Live	1.6
DCmpS4	Linear Add	Yes	Dead	1.2
DCmpS4			Live	1
DCmpS4			Roof Live	1.6
DCmpS4			Reducible Live	1
DCon1	Linear Add	Yes	Dead	1.4
DCon2	Linear Add	Yes	Dead	1.2
DCon2			Live	1.6
DCon2			Reducible Live	1.6
DCon3	Linear Add	Yes	Dead	1.2
DCon3			Live	1.6
DCon3			Roof Live	0.5
DCon3			Reducible Live	1.6
DCon4	Linear Add	Yes	Dead	1.2
DCon4			Live	1
DCon4			Roof Live	1.6
DCon4			Reducible Live	1
DCon5	Linear Add	Yes	Dead	1.2
DCon5			Live	1
DCon5			Reducible Live	1
DCon5			Wind	1
DCon6	Linear Add	Yes	Dead	1.2
DCon6			Live	1
DCon6			Reducible Live	1
DCon6			Wind	-1
DCon7	Linear Add	Yes	Dead	1.2
DCon7			Live	1
DCon7			Roof Live	0.5
DCon7			Reducible Live	1
DCon7			Wind	1
DCon8	Linear Add	Yes	Dead	1.2
DCon8			Live	1
DCon8			Roof Live	0.5
DCon8			Reducible Live	1
DCon8			Wind	-1
DCon9	Linear Add	Yes	Dead	1.2
DCon9			Roof Live	1.6
DCon9			Wind	0.5
DCon10	Linear Add	Yes	Dead	1.2
DCon10			Roof Live	1.6
DCon10			Wind	-0.5
DCon11	Linear Add	Yes	Dead	0.9
DCon11			Wind	1

Table 3.5 - Load Combination Definitions (Part 1 of 2, continued)

Name	Type	Is Auto	Load Name	SF
DCon12	Linear Add	Yes	Dead	0.9
DCon12			Wind	-1
DSIbU1	Linear Add	Yes	Dead	1.4
DSIbU2	Linear Add	Yes	Dead	1.2
DSIbU2			Live	1.6
DSIbU2			Roof Live	1.6
DSIbU2			Reducible Live	1.6
DSIbU3	Linear Add	Yes	Dead	1.2
DSIbU3			Live	1
DSIbU3			Roof Live	1
DSIbU3			Reducible Live	1
DSIbU3			Wind	1
DSIbU4	Linear Add	Yes	Dead	1.2
DSIbU4			Live	1
DSIbU4			Roof Live	1
DSIbU4			Reducible Live	1
DSIbU4			Wind	-1
DSIbU5	Linear Add	Yes	Dead	0.9
DSIbU5			Wind	1
DSIbU6	Linear Add	Yes	Dead	0.9
DSIbU6			Wind	-1
DStID1	Linear Add	Yes	Dead	1
DStID2	Linear Add	Yes	Dead	1
DStID2			Live	1
DStID2			Reducible Live	1
DStIS1	Linear Add	Yes	Dead	1.4
DStIS2	Linear Add	Yes	Dead	1.2
DStIS2			Live	1.6
DStIS2			Reducible Live	1.6
DStIS3	Linear Add	Yes	Dead	1.2
DStIS3			Live	1.6
DStIS3			Roof Live	0.5
DStIS3			Reducible Live	1.6
DStIS4	Linear Add	Yes	Dead	1.2
DStIS4			Live	1
DStIS4			Roof Live	1.6
DStIS4			Reducible Live	1
DStIS5	Linear Add	Yes	Dead	1.2
DStIS5			Live	1
DStIS5			Reducible Live	1
DStIS5			Wind	1
DStIS6	Linear Add	Yes	Dead	1.2
DStIS6			Live	1
DStIS6			Reducible Live	1
DStIS6			Wind	-1
DStIS7	Linear Add	Yes	Dead	1.2

Table 3.5 - Load Combination Definitions (Part 1 of 2, continued)

Name	Type	Is Auto	Load Name	SF
DStlS7			Live	1
DStlS7			Roof Live	0.5
DStlS7			Reducible Live	1
DStlS7			Wind	1
DStlS8	Linear Add	Yes	Dead	1.2
DStlS8			Live	1
DStlS8			Roof Live	0.5
DStlS8			Reducible Live	1
DStlS8			Wind	-1
DStlS9	Linear Add	Yes	Dead	1.2
DStlS9			Roof Live	1.6
DStlS9			Wind	0.5
DStlS10	Linear Add	Yes	Dead	1.2
DStlS10			Roof Live	1.6
DStlS10			Wind	-0.5
DStlS11	Linear Add	Yes	Dead	0.9
DStlS11			Wind	1
DStlS12	Linear Add	Yes	Dead	0.9
DStlS12			Wind	-1
DWal1	Linear Add	Yes	Dead	1.4
DWal2	Linear Add	Yes	Dead	1.2
DWal2			Live	1.6
DWal2			Reducible Live	1.6
DWal3	Linear Add	Yes	Dead	1.2
DWal3			Live	1.6
DWal3			Roof Live	0.5
DWal3			Reducible Live	1.6
DWal4	Linear Add	Yes	Dead	1.2
DWal4			Live	1
DWal4			Roof Live	1.6
DWal4			Reducible Live	1
DWal5	Linear Add	Yes	Dead	1.2
DWal5			Live	1
DWal5			Reducible Live	1
DWal5			Wind	1
DWal6	Linear Add	Yes	Dead	1.2
DWal6			Live	1
DWal6			Reducible Live	1
DWal6			Wind	-1
DWal7	Linear Add	Yes	Dead	1.2
DWal7			Live	1
DWal7			Roof Live	0.5
DWal7			Reducible Live	1
DWal7			Wind	1
DWal8	Linear Add	Yes	Dead	1.2
DWal8			Live	1

Table 3.5 - Load Combination Definitions (Part 1 of 2, continued)

Name	Type	Is Auto	Load Name	SF
DWal8			Roof Live	0.5
DWal8			Reducible Live	1
DWal8			Wind	-1
DWal9	Linear Add	Yes	Dead	1.2
DWal9			Roof Live	1.6
DWal9			Wind	0.5
DWal10	Linear Add	Yes	Dead	1.2
DWal10			Roof Live	1.6
DWal10			Wind	-0.5
DWal11	Linear Add	Yes	Dead	0.9
DWal11			Wind	1
DWal12	Linear Add	Yes	Dead	0.9
DWal12			Wind	-1
LRFD1 1.4D	Linear Add	No	Dead	1.4
LRFD2 1.2D+1.6L+0.5Lr	Linear Add	No	Dead	1.2
LRFD2 1.2D+1.6L+0.5Lr			Live	1.6
LRFD2 1.2D+1.6L+0.5Lr			Roof Live	0.5
LRFD2 1.2D+1.6L+0.5Lr			Reducible Live	1.6
LRFD3 1.2D+1.0L+1.6Lr	Linear Add	No	Dead	1.2
LRFD3 1.2D+1.0L+1.6Lr			Live	1
LRFD3 1.2D+1.0L+1.6Lr			Roof Live	1.6
LRFD3 1.2D+1.0L+1.6Lr			Reducible Live	1
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W	Linear Add	No	Dead	1.2
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W			Live	1
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W			Roof Live	0.5
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W			Wind	1
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W			Reducible Live	1
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W	Linear Add	No	Dead	1.2
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W			Live	1
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W			Roof Live	0.5
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W			Wind	-1
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W			Reducible Live	1
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	Linear Add	No	Dead	1.2
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W			Live	1
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W			Roof Live	0.5
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W			Flood	1
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W			Wind	0.5
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W			Reducible Live	1
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	Linear Add	No	Dead	1.2
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W			Live	1
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W			Roof Live	0.5
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W			Flood	1
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W			Wind	-0.5
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W			Reducible Live	1
LRFD6a-1 0.9D+1.0W	Linear Add	No	Dead	0.9
LRFD6a-1 0.9D+1.0W			Wind	1

Table 3.5 - Load Combination Definitions (Part 1 of 2, continued)

Name	Type	Is Auto	Load Name	SF
LRFD6a-2 0.9D-1.0W	Linear Add	No	Dead	0.9
LRFD6a-2 0.9D-1.0W			Wind	-1
LRFD6b-1 0.9D+1.0Fa+0.5W	Linear Add	No	Dead	0.9
LRFD6b-1 0.9D+1.0Fa+0.5W			Flood	1
LRFD6b-1 0.9D+1.0Fa+0.5W			Wind	0.5
LRFD6b-2 0.9D+1.0Fa-0.5W	Linear Add	No	Dead	0.9
LRFD6b-2 0.9D+1.0Fa-0.5W			Flood	1
LRFD6b-2 0.9D+1.0Fa-0.5W			Wind	-0.5
LRFD $_{Env}$	Envelope	No	Wind	1
LRFD Envelope	Envelope	No	LRFD1 1.4D	1
LRFD Envelope			LRFD2 1.2D+1.6L+0.5Lr	1
LRFD Envelope			LRFD3 1.2D+1.0L+1.6Lr	1
LRFD Envelope			LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W	1
LRFD Envelope			LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W	1
LRFD Envelope			LRFD6a-1 0.9D+1.0W	1
LRFD Envelope			LRFD6a-2 0.9D-1.0W	1
LRFD Envelope			LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	1
LRFD Envelope			LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	1
LRFD Envelope			LRFD6b-1 0.9D+1.0Fa+0.5W	1
LRFD Envelope			LRFD6b-2 0.9D+1.0Fa-0.5W	1

Table 3.5 - Load Combination Definitions (Part 2 of 2)

Name	Notes
ASD1 D	
ASD2 D+L	
ASD2 D+L	
ASD2 D+L	
ASD3 D+Lr	
ASD3 D+Lr	
ASD4 D+0.75L+0.75Lr	
ASD4 D+0.75L+0.75Lr	
ASD4 D+0.75L+0.75Lr	
ASD4 D+0.75L+0.75Lr	
ASD5a-1 D+0.6W	
ASD5a-1 D+0.6W	
ASD5a-2 D-0.6W	
ASD5a-2 D-0.6W	
ASD5b-1 D+0.75Fa+0.6W	
ASD5b-1 D+0.75Fa+0.6W	
ASD5b-1 D+0.75Fa+0.6W	
ASD5b-2 D+0.75Fa-0.6W	
ASD5b-2 D+0.75Fa-0.6W	
ASD5b-2 D+0.75Fa-0.6W	
ASD6a-1 D+0.75L+0.75Lr+0.45W	
ASD6a-1 D+0.75L+0.75Lr+0.45W	
ASD6a-1 D+0.75L+0.75Lr+0.45W	

Table 3.5 - Load Combination Definitions (Part 2 of 2, continued)

Name	Notes
ASD6a-1 D+0.75L+0.75Lr+0.45W	
ASD6a-1 D+0.75L+0.75Lr+0.45W	
ASD6a-2 D+0.75L+0.75Lr-0.45W	
ASD6a-2 D+0.75L+0.75Lr-0.45W	
ASD6a-2 D+0.75L+0.75Lr-0.45W	
ASD6a-2 D+0.75L+0.75Lr-0.45W	
ASD6a-2 D+0.75L+0.75Lr-0.45W	
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	
ASD7a-1 0.6D+0.6W	
ASD7a-1 0.6D+0.6W	
ASD7a-2 0.6D-0.6W	
ASD7a-2 0.6D-0.6W	
ASD7b-1 0.6D+0.75Fa+0.6W	
ASD7b-1 0.6D+0.75Fa+0.6W	
ASD7b-1 0.6D+0.75Fa+0.6W	
ASD7b-2 0.6D+0.75Fa-0.6W	
ASD7b-2 0.6D+0.75Fa-0.6W	
ASD7b-2 0.6D+0.75Fa-0.6W	
ASD_{Env}	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	
ASD Envelope	

Table 3.5 - Load Combination Definitions (Part 2 of 2, continued)

Name	Notes
DCmpC1	Dead [Construction]
DCmpC2	Dead + Construction Live [Construction]
DCmpD1	Dead [Deflections]
DCmpD2	Dead + Live [Deflections]
DCmpD2	
DCmpD2	
DCmpS1	Dead [Strength]
DCmpS2	Dead + Live [Strength]
DCmpS2	
DCmpS2	
DCmpS3	Dead + Live + Roof Live [Strength]
DCmpS3	
DCmpS3	
DCmpS3	
DCmpS4	Dead + Live + Roof Live [Strength]
DCmpS4	
DCmpS4	
DCmpS4	
DCon1	Dead [Strength]
DCon2	Dead + Live [Strength]
DCon2	
DCon2	
DCon3	Dead + Live + Roof Live [Strength]
DCon3	
DCon3	
DCon3	
DCon4	Dead + Live + Roof Live [Strength]
DCon4	
DCon4	
DCon4	
DCon5	Dead + Live + Wind + Snow [Strength]
DCon5	
DCon5	
DCon5	
DCon6	Dead + Live - Wind + Snow [Strength]
DCon6	
DCon6	
DCon6	
DCon7	Dead + Live + Roof Live + Wind [Strength]
DCon7	
DCon7	
DCon7	
DCon7	
DCon8	Dead + Live + Roof Live - Wind [Strength]
DCon8	
DCon8	

Table 3.5 - Load Combination Definitions (Part 2 of 2, continued)

Name	Notes
DCon8	
DCon8	
DCon9	Dead + Roof Live + Wind [Strength]
DCon9	
DCon9	
DCon10	Dead + Roof Live - Wind [Strength]
DCon10	
DCon10	
DCon11	Dead (min) + Wind [Strength]
DCon11	
DCon12	Dead (min) - Wind [Strength]
DCon12	
DSlbU1	
DSlbU2	
DSlbU2	
DSlbU2	
DSlbU2	
DSlbU3	
DSlbU3	
DSlbU3	
DSlbU3	
DSlbU3	
DSlbU4	
DSlbU4	
DSlbU4	
DSlbU4	
DSlbU4	
DSlbU5	
DSlbU5	
DSlbU6	
DSlbU6	
DStlD1	Dead [Deflections]
DStlD2	Dead + Live [Deflections]
DStlD2	
DStlD2	
DStlS1	Dead [Strength]
DStlS2	Dead + Live [Strength]
DStlS2	
DStlS2	
DStlS3	Dead + Live + Roof Live [Strength]
DStlS3	
DStlS3	
DStlS3	
DStlS4	Dead + Live + Roof Live [Strength]
DStlS4	
DStlS4	

Table 3.5 - Load Combination Definitions (Part 2 of 2, continued)

Name	Notes
DStlS4	
DStlS5	Dead + Live + Wind + Snow [Strength]
DStlS5	
DStlS5	
DStlS5	
DStlS6	Dead + Live - Wind + Snow [Strength]
DStlS6	
DStlS6	
DStlS6	
DStlS7	Dead + Live + Roof Live + Wind [Strength]
DStlS7	
DStlS7	
DStlS7	
DStlS7	
DStlS8	Dead + Live + Roof Live - Wind [Strength]
DStlS8	
DStlS8	
DStlS8	
DStlS8	
DStlS9	Dead + Roof Live + Wind [Strength]
DStlS9	
DStlS9	
DStlS10	Dead + Roof Live - Wind [Strength]
DStlS10	
DStlS10	
DStlS11	Dead (min) + Wind [Strength]
DStlS11	
DStlS12	Dead (min) - Wind [Strength]
DStlS12	
DWal1	Dead [Strength]
DWal2	Dead + Live [Strength]
DWal2	
DWal2	
DWal3	Dead + Live + Roof Live [Strength]
DWal3	
DWal3	
DWal3	
DWal4	Dead + Live + Roof Live [Strength]
DWal4	
DWal4	
DWal4	
DWal5	Dead + Live + Wind + Snow [Strength]
DWal5	
DWal5	
DWal5	
DWal6	Dead + Live - Wind + Snow [Strength]

Table 3.5 - Load Combination Definitions (Part 2 of 2, continued)

Name	Notes
DWal6	
DWal6	
DWal6	
DWal7	Dead + Live + Roof Live + Wind [Strength]
DWal7	
DWal7	
DWal7	
DWal7	
DWal8	Dead + Live + Roof Live - Wind [Strength]
DWal8	
DWal8	
DWal8	
DWal8	
DWal9	Dead + Roof Live + Wind [Strength]
DWal9	
DWal9	
DWal10	Dead + Roof Live - Wind [Strength]
DWal10	
DWal10	
DWal11	Dead (min) + Wind [Strength]
DWal11	
DWal12	Dead (min) - Wind [Strength]
DWal12	
LRFD1 1.4D	
LRFD2 1.2D+1.6L+0.5Lr	
LRFD2 1.2D+1.6L+0.5Lr	
LRFD2 1.2D+1.6L+0.5Lr	
LRFD2 1.2D+1.6L+0.5Lr	
LRFD3 1.2D+1.0L+1.6Lr	
LRFD3 1.2D+1.0L+1.6Lr	
LRFD3 1.2D+1.0L+1.6Lr	
LRFD3 1.2D+1.0L+1.6Lr	
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W	
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W	
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W	
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W	
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W	
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W	
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W	
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W	
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W	
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W	
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	

Table 3.5 - Load Combination Definitions (Part 2 of 2, continued)

Name	Notes
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	
LRFD6a-1 0.9D+1.0W	
LRFD6a-1 0.9D+1.0W	
LRFD6a-2 0.9D-1.0W	
LRFD6a-2 0.9D-1.0W	
LRFD6b-1 0.9D+1.0Fa+0.5W	
LRFD6b-1 0.9D+1.0Fa+0.5W	
LRFD6b-1 0.9D+1.0Fa+0.5W	
LRFD6b-2 0.9D+1.0Fa-0.5W	
LRFD6b-2 0.9D+1.0Fa-0.5W	
LRFD6b-2 0.9D+1.0Fa-0.5W	
LRFD $_{Env}$	
LRFD Envelope	
LRFD Envelope	
LRFD Envelope	
LRFD Envelope	
LRFD Envelope	
LRFD Envelope	
LRFD Envelope	
LRFD Envelope	
LRFD Envelope	
LRFD Envelope	
LRFD Envelope	

4 Analysis Results

This chapter provides analysis results.

4.1 Structure Results

Table 4.1 - Base Reactions (Part 1 of 2)

Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip	MX kip-ft	MY kip-ft
Dead	LinStatic		0	0	2045.167	138721.3848	-266957.1339
Live	LinStatic		0	0	241.392	17087.4107	-30326.6866
Roof Live	LinStatic		0	0	136.947	9201.0139	-18035.525
Wind	LinStatic	Max	0	81.673	0	2702.5227	0.4104
Wind	LinStatic	Min	-77.099	-139.329	0	-1451.1104	-1503.5172
Flood	LinStatic		0	0	0	0	0
Reducible Live	LinStatic		0	0	0	0	0
ASD1 D	Combination		0	0	2045.167	138721.3848	-266957.1339
ASD2 D+L	Combination		0	0	2286.559	155808.7955	-297283.8205
ASD3 D+Lr	Combination		0	0	2182.115	147922.3988	-284992.6589
ASD4 D+0.75L+0.75Lr	Combination		0	0	2328.922	158437.7033	-303228.7925
ASD5a-1 D+0.6W	Combination	Max	0	49.004	2045.167	140342.8985	-266956.8877
ASD5a-1 D+0.6W	Combination	Min	-46.259	-83.597	2045.167	137850.7186	-267859.2442
ASD5a-2 D-0.6W	Combination	Max	46.259	83.597	2045.167	139592.0511	-266055.0236
ASD5a-2 D-0.6W	Combination	Min	0	-49.004	2045.167	137099.8712	-266957.3802
ASD6a-1 D+0.75L+0.75Lr+0.45W	Combination	Max	0	36.753	2328.922	159653.8385	-303228.6079
ASD6a-1 D+0.75L+0.75Lr+0.45W	Combination	Min	-34.695	-62.698	2328.922	157784.7036	-303905.3753
ASD6a-2 D+0.75L+0.75Lr-0.45W	Combination	Max	34.695	62.698	2328.922	159090.703	-302552.2098
ASD6a-2 D+0.75L+0.75Lr-0.45W	Combination	Min	0	-36.753	2328.922	157221.5681	-303228.9772
ASD7a-1 0.6D+0.6W	Combination	Max	0	49.004	1227.1	84854.3445	-160174.0341
ASD7a-1 0.6D+0.6W	Combination	Min	-46.259	-83.597	1227.1	82362.1646	-161076.3907
ASD7a-2 0.6D-0.6W	Combination	Max	46.259	83.597	1227.1	84103.4971	-159272.17
ASD7a-2 0.6D-0.6W	Combination	Min	0	-49.004	1227.1	81611.3172	-160174.5266
LRFD1 1.4D	Combination		0	0	2863.234	194209.9387	-373739.9875
LRFD2 1.2D+1.6L+0.5Lr	Combination		0	0	2908.902	198406.0259	-377889.0217
LRFD3 1.2D+1.0L+1.6Lr	Combination		0	0	2914.709	198274.6948	-379532.0872
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W	Combination	Max	0	81.673	2764.066	190856.1022	-359692.5993
LRFD4a-1 1.2D+1.0L+0.5Lr+1.0W	Combination	Min	-77.099	-139.329	2764.066	186702.469	-361196.5269
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W	Combination	Max	77.099	139.329	2764.066	189604.6899	-358189.4925
LRFD4a-2 1.2D+1.0L+0.5Lr-1.0W	Combination	Min	0	-81.673	2764.066	185451.0567	-359693.4201
LRFD6a-1 0.9D+1.0W	Combination	Max	0	81.673	1840.65	127551.7691	-240261.0101
LRFD6a-1 0.9D+1.0W	Combination	Min	-77.099	-139.329	1840.65	123398.1359	-241764.9377
LRFD6a-2 0.9D-1.0W	Combination	Max	77.099	139.329	1840.65	126300.3567	-238757.9033
LRFD6a-2 0.9D-1.0W	Combination	Min	0	-81.673	1840.65	122146.7236	-240261.8309
ASD5b-1 D+0.75Fa+0.6W	Combination	Max	0	49.004	2045.167	140342.8985	-266956.8877
ASD5b-1 D+0.75Fa+0.6W	Combination	Min	-46.259	-83.597	2045.167	137850.7186	-267859.2442
ASD5b-2 D+0.75Fa-0.6W	Combination	Max	46.259	83.597	2045.167	139592.0511	-266055.0236
ASD5b-2 D+0.75Fa-0.6W	Combination	Min	0	-49.004	2045.167	137099.8712	-266957.3802
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	Combination	Max	0	36.753	2328.922	159653.8385	-303228.6079
ASD6b-1 D+0.75L+0.75Lr+0.75Fa+0.45W	Combination	Min	-34.695	-62.698	2328.922	157784.7036	-303905.3753
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	Combination	Max	34.695	62.698	2328.922	159090.703	-302552.2098

Table 4.1 - Base Reactions (Part 1 of 2, continued)

Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip	MX kip-ft	MY kip-ft
ASD6b-2 D+0.75L+0.75Lr+0.75Fa-0.45W	Combination	Min	0	-36.753	2328.922	157221.5681	-303228.9772
ASD7b-1 0.6D+0.75Fa+0.6W	Combination	Max	0	49.004	1227.1	84854.3445	-160174.0341
ASD7b-1 0.6D+0.75Fa+0.6W	Combination	Min	-46.259	-83.597	1227.1	82362.1646	-161076.3907
ASD7b-2 0.6D+0.75Fa-0.6W	Combination	Max	46.259	83.597	1227.1	84103.4971	-159272.17
ASD7b-2 0.6D+0.75Fa-0.6W	Combination	Min	0	-49.004	1227.1	81611.3172	-160174.5266
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	Combination	Max	0	40.836	2764.066	189504.8408	-359692.8045
LRFD4b-1 1.2D+1.0L+0.5Lr+1.0Fa+0.5W	Combination	Min	-38.549	-69.664	2764.066	187428.0242	-360444.7683
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	Combination	Max	38.549	69.664	2764.066	188879.1346	-358941.2511
LRFD4b-2 1.2D+1.0L+0.5Lr+1.0Fa-0.5W	Combination	Min	0	-40.836	2764.066	186802.3181	-359693.2149
LRFD6b-1 0.9D+1.0Fa+0.5W	Combination	Max	0	40.836	1840.65	126200.5077	-240261.2153
LRFD6b-1 0.9D+1.0Fa+0.5W	Combination	Min	-38.549	-69.664	1840.65	124123.6911	-241013.1791
LRFD6b-2 0.9D+1.0Fa-0.5W	Combination	Max	38.549	69.664	1840.65	125574.8015	-239509.6619
LRFD6b-2 0.9D+1.0Fa-0.5W	Combination	Min	0	-40.836	1840.65	123497.985	-240261.6257
ASD Envelope	Combination	Max	46.259	83.597	2328.922	159653.8385	-159272.17
ASD Envelope	Combination	Min	-46.259	-83.597	1227.1	81611.3172	-303905.3753
LRFD Envelope	Combination	Max	77.099	139.329	2914.709	198406.0259	-238757.9033
LRFD Envelope	Combination	Min	-77.099	-139.329	1840.65	122146.7236	-379532.0872
LRFD $_{Env}$	Combination	Max	0	81.673	0	2702.5227	0.4104
LRFD $_{Env}$	Combination	Min	-77.099	-139.329	0	-1451.1104	-1503.5172
ASD $_{Env}$	Combination	Max	0	49.004	0	1621.5136	0.2462
ASD $_{Env}$	Combination	Min	-46.259	-83.597	0	-870.6662	-902.1103
DSlbU1	Combination		0	0	2863.234	194209.9387	-373739.9875
DSlbU2	Combination		0	0	3059.544	208527.1412	-397728.0991
DSlbU3	Combination	Max	0	81.673	2832.54	195456.6092	-368710.3618
DSlbU3	Combination	Min	-77.099	-139.329	2832.54	191302.976	-370214.2894
DSlbU4	Combination	Max	77.099	139.329	2832.54	194205.1968	-367207.255
DSlbU4	Combination	Min	0	-81.673	2832.54	190051.5637	-368711.1826
DSlbU5	Combination	Max	0	81.673	1840.65	127551.7691	-240261.0101
DSlbU5	Combination	Min	-77.099	-139.329	1840.65	123398.1359	-241764.9377
DSlbU6	Combination	Max	77.099	139.329	1840.65	126300.3567	-238757.9033
DSlbU6	Combination	Min	0	-81.673	1840.65	122146.7236	-240261.8309
DCon1	Combination		0	0	2863.234	194209.9387	-373739.9875
DCon2	Combination		0	0	2840.428	193805.5189	-368871.2592
DCon3	Combination		0	0	2908.902	198406.0259	-377889.0217
DCon4	Combination		0	0	2914.709	198274.6948	-379532.0872
DCon5	Combination	Max	0	81.673	2695.593	186255.5952	-350674.8368
DCon5	Combination	Min	-77.099	-139.329	2695.593	182101.9621	-352178.7645
DCon6	Combination	Max	77.099	139.329	2695.593	185004.1829	-349171.73
DCon6	Combination	Min	0	-81.673	2695.593	180850.5497	-350675.6577
DCon7	Combination	Max	0	81.673	2764.066	190856.1022	-359692.5993
DCon7	Combination	Min	-77.099	-139.329	2764.066	186702.469	-361196.5269
DCon8	Combination	Max	77.099	139.329	2764.066	189604.6899	-358189.4925
DCon8	Combination	Min	0	-81.673	2764.066	185451.0567	-359693.4201
DCon9	Combination	Max	0	40.836	2673.316	182538.5455	-349205.1954
DCon9	Combination	Min	-38.549	-69.664	2673.316	180461.7289	-349957.1592

Table 4.1 - Base Reactions (Part 1 of 2, continued)

Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip	MX kip-ft	MY kip-ft
DCon10	Combination	Max	38.549	69.664	2673.316	181912.8393	-348453.642
DCon10	Combination	Min	0	-40.836	2673.316	179836.0227	-349205.6058
DCon11	Combination	Max	0	81.673	1840.65	127551.7691	-240261.0101
DCon11	Combination	Min	-77.099	-139.329	1840.65	123398.1359	-241764.9377
DCon12	Combination	Max	77.099	139.329	1840.65	126300.3567	-238757.9033
DCon12	Combination	Min	0	-81.673	1840.65	122146.7236	-240261.8309
DWal1	Combination		0	0	2863.234	194209.9387	-373739.9875
DWal2	Combination		0	0	2840.428	193805.5189	-368871.2592
DWal3	Combination		0	0	2908.902	198406.0259	-377889.0217
DWal4	Combination		0	0	2914.709	198274.6948	-379532.0872
DWal5	Combination	Max	0	81.673	2695.593	186255.5952	-350674.8368
DWal5	Combination	Min	-77.099	-139.329	2695.593	182101.9621	-352178.7645
DWal6	Combination	Max	77.099	139.329	2695.593	185004.1829	-349171.73
DWal6	Combination	Min	0	-81.673	2695.593	180850.5497	-350675.6577
DWal7	Combination	Max	0	81.673	2764.066	190856.1022	-359692.5993
DWal7	Combination	Min	-77.099	-139.329	2764.066	186702.469	-361196.5269
DWal8	Combination	Max	77.099	139.329	2764.066	189604.6899	-358189.4925
DWal8	Combination	Min	0	-81.673	2764.066	185451.0567	-359693.4201
DWal9	Combination	Max	0	40.836	2673.316	182538.5455	-349205.1954
DWal9	Combination	Min	-38.549	-69.664	2673.316	180461.7289	-349957.1592
DWal10	Combination	Max	38.549	69.664	2673.316	181912.8393	-348453.642
DWal10	Combination	Min	0	-40.836	2673.316	179836.0227	-349205.6058
DWal11	Combination	Max	0	81.673	1840.65	127551.7691	-240261.0101
DWal11	Combination	Min	-77.099	-139.329	1840.65	123398.1359	-241764.9377
DWal12	Combination	Max	77.099	139.329	1840.65	126300.3567	-238757.9033
DWal12	Combination	Min	0	-81.673	1840.65	122146.7236	-240261.8309
DStlS1	Combination		0	0	2863.234	194209.9387	-373739.9875
DStlS2	Combination		0	0	2840.428	193805.5189	-368871.2592
DStlS3	Combination		0	0	2908.902	198406.0259	-377889.0217
DStlS4	Combination		0	0	2914.709	198274.6948	-379532.0872
DStlS5	Combination	Max	0	81.673	2695.593	186255.5952	-350674.8368
DStlS5	Combination	Min	-77.099	-139.329	2695.593	182101.9621	-352178.7645
DStlS6	Combination	Max	77.099	139.329	2695.593	185004.1829	-349171.73
DStlS6	Combination	Min	0	-81.673	2695.593	180850.5497	-350675.6577
DStlS7	Combination	Max	0	81.673	2764.066	190856.1022	-359692.5993
DStlS7	Combination	Min	-77.099	-139.329	2764.066	186702.469	-361196.5269
DStlS8	Combination	Max	77.099	139.329	2764.066	189604.6899	-358189.4925
DStlS8	Combination	Min	0	-81.673	2764.066	185451.0567	-359693.4201
DStlS9	Combination	Max	0	40.836	2673.316	182538.5455	-349205.1954
DStlS9	Combination	Min	-38.549	-69.664	2673.316	180461.7289	-349957.1592
DStlS10	Combination	Max	38.549	69.664	2673.316	181912.8393	-348453.642
DStlS10	Combination	Min	0	-40.836	2673.316	179836.0227	-349205.6058
DStlS11	Combination	Max	0	81.673	1840.65	127551.7691	-240261.0101
DStlS11	Combination	Min	-77.099	-139.329	1840.65	123398.1359	-241764.9377
DStlS12	Combination	Max	77.099	139.329	1840.65	126300.3567	-238757.9033

Table 4.1 - Base Reactions (Part 1 of 2, continued)

Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip	MX kip-ft	MY kip-ft
DStlS12	Combination	Min	0	-81.673	1840.65	122146.7236	-240261.8309
DStlD1	Combination		0	0	2045.167	138721.3848	-266957.1339
DStlD2	Combination		0	0	2286.559	155808.7955	-297283.8205
DCmpD1	Combination		0	0	2045.167	138721.3848	-266957.1339
DCmpD2	Combination		0	0	2286.559	155808.7955	-297283.8205
DCmpS1	Combination		0	0	2863.234	194209.9387	-373739.9875
DCmpS2	Combination		0	0	2840.428	193805.5189	-368871.2592
DCmpS3	Combination		0	0	2908.902	198406.0259	-377889.0217
DCmpS4	Combination		0	0	2914.709	198274.6948	-379532.0872
DCmpC1	Combination		0	0	2863.234	194209.9387	-373739.9875
DCmpC2	Combination		0	0	2454.201	166465.6618	-320348.5607

Table 4.1 - Base Reactions (Part 2 of 2)

MZ kip-ft	X ft	Y ft	Z ft
0.0063	0	0	-1.5
0.0011	0	0	-1.5
0.001	0	0	-1.5
13929.8869	0	0	-1.5
-16778.9276	0	0	-1.5
0	0	0	-1.5
0	0	0	-1.5
0.0063	0	0	-1.5
0.0073	0	0	-1.5
0.0073	0	0	-1.5
0.0079	0	0	-1.5
8357.9384	0	0	-1.5
-10067.3503	0	0	-1.5
10067.3628	0	0	-1.5
-8357.9259	0	0	-1.5
6268.4569	0	0	-1.5
-7550.5096	0	0	-1.5
7550.5253	0	0	-1.5
-6268.4412	0	0	-1.5
8357.9359	0	0	-1.5
-10067.3528	0	0	-1.5
10067.3603	0	0	-1.5
-8357.9284	0	0	-1.5
0.0088	0	0	-1.5
0.0098	0	0	-1.5
0.0103	0	0	-1.5
13929.896	0	0	-1.5
-16778.9185	0	0	-1.5
16778.9367	0	0	-1.5
-13929.8778	0	0	-1.5

Table 4.1 - Base Reactions (Part 2 of 2, continued)

MZ kip-ft	X ft	Y ft	Z ft
13929.8925	0	0	-1.5
-16778.922	0	0	-1.5
16778.9333	0	0	-1.5
-13929.8812	0	0	-1.5
8357.9384	0	0	-1.5
-10067.3503	0	0	-1.5
10067.3628	0	0	-1.5
-8357.9259	0	0	-1.5
6268.4569	0	0	-1.5
-7550.5096	0	0	-1.5
7550.5253	0	0	-1.5
-6268.4412	0	0	-1.5
8357.9359	0	0	-1.5
-10067.3528	0	0	-1.5
10067.3603	0	0	-1.5
-8357.9284	0	0	-1.5
6964.9525	0	0	-1.5
-8389.4547	0	0	-1.5
8389.4729	0	0	-1.5
-6964.9343	0	0	-1.5
6964.9491	0	0	-1.5
-8389.4582	0	0	-1.5
8389.4695	0	0	-1.5
-6964.9378	0	0	-1.5
10067.3628	0	0	-1.5
-10067.3528	0	0	-1.5
16778.9367	0	0	-1.5
-16778.922	0	0	-1.5
13929.8869	0	0	-1.5
-16778.9276	0	0	-1.5
8357.9321	0	0	-1.5
-10067.3566	0	0	-1.5
0.0088	0	0	-1.5
0.0109	0	0	-1.5
13929.8965	0	0	-1.5
-16778.918	0	0	-1.5
16778.9373	0	0	-1.5
-13929.8772	0	0	-1.5
13929.8925	0	0	-1.5
-16778.922	0	0	-1.5
16778.9333	0	0	-1.5
-13929.8812	0	0	-1.5
0.0088	0	0	-1.5
0.0092	0	0	-1.5
0.0098	0	0	-1.5

Table 4.1 - Base Reactions (Part 2 of 2, continued)

MZ kip-ft	X ft	Y ft	Z ft
0.0103	0	0	-1.5
13929.8955	0	0	-1.5
-16778.919	0	0	-1.5
16778.9362	0	0	-1.5
-13929.8783	0	0	-1.5
13929.896	0	0	-1.5
-16778.9185	0	0	-1.5
16778.9367	0	0	-1.5
-13929.8778	0	0	-1.5
6964.9526	0	0	-1.5
-8389.4546	0	0	-1.5
8389.473	0	0	-1.5
-6964.9342	0	0	-1.5
13929.8925	0	0	-1.5
-16778.922	0	0	-1.5
16778.9333	0	0	-1.5
-13929.8812	0	0	-1.5
0.0088	0	0	-1.5
0.0092	0	0	-1.5
0.0098	0	0	-1.5
0.0103	0	0	-1.5
13929.8955	0	0	-1.5
-16778.919	0	0	-1.5
16778.9362	0	0	-1.5
-13929.8783	0	0	-1.5
13929.896	0	0	-1.5
-16778.9185	0	0	-1.5
16778.9367	0	0	-1.5
-13929.8778	0	0	-1.5
6964.9526	0	0	-1.5
-8389.4546	0	0	-1.5
8389.473	0	0	-1.5
-6964.9342	0	0	-1.5
13929.8925	0	0	-1.5
-16778.922	0	0	-1.5
16778.9333	0	0	-1.5
-13929.8812	0	0	-1.5
0.0088	0	0	-1.5
0.0092	0	0	-1.5
0.0098	0	0	-1.5
0.0103	0	0	-1.5
13929.8955	0	0	-1.5
-16778.919	0	0	-1.5
16778.9362	0	0	-1.5
-13929.8783	0	0	-1.5

Table 4.1 - Base Reactions (Part 2 of 2, continued)

MZ kip-ft	X ft	Y ft	Z ft
13929.896	0	0	-1.5
-16778.9185	0	0	-1.5
16778.9367	0	0	-1.5
-13929.8778	0	0	-1.5
6964.9526	0	0	-1.5
-8389.4546	0	0	-1.5
8389.473	0	0	-1.5
-6964.9342	0	0	-1.5
13929.8925	0	0	-1.5
-16778.922	0	0	-1.5
16778.9333	0	0	-1.5
-13929.8812	0	0	-1.5
0.0063	0	0	-1.5
0.0073	0	0	-1.5
0.0063	0	0	-1.5
0.0073	0	0	-1.5
0.0088	0	0	-1.5
0.0092	0	0	-1.5
0.0098	0	0	-1.5
0.0103	0	0	-1.5
0.0088	0	0	-1.5
0.0075	0	0	-1.5

Table 4.2 - Centers Of Mass And Rigidity

Story	Diaphragm	Mass X lb-s2/ft	Mass Y lb-s2/ft	XCM ft	YCM ft	Cum Mass X lb-s2/ft	Cum Mass Y lb-s2/ft	XCCM ft	YCCM ft	XCR ft	YCR ft
Roof	D1	27907.07	27907.07	132.4135	67.1325	27907.07	27907.07	132.4135	67.1325		
2nd Floor	D1	31419.7	31419.7	128.6472	69.6792	59326.76	59326.76	130.4188	68.4812		
1st Floor	D1	0	0	119.6903	70.7172	59326.76	59326.76	130.4188	68.4812		

4.2 Modal Results

Table 4.3 - Modal Periods And Frequencies

Case	Mode	Period sec	Frequency cyc/sec	CircFreq rad/sec	Eigenvalue rad2/sec2
Modal	1	0.247	4.047	25.4296	646.6635
Modal	2	0.117	8.562	53.795	2893.9038
Modal	3	0.085	11.743	73.7851	5444.2377
Modal	4	0.082	12.241	76.9123	5915.4955
Modal	5	0.041	24.66	154.943	24007.3274
Modal	6	0.04	25.261	158.7226	25192.8788
Modal	7	0.039	25.608	160.9005	25888.9819
Modal	8	0.038	26.022	163.5003	26732.3465
Modal	9	0.038	26.129	164.1715	26952.2661

Table 4.3 - Modal Periods And Frequencies (continued)

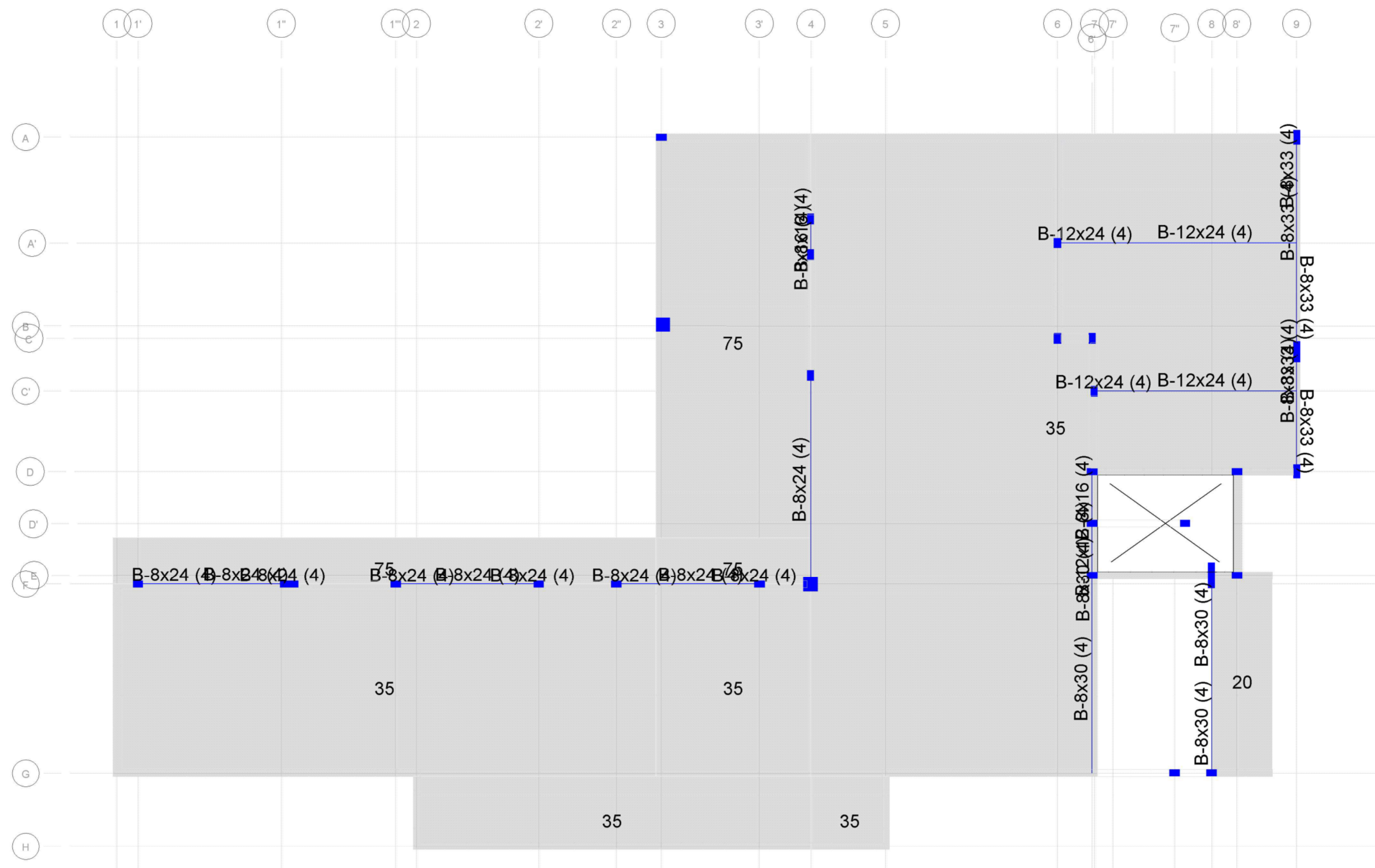
Case	Mode	Period sec	Frequency cyc/sec	CircFreq rad/sec	Eigenvalue rad2/sec2
Modal	10	0.038	26.205	164.65	27109.6207
Modal	11	0.038	26.347	165.542	27404.1562
Modal	12	0.038	26.384	165.7756	27481.5611

Table 4.4 - Modal Participating Mass Ratios (Part 1 of 2)

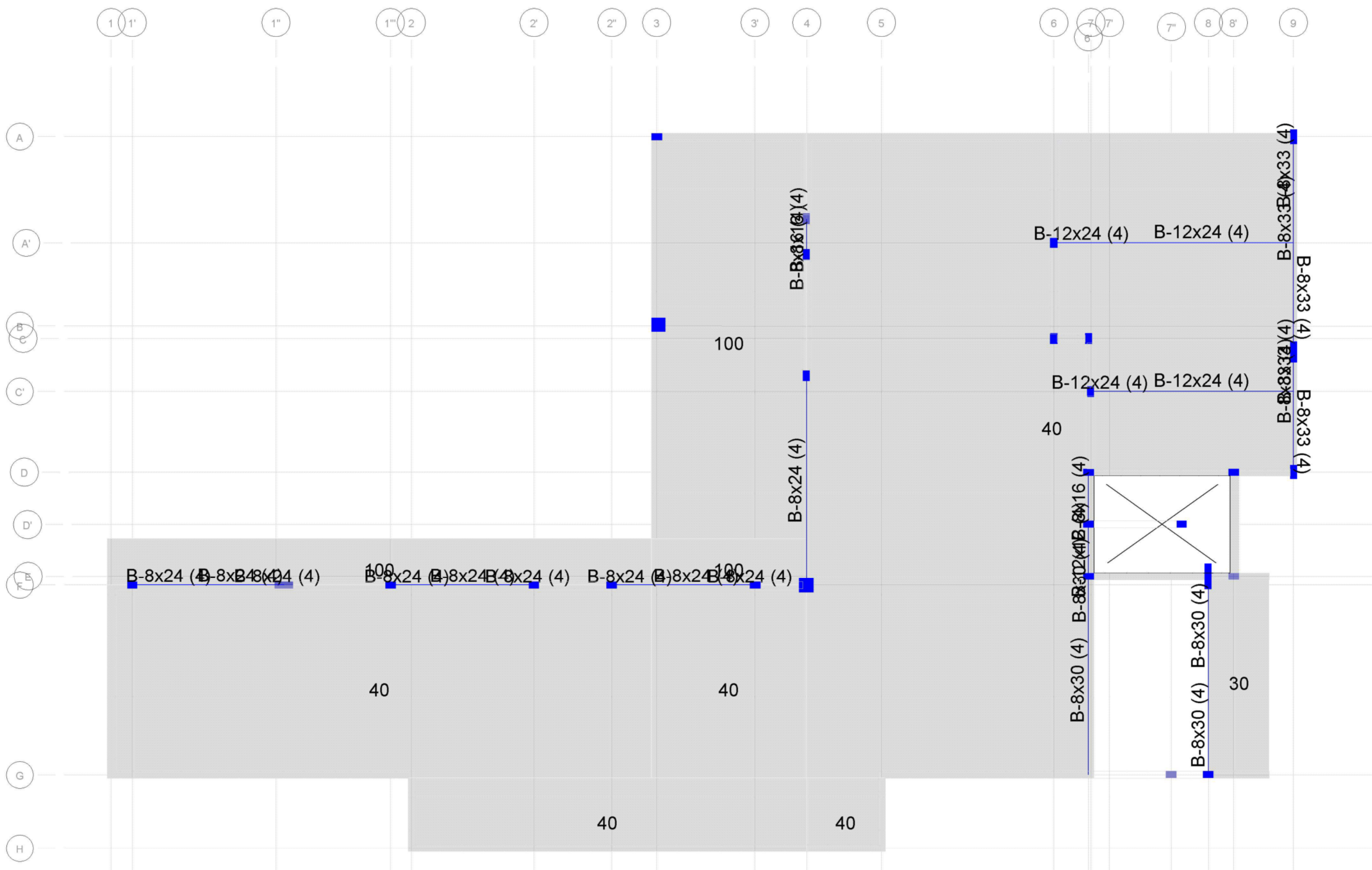
Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX	RY	RZ	SumRX
Modal	1	0.247	0.0057	0.7638	0	0.0057	0.7638	0	0.2161	0.0014	0.0231	0.2161
Modal	2	0.117	0.3774	0.0253	0	0.3832	0.7892	0	0.0038	0.0502	0.4702	0.2199
Modal	3	0.085	0.415	0.0126	0	0.7981	0.8017	0	0.061	0.0764	0.3375	0.2809
Modal	4	0.082	0.0892	0.1354	0	0.8873	0.9372	0	0.3311	0.0019	0.0383	0.6119
Modal	5	0.041	0.0001	0.0002	0	0.8874	0.9374	0	0.0012	0.0007	0.0011	0.6132
Modal	6	0.04	0.0226	0.0031	0	0.91	0.9404	0	0.0175	0.2111	0.0447	0.6306
Modal	7	0.039	0.0008	0.0021	0	0.9109	0.9425	0	0.013	0.0079	1.328E-05	0.6436
Modal	8	0.038	0.0001	0.0004	0	0.911	0.9429	0	0.0025	0.0007	0.0001	0.6461
Modal	9	0.038	0.0002	0.003	0	0.9112	0.9459	0	0.0186	0.0017	0.0005	0.6647
Modal	10	0.038	0.0003	2.231E-05	0	0.9114	0.9459	0	0.0002	0.0014	0.0001	0.6649
Modal	11	0.038	0.0002	0.0032	0	0.9116	0.9491	0	0.0211	0.0019	0.001	0.686
Modal	12	0.038	0.0005	0.0012	0	0.9122	0.9504	0	0.0088	0.0048	0.0003	0.6948

Table 4.4 - Modal Participating Mass Ratios (Part 2 of 2)

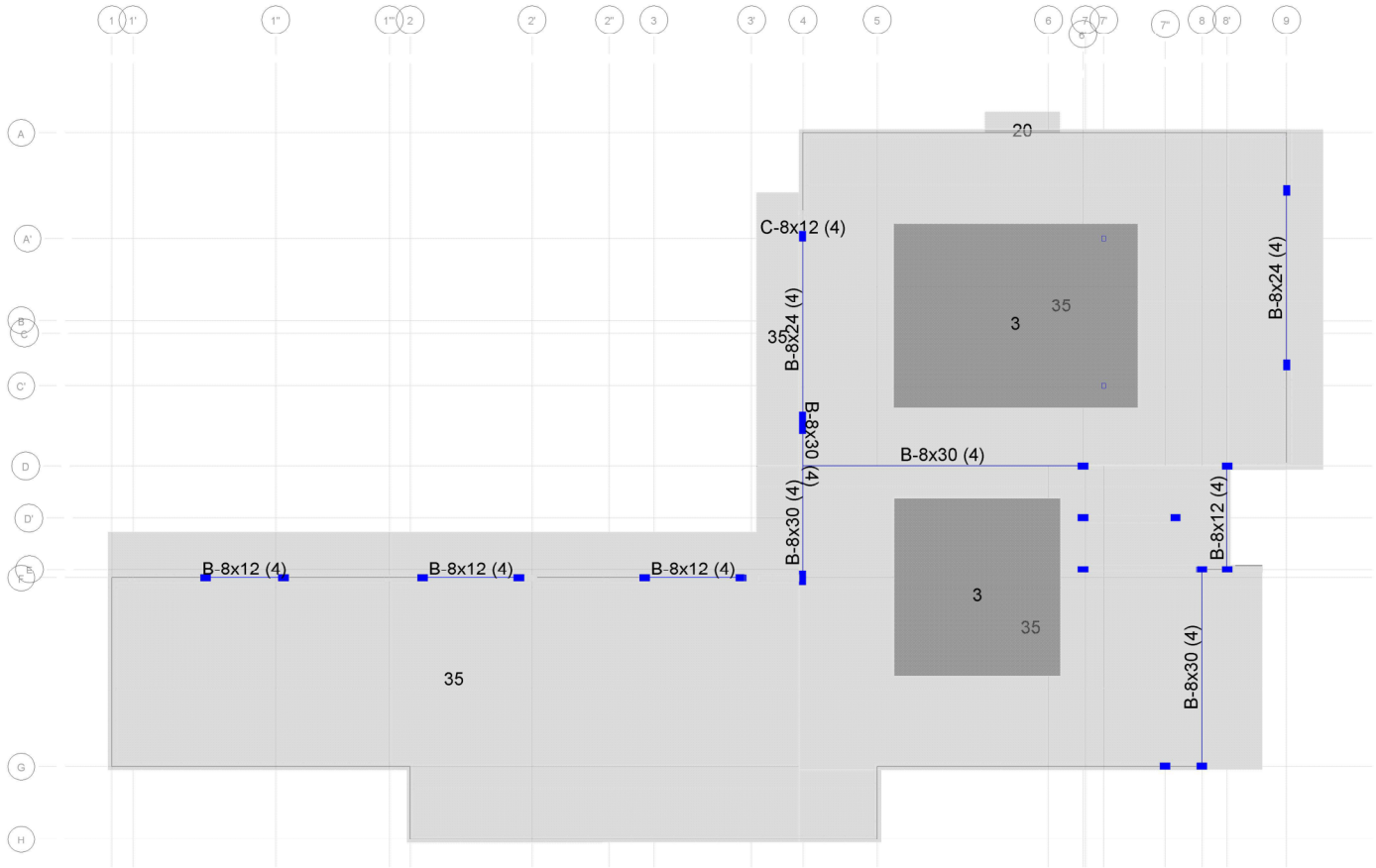
Case	Mode	SumRY	SumRZ
Modal	1	0.0014	0.0231
Modal	2	0.0516	0.4933
Modal	3	0.128	0.8307
Modal	4	0.1299	0.869
Modal	5	0.1306	0.8701
Modal	6	0.3417	0.9148
Modal	7	0.3497	0.9148
Modal	8	0.3504	0.9149
Modal	9	0.3521	0.9155
Modal	10	0.3535	0.9156
Modal	11	0.3554	0.9166
Modal	12	0.3602	0.9169



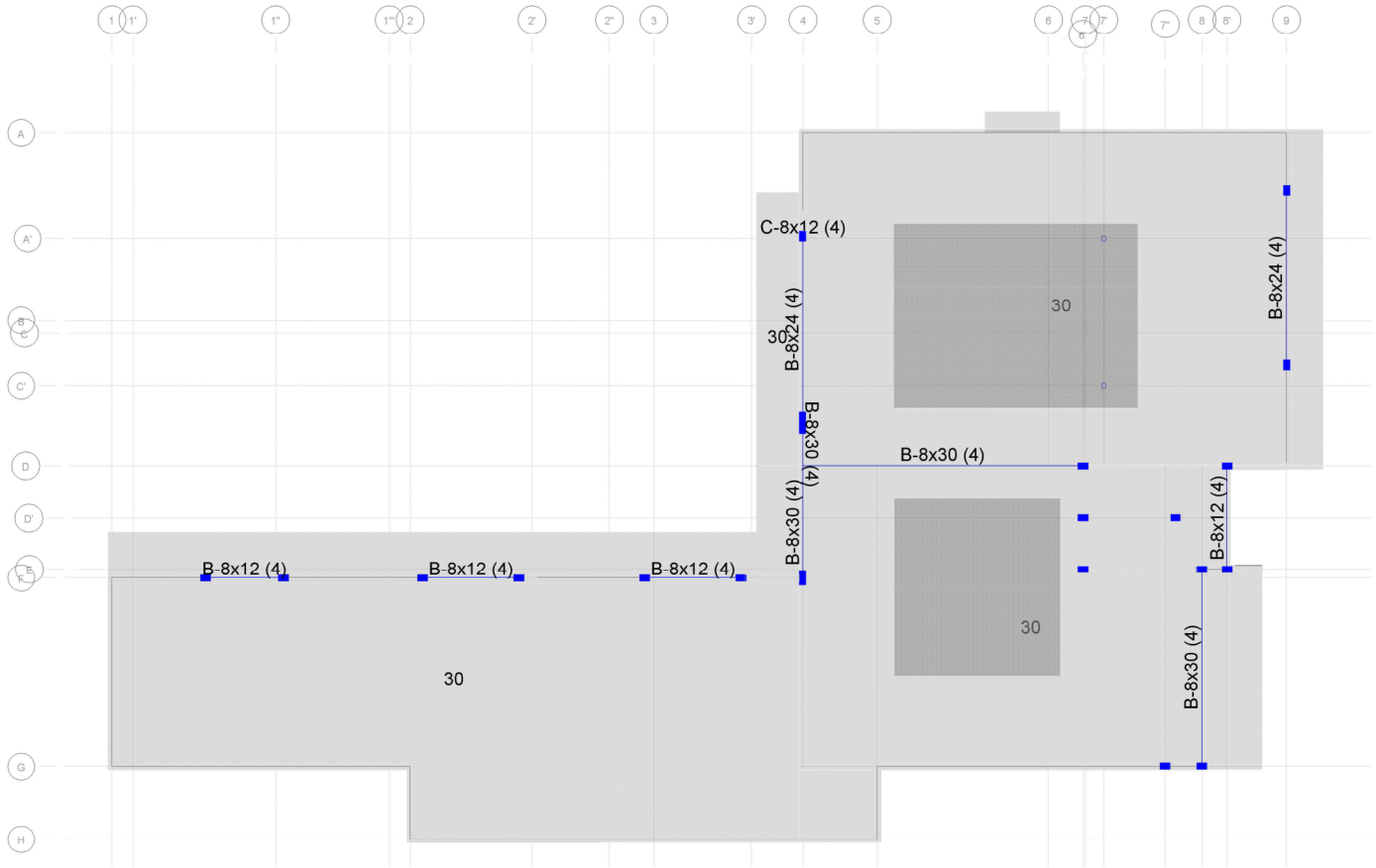
24-0609P8_v00 (052324).EDB Plan View - 2nd Floor - Z = 12.5 (ft) Uniform Loads Gravity (Super Dead) [lb/ft²]



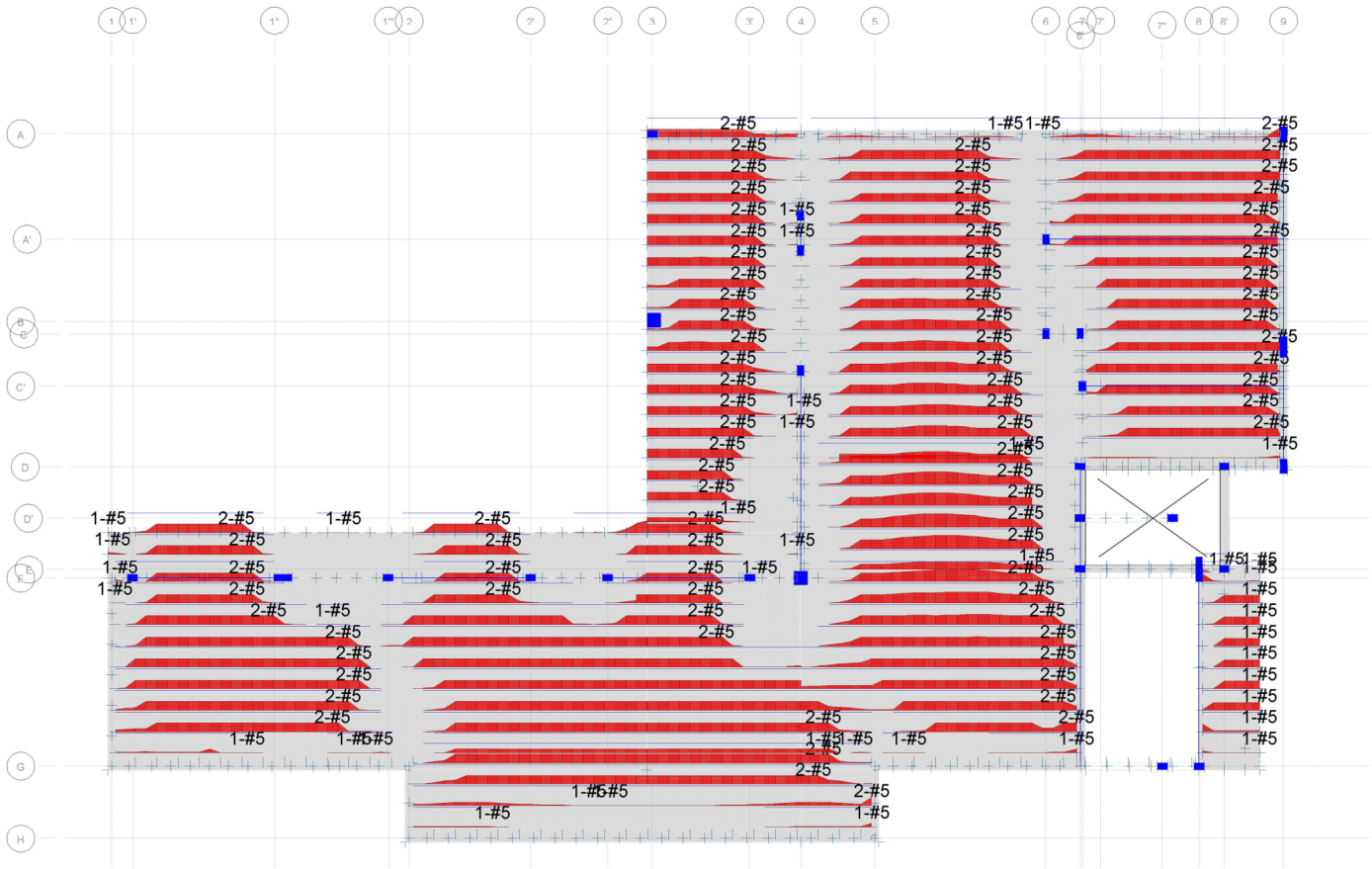
24-0609P8_v00 (052324).EDB Plan View - 2nd Floor - Z = 12.5 (ft) Uniform Loads Gravity (Live) [lb/ft²]



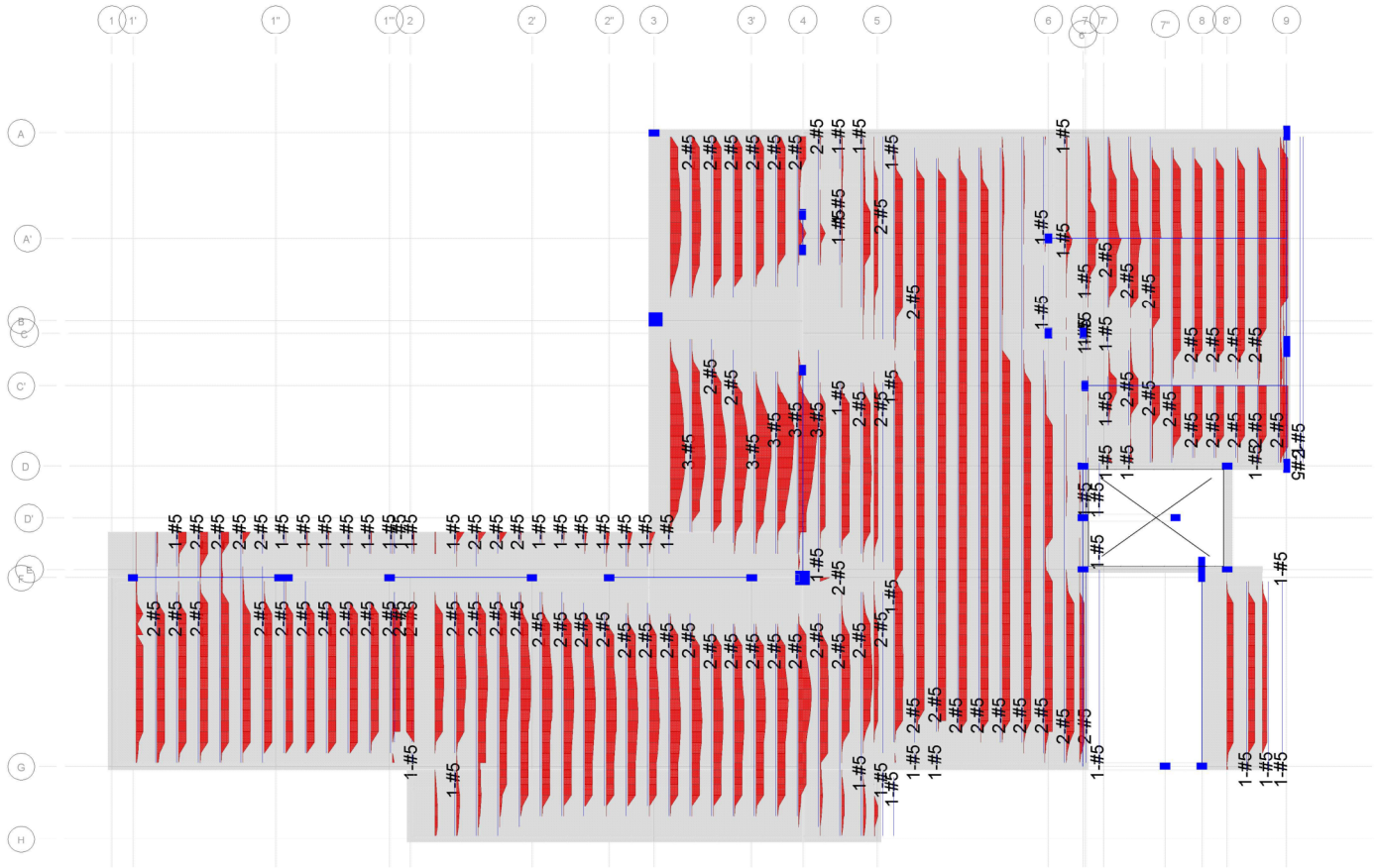
24-0609P8_v00 (052324).EDB Plan View - Roof - Z = 23.6667 (ft) Uniform Loads Gravity (Super Dead) [lb/ft²]



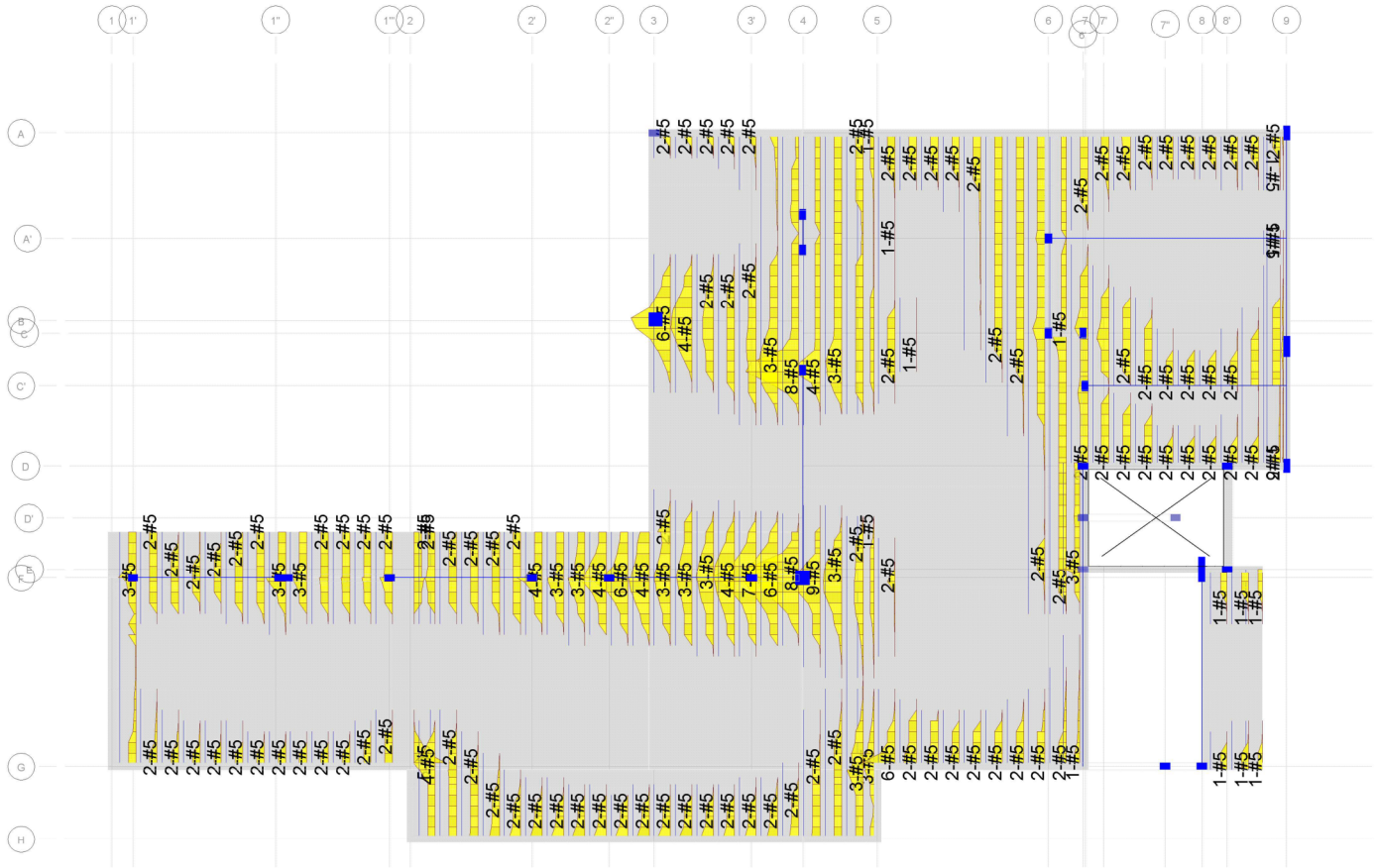
24-0609P8_v00 (052324).EDB Plan View - Roof - Z = 23.6667 (ft) Uniform Loads Gravity (Roof Live) [lb/ft²]



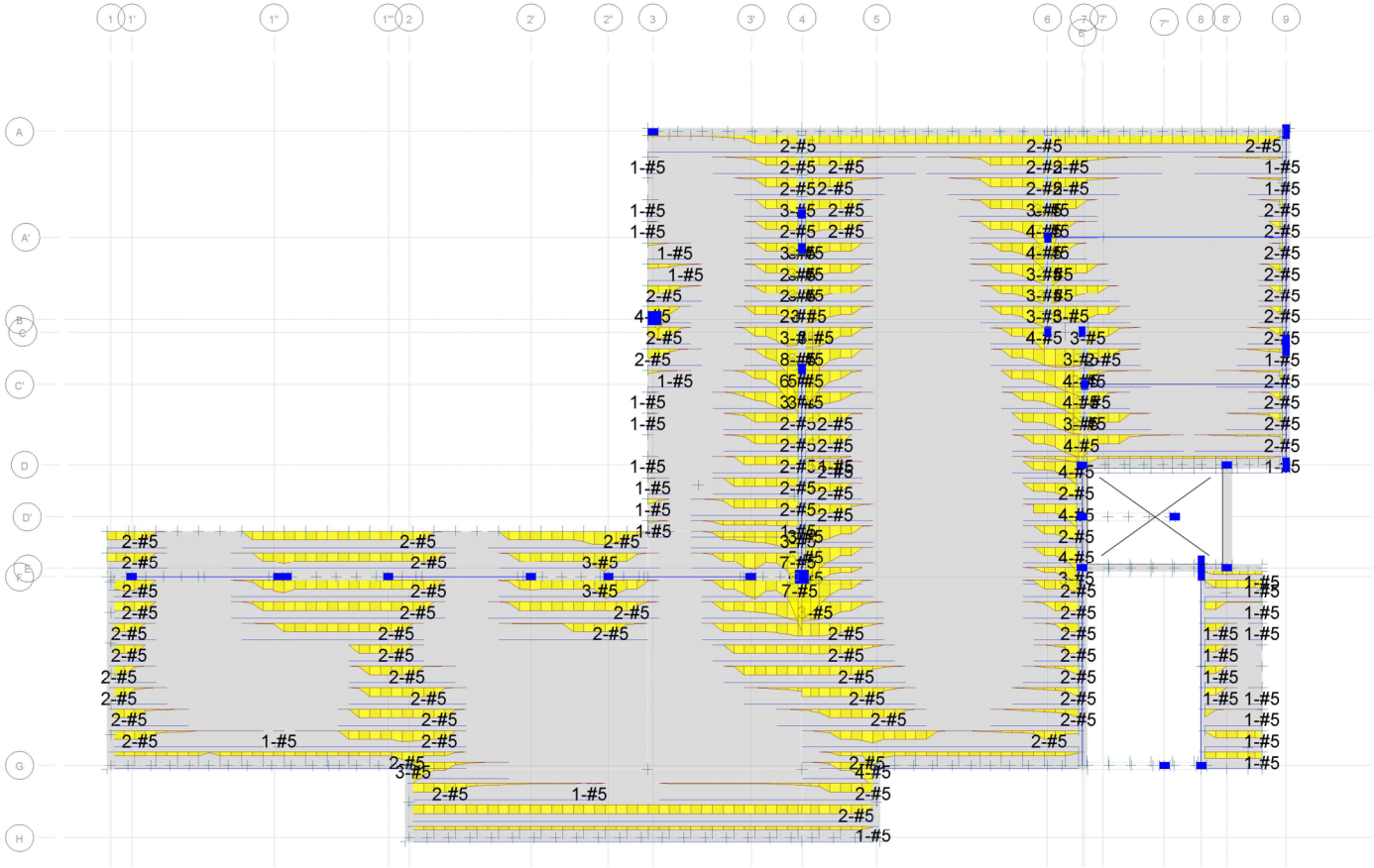
24-0609P8_v00 (052324)ETABS Plan View - 2nd Floor - Z = 12.5 (ft) Slab Strip Design - Layer A - Bottom Reinforcement (Enveloping Flexural)



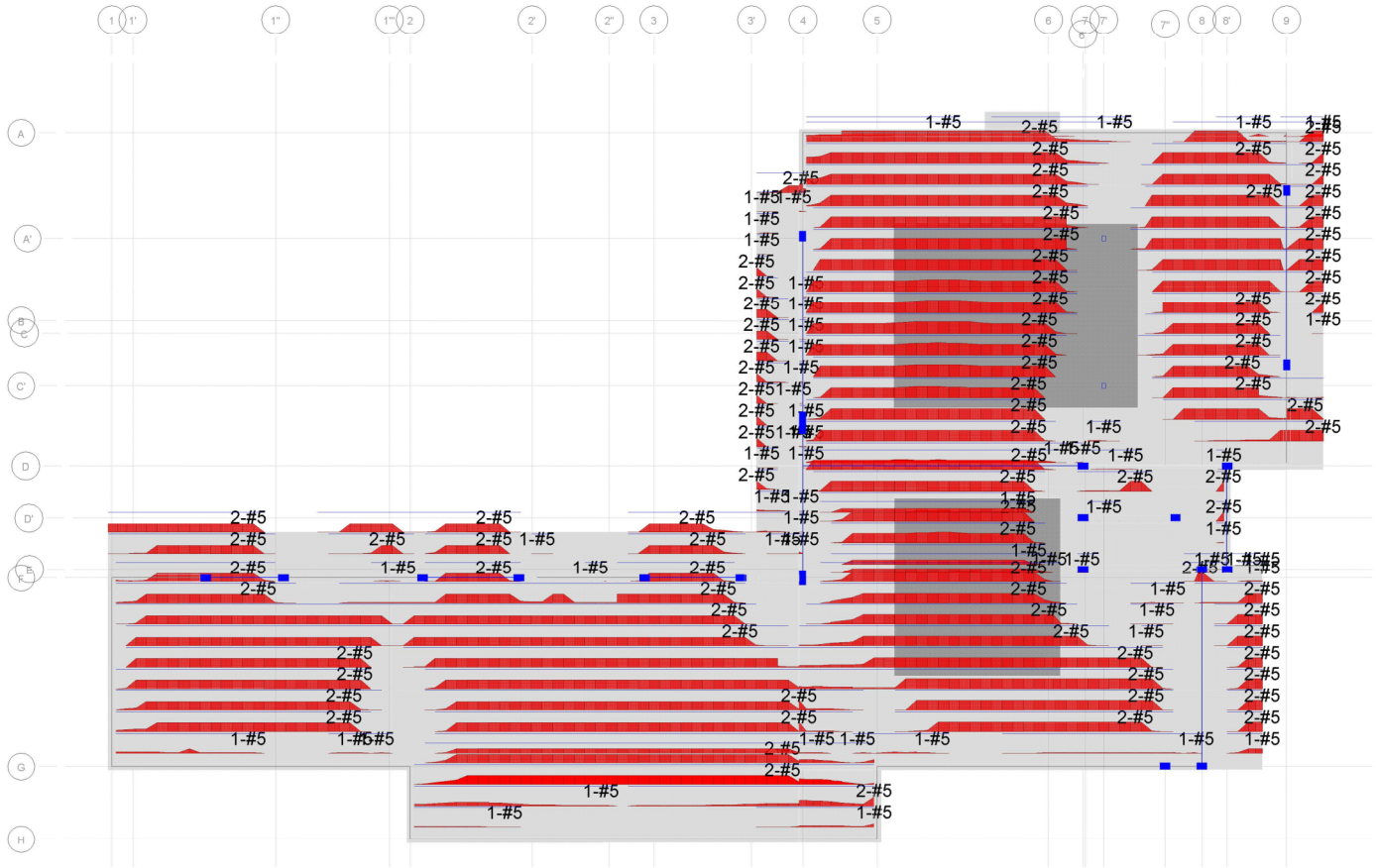
24-0609P8_v00 (052324)ETABS Plan View - 2nd Floor - Z = 12.5 (ft) Slab Strip Design - Layer B - Bottom Reinforcement (Enveloping Flexural)



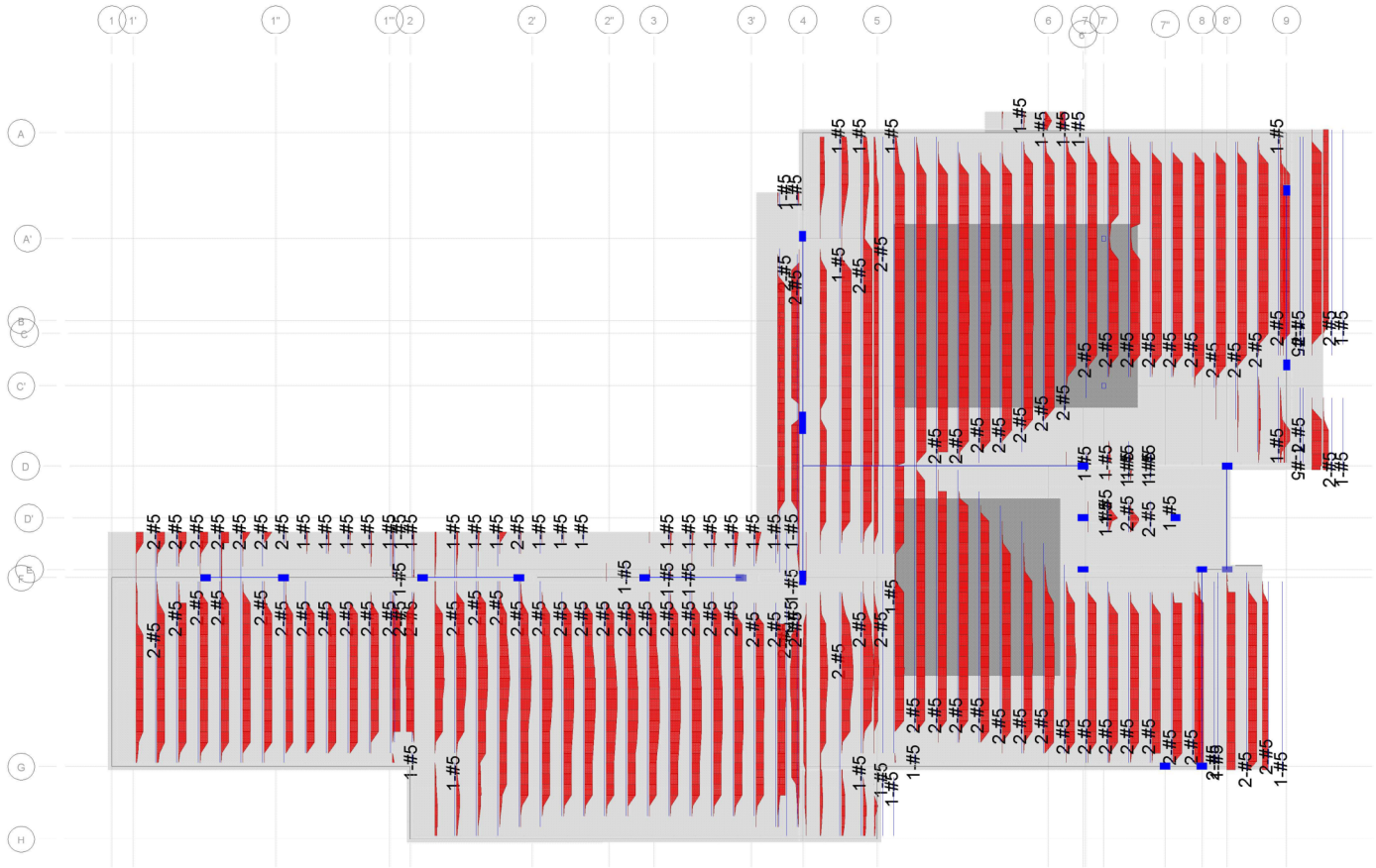
24-0609P8_v00 (052324).EDB Plan View - 2nd Floor - Z = 12.5 (ft) Slab Strip Design - Layer B - Top Reinforcement (Enveloping Flexural)



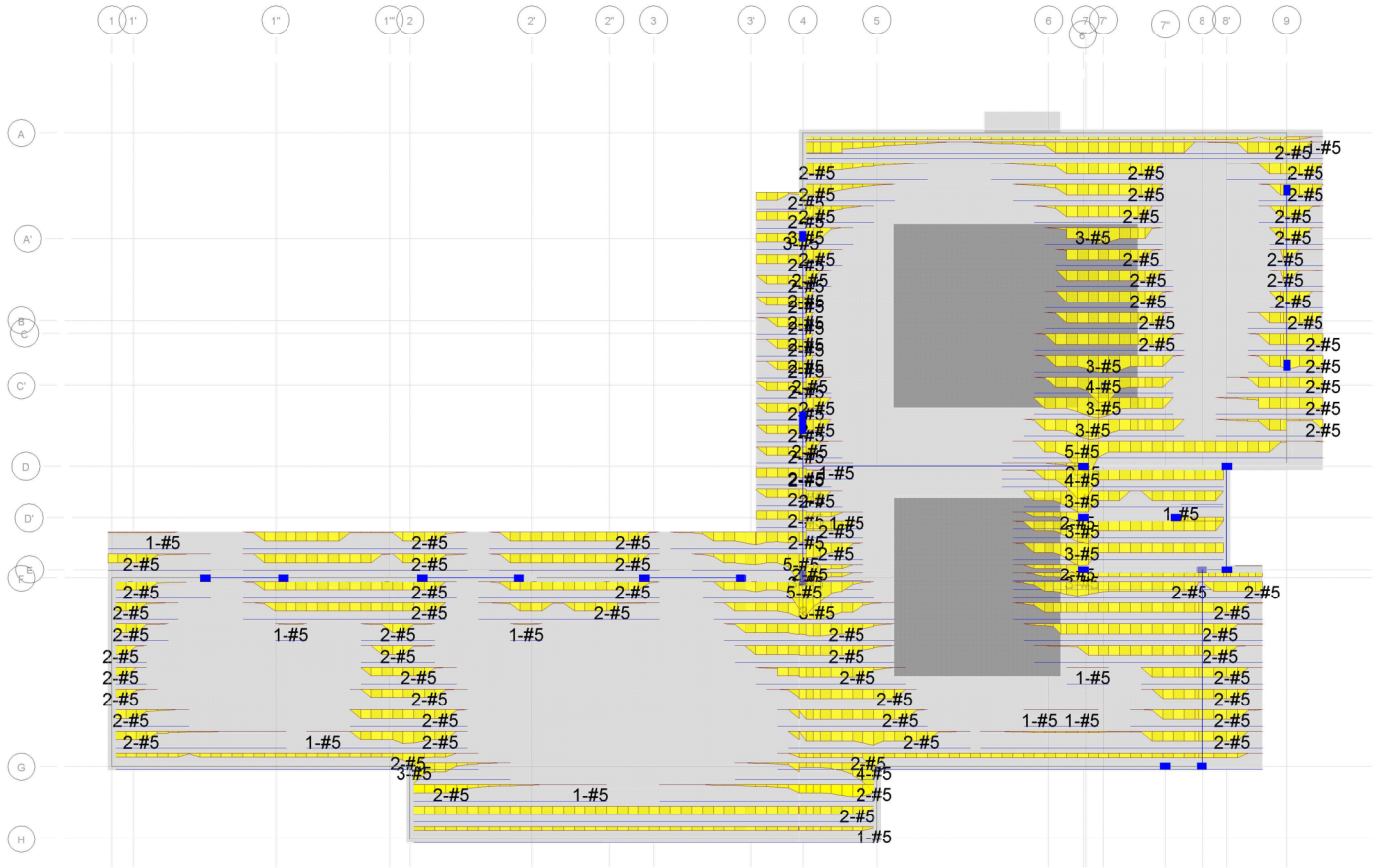
24-0609P8_v00 (052324).EDB Plan View - 2nd Floor - Z = 12.5 (ft) Slab Strip Design - Layer A - Top Reinforcement (Enveloping Flexural)



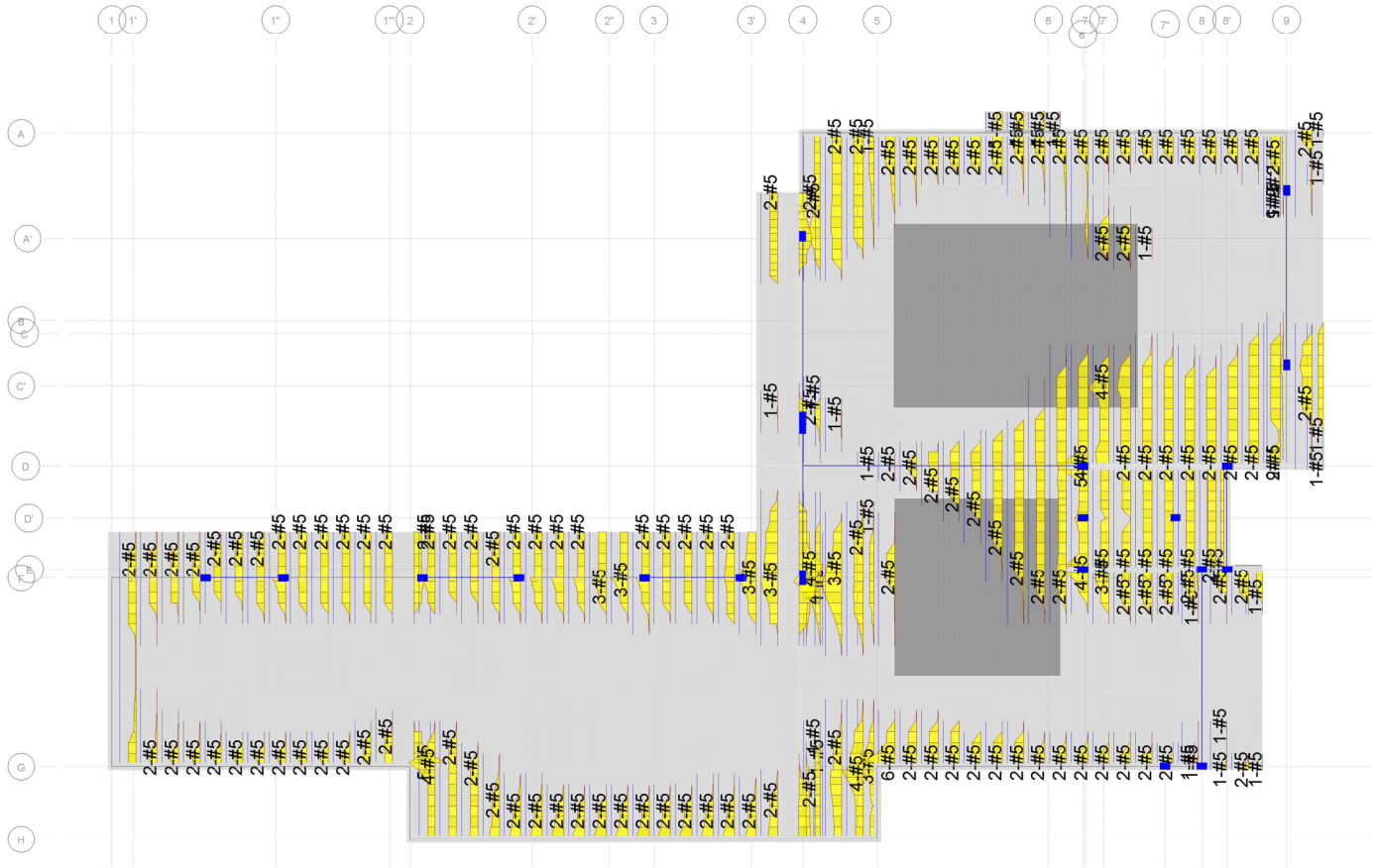
24-0609P8_v00 (052324).ETAB Plan View - Roof - Z = 23.6667 (ft) Slab Strip Design - Layer A - Bottom Reinforcement (Enveloping Flexural)



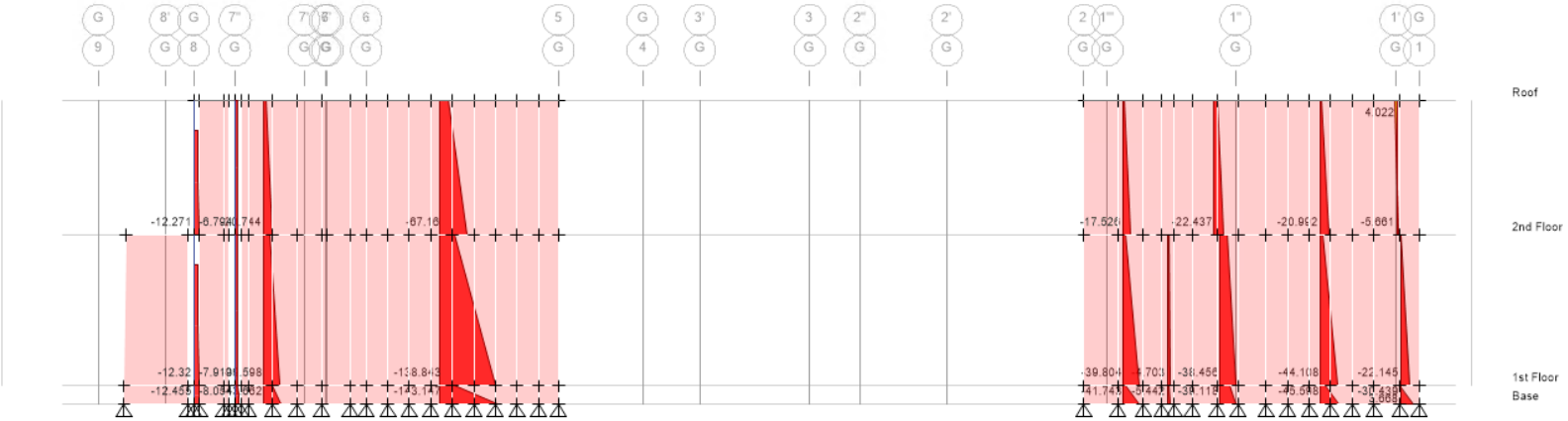
24-0609P8_v00 (052324).ETAB Plan View - Roof - Z = 23.6667 (ft) Slab Strip Design - Layer B - Bottom Reinforcement (Enveloping Flexural)



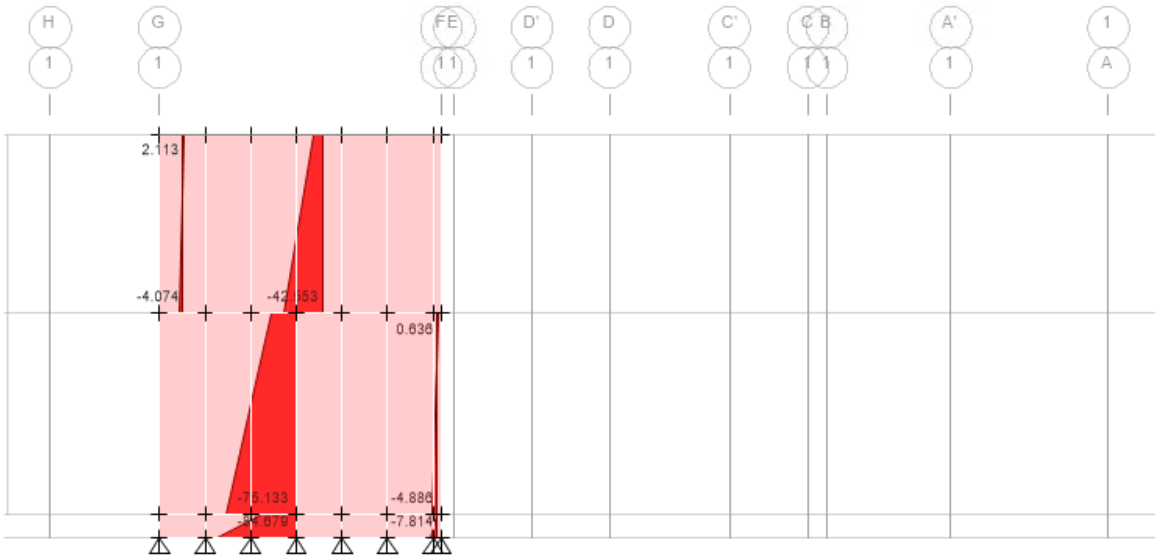
24-0609P8_v00 (052324).EDB Plan View - Roof - Z = 23.6667 (ft) Slab Strip Design - Layer A - Top Reinforcement (Enveloping Flexural)



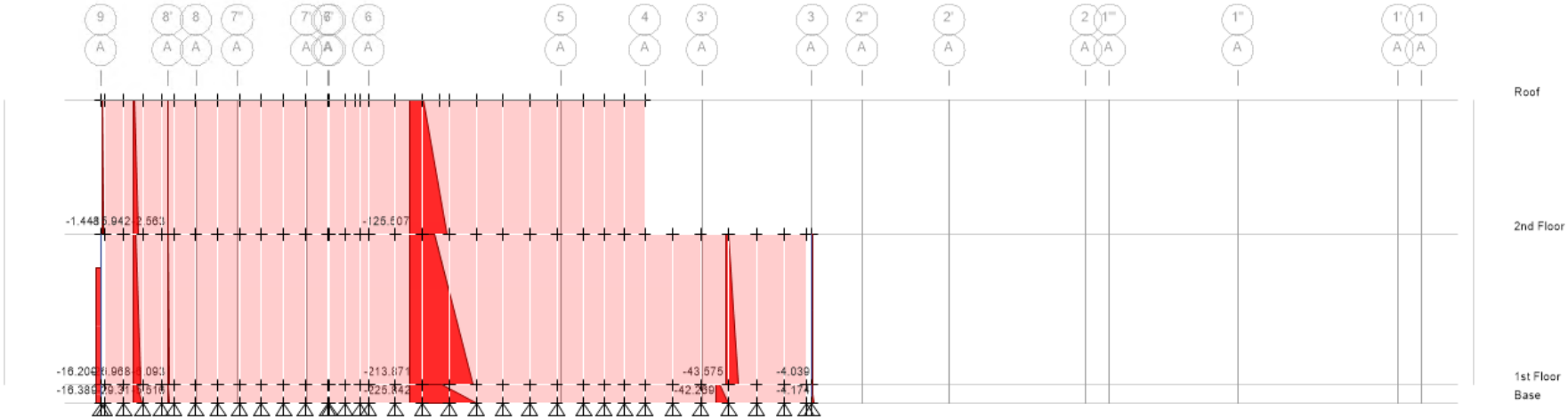
24-0609P8_v00 (052324).EDB Plan View - Roof - Z = 23.6667 (ft) Slab Strip Design - Layer B - Top Reinforcement (Enveloping Flexural)



Elevation View -G axial Force Diagram (LRFD Envelope) Step 1/12 [kip]



Elevation View -1 axial Force Diagram (LRFD Envelope) Step 1/12 [kip]



Elevation View -A axial Force Diagram (LRFD Envelope) Step 1/12 [kip]

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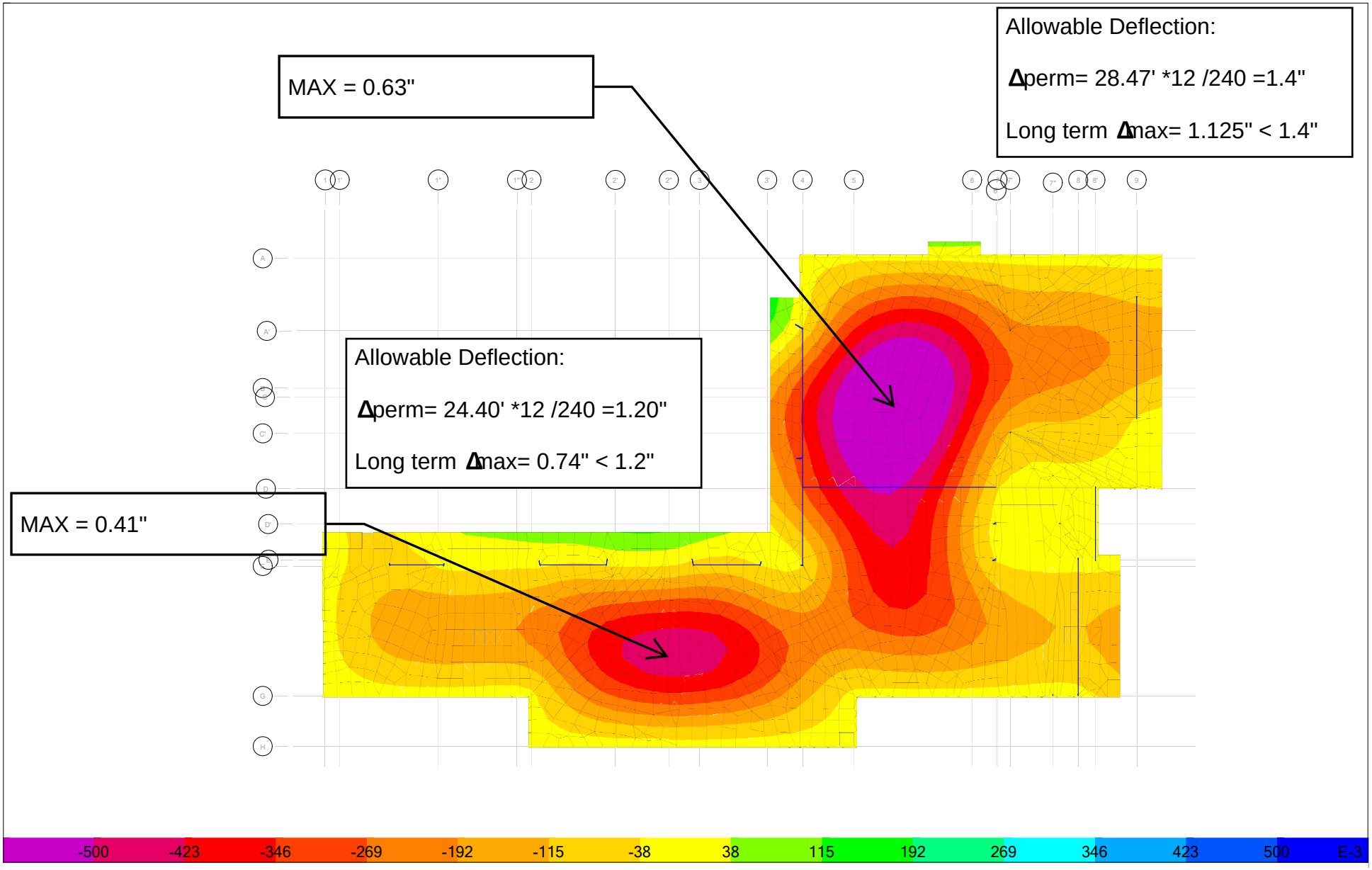
Ste. 370 Doral, FL 33122
(305) 599-8133
info@easterneg.com
www.easterneg.com

LONG TERM DEFLEXION



24-0609P8_v00 (051724).EDB Plan View - Roof - Z = 23.6667 (ft) - Displacements (ASD3 D+Lr) [in]

Compression Steel Roof

Reinforced Concrete Long-Term Deflections per ACI 9.5.2.5

Member Data:

$L := 28$ ft — Span of Member

$b := 12$ in — Width of Member

$d := 8.5625$ in — Effective Depth of Member

$A'_s := 1.24$ in^2 — Total Compression Reinforcement at Midspan
for Simple & Continuous Beams, at Fixed-end for Cantilevers

$Allow_{live} := 360$ — Denominator (Span/Deflection) for Permissible Live Load Deflection
180.....for Flat Roofs w/o damageable non-structural elements
360.....for Floors w/o damageable non-structural elements
(Table 9.5(b))

$Allow_{LT+L} := 240$ — Denominator (Span/Deflection) for Permissible Sustained and Live Load Deflection
480.....for Flat Roofs w/o damageable non-structural elements
240.....for Floors w/o damageable non-structural elements
(Table 9.5(b))

$Allow_{Total} := 240.0$ — Denominator (Span/Deflection) for Total Deflection

$\%_L := 30$ % — Percent of Live Load to be Considered Sustained in LT Deflection

Analysis Deflections:

$\Delta_D := 0.53$ — Immediate Dead Load Deflection

$\Delta_{D+L} := 0.62$ — Immediate Total Deflection (Dead + Live)

Time-Dependent Factor:

$\xi := 2.0$ — Time-dependent factor for Sustained Loads:

2.0.....5 years or more
1.4.....12 months
1.2.....6 months
1.0.....3 months

Compression Ratio and Additional Deflection Factor:

$$\rho' := \frac{A'_s}{b \cdot d}$$ $\rho' = 0.01207$

$$\lambda_\Delta := \frac{\xi}{1 + 50 \cdot \rho'}$$ $\lambda_\Delta = 1.247$

Immediate Live Load Deflection:

$$\Delta_L := \Delta_{D+L} - \Delta_D$$ $\Delta_L = 0.09$ in

$$Ratio_{Live} := \frac{L \cdot 12}{\Delta_L}$$ $Ratio_{Live} = 3.733 \times 10^3$

$$Immediate_{Live} := if\left(\Delta_L \le \frac{L \cdot 12}{Allow_{live}}, \text{"O.K."}, \text{"N.G."}\right)$$ $Immediate_{Live} = \text{"O.K."}$

Additional Deflection due to Sustained and Live Loads:

$$\Delta_{LT(D)+L} := \lambda_{\Delta} \cdot \left(\Delta_D + \frac{\%_L}{100} \cdot \Delta_L \right) + \Delta_L$$

$\Delta_{LT(D)+L} = 0.78$ in

$$Ratio_{LT(S)+L} := \frac{L \cdot 12}{\lambda_{\Delta} \cdot \left(\Delta_D + \frac{\%_L}{100} \cdot \Delta_L \right) + \Delta_L}$$

$Ratio_{LT(S)+L} = 428$

$$LT_{S+L} := \text{if}\left(\Delta_{LT(D)+L} \le \frac{L \cdot 12}{Allow_{LT+L}}, \text{"O.K."}, \text{"N.G."} \right)$$

$LT_{S+L} = \text{"O.K."}$

Total Deflection due to Dead, Long-Term and Live Loads:

$$\Delta_{total} := \Delta_D + \lambda_{\Delta} \cdot \left(\Delta_D + \frac{\%_L}{100} \cdot \Delta_L \right) + \Delta_L$$

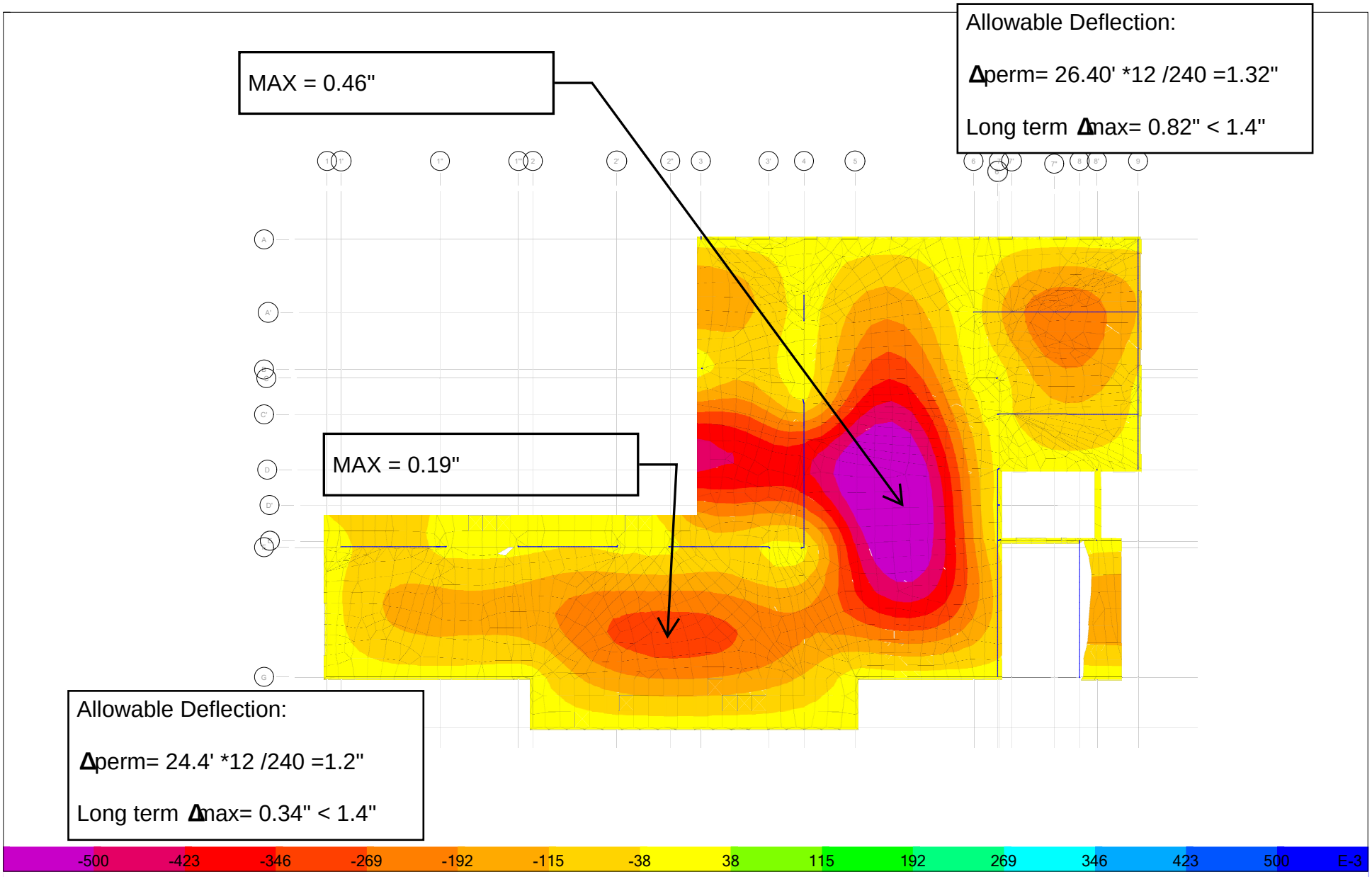
$\Delta_{total} = 1.31$ in

$$Ratio_{Total} := \frac{L \cdot 12}{\Delta_D + \lambda_{\Delta} \cdot \left(\Delta_D + \frac{\%_L}{100} \cdot \Delta_L \right) + \Delta_L}$$

$Ratio_{Total} = 256$

$$Total_{Adequacy} := \text{if}\left(\Delta_{total} \le \frac{L \cdot 12}{Allow_{Total}}, \text{"O.K."}, \text{"N.G."} \right)$$

$Total_{Adequacy} = \text{"O.K."}$



24-0609P8_v00 (051724).EDB Plan View - 2nd Floor - Z = 12.5 (ft) - Displacements (ASD2 D+L) [in]

Compression Steel 2nd Floor

Reinforced Concrete Long-Term Deflections per ACI 9.5.2.5

Member Data:

$L := 24$ ft — Span of Member

$b := 12$ in — Width of Member

$d := 6.5625$ in — Effective Depth of Member

$A'_s := 1.24$ in^2 — Total Compression Reinforcement at Midspan
for Simple & Continuous Beams, at Fixed-end for Cantilevers

$Allow_{live} := 360$ — Denominator (Span/Deflection) for Permissible Live Load Deflection
180.....for Flat Roofs w/o damageable non-structural elements
360.....for Floors w/o damageable non-structural elements
(Table 9.5(b))

$Allow_{LT+L} := 240$ — Denominator (Span/Deflection) for Permissible Sustained and Live Load Deflection
480.....for Flat Roofs w/o damageable non-structural elements
240.....for Floors w/o damageable non-structural elements
(Table 9.5(b))

$Allow_{Total} := 240.0$ — Denominator (Span/Deflection) for Total Deflection

$\%_L := 30$ % — Percent of Live Load to be Considered Sustained in LT Deflection

Analysis Deflections:

$\Delta_D := 0.47$ — Immediate Dead Load Deflection

$\Delta_{D+L} := 0.59$ — Immediate Total Deflection (Dead + Live)

Time-Dependent Factor:

$\xi := 2.0$ — Time-dependent factor for Sustained Loads:

2.0.....5 years or more
1.4.....12 months
1.2.....6 months
1.0.....3 months

Compression Ratio and Additional Deflection Factor:

$$\rho' := \frac{A'_s}{b \cdot d}$$ $\rho' = 0.01575$

$$\lambda_\Delta := \frac{\xi}{1 + 50 \cdot \rho'}$$ $\lambda_\Delta = 1.119$

Immediate Live Load Deflection:

$$\Delta_L := \Delta_{D+L} - \Delta_D$$ $\Delta_L = 0.12$ in

$$Ratio_{Live} := \frac{L \cdot 12}{\Delta_L}$$ $Ratio_{Live} = 2.4 \times 10^3$

$$Immediate_{Live} := if\left(\Delta_L \le \frac{L \cdot 12}{Allow_{live}}, \text{"O.K."}, \text{"N.G."}\right)$$ $Immediate_{Live} = \text{"O.K."}$

Additional Deflection due to Sustained and Live Loads:

$$\Delta_{LT(D)+L} := \lambda_{\Delta} \cdot \left(\Delta_D + \frac{\%_L}{100} \cdot \Delta_L \right) + \Delta_L$$

$\Delta_{LT(D)+L} = 0.69$ in

$$Ratio_{LT(S)+L} := \frac{L \cdot 12}{\lambda_{\Delta} \cdot \left(\Delta_D + \frac{\%_L}{100} \cdot \Delta_L \right) + \Delta_L}$$

$Ratio_{LT(S)+L} = 420$

$$LT_{S+L} := \text{if}\left(\Delta_{LT(D)+L} \le \frac{L \cdot 12}{Allow_{LT+L}}, \text{"O.K."}, \text{"N.G."} \right)$$

$LT_{S+L} = \text{"O.K."}$

Total Deflection due to Dead, Long-Term and Live Loads:

$$\Delta_{total} := \Delta_D + \lambda_{\Delta} \cdot \left(\Delta_D + \frac{\%_L}{100} \cdot \Delta_L \right) + \Delta_L$$

$\Delta_{total} = 1.16$ in

$$Ratio_{Total} := \frac{L \cdot 12}{\Delta_D + \lambda_{\Delta} \cdot \left(\Delta_D + \frac{\%_L}{100} \cdot \Delta_L \right) + \Delta_L}$$

$Ratio_{Total} = 249$

$$Total_{Adequacy} := \text{if}\left(\Delta_{total} \le \frac{L \cdot 12}{Allow_{Total}}, \text{"O.K."}, \text{"N.G."} \right)$$

$Total_{Adequacy} = \text{"O.K."}$

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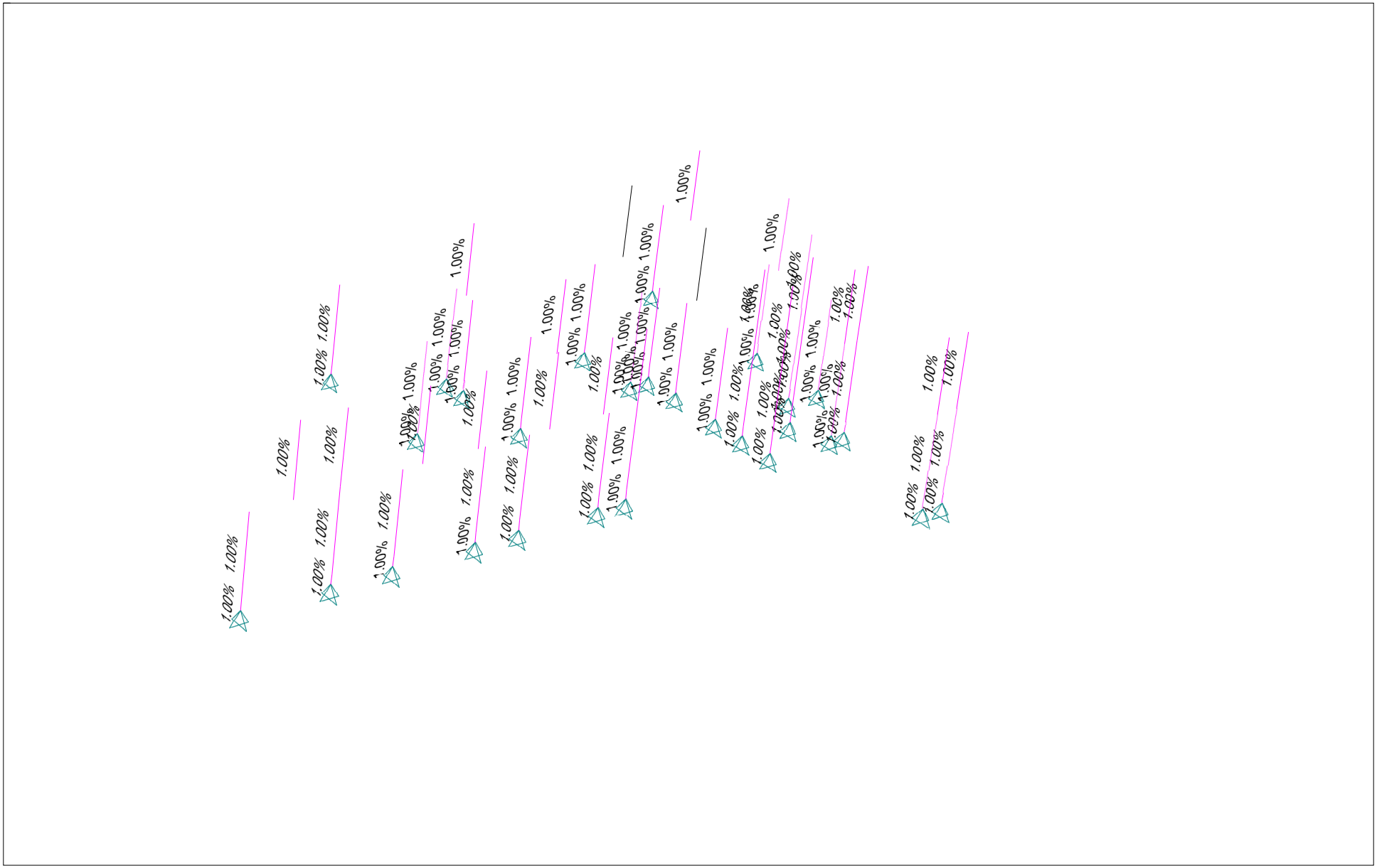
COLUMN DESIGN



24-0609P8_v00 (051724).EDB 3-D View Rebar Percentage (ACI 318-19)

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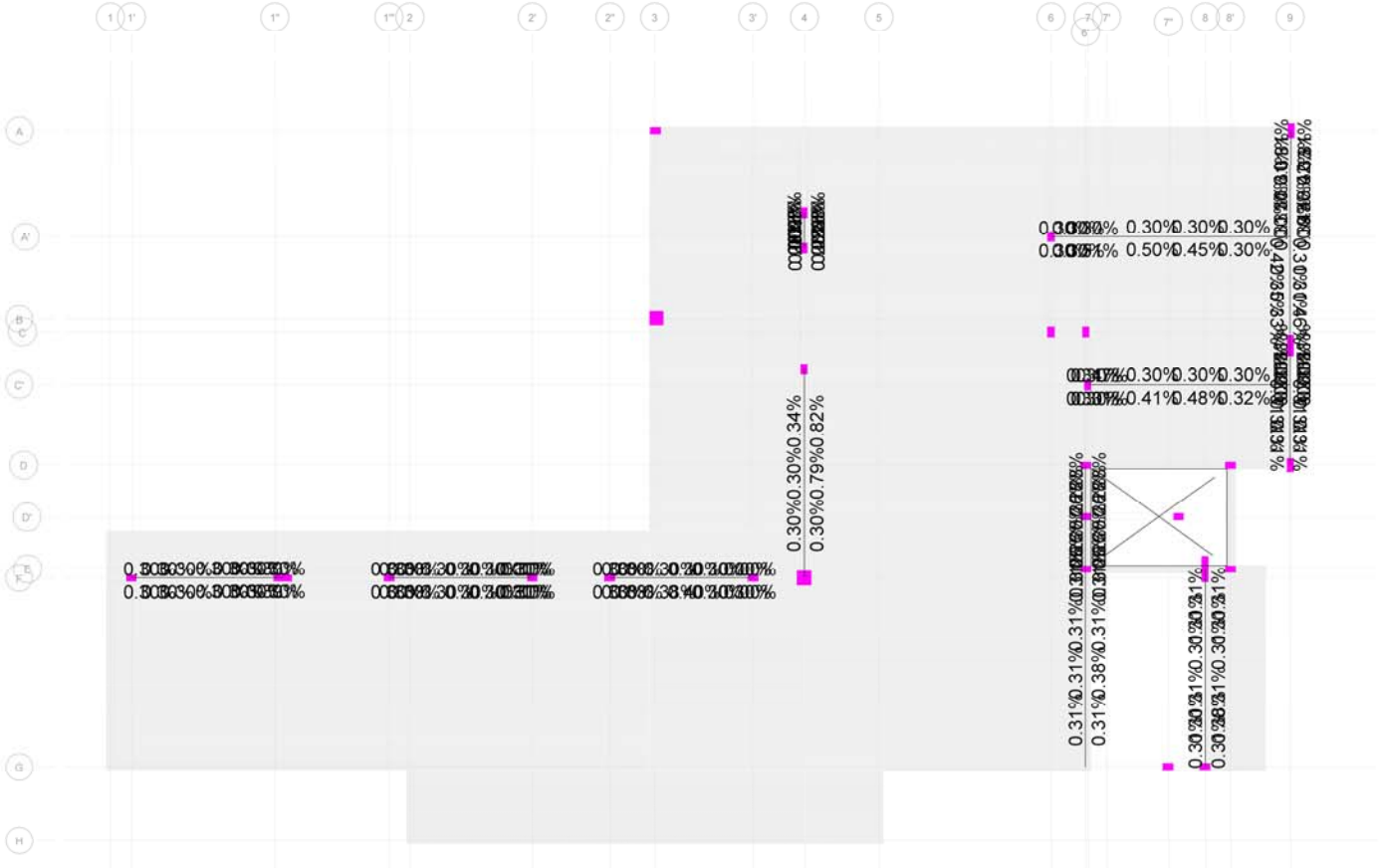
BEAM COLUMN

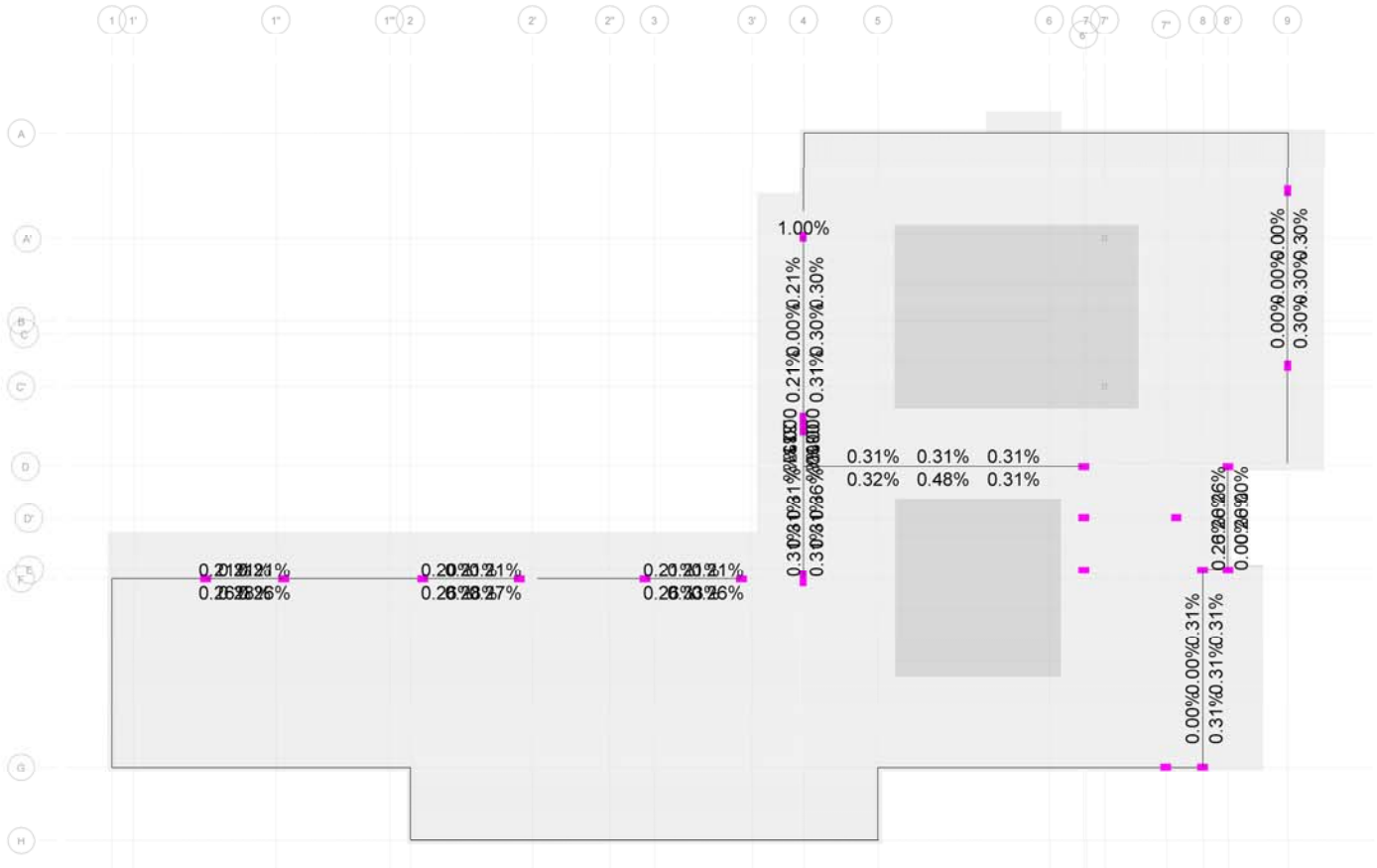
Job. No.: **Date:**

Beam Reinforcement Processing

							LONGITUDINAL BARS																STIRRUPS: SHEAR+TORSION REINF.										
							BOTTOM BARS					TOP BARS					FACE BARS																
Beam Label	Gridline Ref.	Level	Section Size b (in.)	Section Size h (in.)	L (ft.)	f'c (ksi)	$As_{r,req}$ in^2	Min. No. of Bars	Final No. of Bars	Bar No.	Quant. Check	$As_{r,req}$ in^2	Min No. of Bars	Final No. of Bars	Bar No.	Quant. Check	$AsL_{r,req}$ in^2	Min. No. of Bars	Final No. of Bars	Bar No.	Quant. Check	B, T & F Check	Req. A_{sh} in^2/ft	Tu>Tth? Y or N	Perimeter p_h (in)	No. of Legs	Bar No.	Req. Spacing @ Ends (in. o.c.)	ACI 314 Max. Spacing (in. o.c.)	Sugg. Spacing @ Ends (in. o.c.)	Stirrup Quant.	Final Spacing @ Ends (in. o.c.)	Quant. Check
2B-1	4	2	8	24	3.25	4	0.41	2	(2)	#5	O.K.	0.40	2	(2)	#5	O.K.							0.3668	N	50.0	2	#3	7.20	10.5	7.1	(3)	7.0	O.K.
2B-2	A'	2	12	24	21.5	4	1.48	3	(3)	#7	O.K.	0.86	2	(3)	#6	O.K.	1.23	2	(2)	#5	O.K.	O.K.	0.2575	Y	58.0	2	#3	10.25	7.3	7.2	(14)	7.0	O.K.
2B-3	F	2	8	24	12.354	4	0.90	1	(2)	#5	O.K.	0.86	1	(2)	#5	O.K.	0.84	1	(2)	#5	O.K.	O.K.	0.2200	N	50.0	2	#3	12.00	10.5	10.5	(6)	10.0	O.K.
2B-4	4	2	8	16	19.5	4	1.23	3	(4)	#6	O.K.	0.47	1	(2)	#5	O.K.	0.68	2	(2)	#5	O.K.	O.K.	0.2450	N	34.0	2	#3	10.78	6.5	6.5	(14)	6.0	O.K.
2B-5	9	2	8	33	18	4	1.13	3	(4)	#6	O.K.	1.18	3	(4)	#6	O.K.	0.97	2	(2)	#5	O.K.	O.K.	0.3037	Y	68.0	2	#3	8.69	8.5	8.5	(12)	7.0	O.K.
2B-5	9	2	8	33	9	4	0.81	2	(4)	#6	O.K.	0.81	2	(4)	#6	O.K.	1.12	2	(2)	#5	O.K.	O.K.	0.3600	Y	68.0	2	#3	7.33	8.5	7.3	(7)	7.0	O.K.
2B-6	8	2	8	30	18	4	0.84	2	(2)	#7	O.K.	0.73	2	(2)	#7	O.K.	1.01	2	(2)	#5	O.K.	O.K.	0.1966	N	62.0	2	#3	13.43	13.5	13.4	(7)	13.0	O.K.
2B-7	7	2	8	30	18	4	0.89	2	(2)	#7	O.K.	0.73	2	(2)	#7	O.K.	0.98	2	(2)	#5	O.K.	O.K.	0.2969	Y	62.0	2	#3	8.89	7.8	7.7	(12)	7.0	O.K.
2B-8	E	2	12	12	4.2	4	0.38	2	(3)	#5	O.K.	0.38	2	(3)	#5	O.K.	0.55	1	(2)	#5	O.K.	O.K.	0.3418	Y	34.0	2	#3	7.72	4.3	4.2	(6)	4.0	O.K.
RB-1	F	R	8	12	8	4	0.34	2	(2)	#5	O.K.	0.25	1	(2)	#5	O.K.	0.41	1	(2)	#5	O.K.	O.K.	0.2607	N	26.0	2	#3	10.13	4.5	4.5	(9)	4.0	O.K.
RB-2	4	R	8	30	12.33	4	0.73	2	(2)	#7	O.K.	0.73	2	(2)	#7	O.K.	0.97	2	(2)	#5	O.K.	O.K.	0.3392	N	62.0	2	#3	7.78	13.5	7.7	(8)	7.0	O.K.
RB-3	4	R	8	16	16	4	0.61	2	(2)	#6	O.K.	0.36	2	(2)	#5	O.K.	0.55	1	(2)	#5	O.K.	O.K.	0.1748	N	34.0	2	#3	15.10	6.5	6.5	(12)	6.0	O.K.
RB-4	8	R	12	23	17.5	4	1.15	3	(4)	#6	O.K.	0.82	2	(4)	#6	O.K.	1.18	2	(2)	#5	O.K.	O.K.	0.1600	Y	56.0	2	#3	16.50	10.0	10.0	(8)	10.0	O.K.
RB-5	8'	R	8	12	9	4	0.25	1	(2)	#5	O.K.	0.25	1	(2)	#5	O.K.							0.0000	N	26.0	2	#3	0.00		12.0		12.0	O.K.
RB-6	D	R	8	30	25.75	4	1.16	3	(4)	#6	O.K.	0.73	2	(2)	#6	O.K.							0.0800	N	62.0	2	#3	33.00	13.5	13.5	(9)	13.0	O.K.
RB-7	9	R	8	24	15.41	4	0.57	2	(2)	#5	O.K.	0.00		(2)	#5								0.0800	N	50.0	2	#3	33.00	10.5	10.5	(8)	10.0	O.K.



24-0609P8_v00 (052324).EDB Plan View - 2nd Floor - Z = 12.5 (ft) Rebar Percentage (ACI 318-19)



24-0609P8_v00 (052324).EDB Plan View - Roof - Z = 23.6667 (ft) Rebar Percentage (ACI 318-19)

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

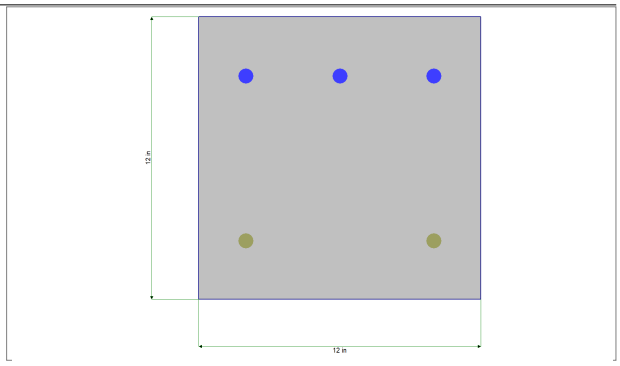
DESCRIPTION: 2B-8

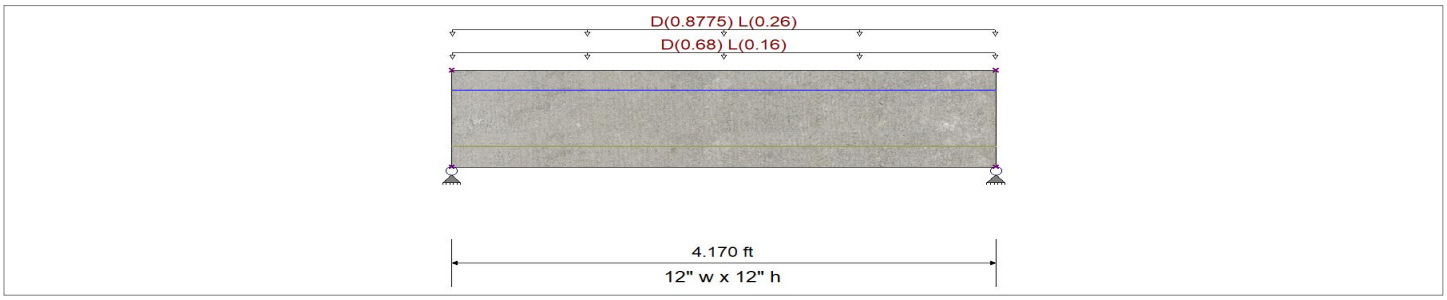
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

General Information

f'c	=	4.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = $f'c^{1/2}$ * 7.50	=	474.342 psi		Shear :	0.750
ψ Density	=	150.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		60.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 12.0 in
Span #1 Reinforcing....
3-#5 at 2.50 in from Top, from 0.0 to 4.170 ft in this span 2-#5 at 2.50 in from Bottom, from 0.0 to 4.170 ft in this s

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.680, L = 0.160 k/ft, Tributary Width = 1.0 ft, (STAIR)
Uniform Load : D = 0.1350, L = 0.040 ksf, Tributary Width = 6.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = **0.213** : 1

Section used for this span	**Typical Section**	
Mu : Applied	5.914	k-ft
Mn * Phi : Allowable	27.814	k-ft
Location of maximum on span	2.089	ft
Span # where maximum occurs	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0	<360.0	L Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0	L Only
Max Downward Total Deflection	0.003 in	Ratio =	18656	>=240.0	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0	<240.0	Span: 1 : +D+L

Cross Section Strength & Inertia

Top & Bottom references are for tension side of secti

Cross Section	Bar Layout Description	Phi*Mn (k-ft) Bottom	Phi*Mn (k-ft) Top	Moment of Inertia (in^4) I gross	Icr - Bottom	Icr - Top
Section 1	3- #5 @ d=2.5",2- #5 @ d=9.5",	27.81	37.88	1,728.00	344.53	474.27

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	4.436	4.436

Concrete Beam

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 2B-8

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from Load Combinations	4.436	4.436
Max Upward from Load Cases	3.560	3.560
D Only	3.560	3.560
+D+L	4.436	4.436
+D+0.750L	4.217	4.217
+0.60D	2.136	2.136
L Only	0.876	0.876

Shear Stirrup Requirements

Entire Beam Span Length : Vu < Phi*Vc / 2, Req'd Vs = Not Reqd per 9.6.3.1, Stirrups are not required.

Maximum Forces & Stresses for Load Combinations

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	4.170	5.91	27.81	0.21
+1.40D					
Span # 1	1	4.170	5.20	27.81	0.19
+1.20D+1.60L					
Span # 1	1	4.170	5.91	27.81	0.21
+1.20D+0.50L					
Span # 1	1	4.170	4.91	27.81	0.18
+1.20D					
Span # 1	1	4.170	4.45	27.81	0.16
+0.90D					
Span # 1	1	4.170	3.34	27.81	0.12

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft	Load Combination	Max. "+" Defl (in)	Location in Span (ft
+D+L	1	0.0027	2.085		0.0000	0.000

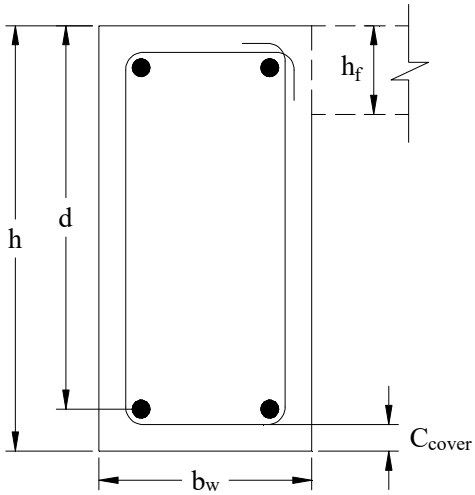
Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl	Location in Span	Max. Upward Defl	Location in Span
D Only	1	0.0022	2.085	0.0000	0.000
+D+L	1	0.0027	2.085	0.0000	0.000
+D+0.750L	1	0.0025	2.085	0.0000	0.000
+0.60D	1	0.0013	2.085	0.0000	0.000
L Only	1	0.0005	2.085	0.0000	0.000

Combined Shear & Torsion Design for Reinforced Concrete Beams (Critial Section)

BEAM 2-B6

Beam Data:



$f'_c := 4000$ psi Compressive Strength of Concrete

$f_y := 60000$ psi Longitudinal Reinforcement Yield Strength

$\lambda := 1.0$ Concrete Weight Modification Factor:

λ = **1.0 for Normal-Weight concrete**
λ = 0.85 for Sand-lightweight concrete
λ = **0.75 for All other lightweight concrete**

$\phi := 0.75$ Shear & Torsion Strength Reduction Factor

$b_w := 8.0$ in Beam Web Width

$h := 30.00$ in Overall Thickness of Member

$d := 28.00$ in Beam Effective Depth (~ h - 2.5)

$h_f := 7.0$ in Flange Depth
(For Isolated members with overhanging flanges and monolithically casted spandrels to slabs)

$C_{cover} := 2.0$ in Concrete Cover

C_{cover} = **1.5 Minimum for Beams**
= 2.0 For Concrete exposed to earth or weather
= **3.0 For Concrete cast against & permanently exposed to earth**

Web Reinforcement Data:

$f_{yt} := 60000$ psi Shear Reinforcement Yield Strength

$A_v := 0.22$ in^2 Shear Area of Reinforcement:

A_v = **0.22 for No. 3 Bars Single Loop**
0.40 For No. 4 Bars Single Loop
0.44 for No. 3 Bars Double Loop
0.80 For No. 4 Bars Double Loop

Torque and Shear Loads:

$T_u := 2858.7$ lb-ft Design Factored Torsional Moment (at 'd' from FOS)
For Equilibrium Torsion T_u = Factored Load * Eccentricity
For Compatibility Torsion $T_u = \phi T_{cr}$

$V_u := 5572$ lbs Design Factored Shear (at 'd' from FOS) (lbs)

Torsion Threshold Check:

$x_0 := b_w$ $\quad$ $y_0 := h$

$A_{cp1} := b_w \cdot h$ $\quad$ $p_{cp1} := 2 \cdot (x_0 + y_0)$

$A_{cp1} = 240.0$ Area enclosed by outside perimeter of beam only (in^2)

$p_{cp1} = 76.0$ Outside perimeter of beam only (in^2)

$h_b := h - h_f$

$L_f := \text{if}(h_b < 4 \cdot h_f, h_b, 4 \cdot h_f)$

$L_f = 23.0$ Length of overhanging flange (in)

$A_{cp2} := (x_0 \cdot y_0) + (L_f \cdot h_f)$ $\quad$ $p_{cp2} := 2 \cdot (x_0 + y_0) + 2 \cdot (L_f + h_f)$

$A_{cp2} = 401.0$ Area enclosed by outside perimeter of beam and flange (in^2)

$p_{cp2} = 136.0$ Outside perimeter of beam and flange (in^2)

$$T_{cr} := 4 \cdot \lambda \cdot \sqrt{f'_c} \cdot \max\left(\frac{A_{cp1}^2}{p_{cp1}}, \frac{A_{cp2}^2}{p_{cp2}}\right) \cdot \frac{1}{12}$$

$$T_{threshold} := \left(\frac{1}{4}\right) \cdot T_{cr}$$

$T_{cr} = 24926.34$ Section Cracking Torque (lb-ft)

$T_{threshold} = 6231.59$ Section Threshold Torsional Value (lb-ft)

$$T_{design} := \begin{cases} \text{"TORSIONAL EFFECTS NEGLECTED"} \\ \text{"DESIGN FOR TORSION"} \quad \text{if } T_u > T_{threshold} \end{cases}$$

T_{design} = "TORSIONAL EFFECTS NEGLECTED"

Nominal Concrete Shear Strength:

$V_c := 2 \cdot \lambda \cdot \sqrt{f'_c} \cdot b_w \cdot d$

$V_c = 28334.01$ lbs

Section Adequacy for Combined Torsion and Shear Stresses:

$$d_{b\text{-stirrup}} := \begin{cases} 0.5 & \text{if } A_v = 0.40 \\ 0.5 & \text{if } A_v = 0.80 \\ 0.375 & \text{otherwise} \end{cases}$$

$d_{b\text{-stirrup}} = 0.375$ in

$x_1 := b_w - 2 \cdot C_{cover} - d_{b\text{-stirrup}}$

$x_1 = 3.63$ in

$y_1 := h - 2 \cdot C_{cover} - d_{b\text{-stirrup}}$

$y_1 = 25.63$ in

$p_h := 2 \cdot (x_1 + y_1)$

$p_h = 58.50$ in

$A_{oh} := x_1 \cdot y_1$

$A_{oh} = 92.89$ in^2

$$f_{vt} := \sqrt{\left(\frac{V_u}{b_w \cdot d}\right)^2 + \left(\frac{T_u \cdot 12 \cdot p_h}{1.7 \cdot A_{oh}^2}\right)^2}$$

$f_{vt} = 139.05$ psi

$$f_{Vcr} := \phi \cdot \left[\left(\frac{V_c}{b_w \cdot d}\right) + 8 \cdot \sqrt{f'_c}\right]$$

$f_{Vcr} = 474.34$ psi

$$SECTION_{adequacy} := \begin{cases} \text{"INCREASE SECTION DIMENSIONS"} \\ \text{"SECTION O.K."} & \text{if } f_{vt} < f_{Vcr} \end{cases}$$

$SECTION_{adequacy}$ = "SECTION O.K."

Maximum Torsional Reinforcement Spacing:

$$s_{max} := \min\left(\frac{p_h}{8}, 12\right)$$

$s_{max} = 7.3$ in

Minimum Torsional Reinforcement:

$$A_{(tv/s)\text{-min}} := \begin{cases} \dfrac{50 \cdot b_w}{f_{yt}} \\ \left[0.75 \cdot \sqrt{f'_c} \cdot \left(\dfrac{b_w}{f_{yt}}\right)\right] & \text{if } f'_c > 4444.4 \end{cases}$$

$A_{(tv/s)\text{-min}} = 0.0067$ in^2 / in / 2 stirrup legs

Minimum Shear Reinforcement:

$$A_{(v/s)\text{-min}} := \begin{cases} \dfrac{50 \cdot b_w}{f_{yt}} \\ \left[0.75 \cdot \sqrt{f'_c} \cdot \left(\dfrac{b_w}{f_{yt}}\right)\right] & \text{if } f'_c > 4444.4 \end{cases}$$

$A_{(v/s)\text{-min}} = 0.0067$ in^2 / in / 2 stirrup legs

Required Torsional Reinforcement:

$A_o := 0.85 \cdot A_{oh}$ $\qquad \theta := \frac{\pi}{4}$

$$A_{(t/s)} := \begin{cases} \dfrac{\left(\dfrac{T_u}{\phi}\right) \cdot 12}{2 \cdot A_o \cdot f_{yt} \cdot \cot(\theta)} \\ 0 \ \text{ if } \dfrac{T_u}{\phi} < T_{threshold} \end{cases}$$

$A_{(t/s)} = 0.0000$ $\qquad$ in^2 / in / 1 stirrup leg

Required Shear Reinforcement:

$$A_{(v/s)} := \begin{cases} \max\left[\left(\dfrac{\dfrac{V_u}{\phi} - V_c}{f_{yt} \cdot d}\right), A_{(v/s)\text{-min}}\right] \\ A_{(v/s)\text{-min}} \ \text{ if } 0.5 \cdot V_c < \left(\dfrac{V_u}{\phi}\right) \le V_c \\ 0 \ \text{ if } \dfrac{V_u}{\phi} \le 0.5 \cdot V_c \end{cases}$$

$A_{(v/s)} = 0.0000$ $\qquad$ in^2 / in / 2 stirrup legs

Required Combined Stirrup Spacing:

$$s_{req} := \min\left(\min\left(\frac{A_v}{2 \cdot A_{(t/s)} + A_{(v/s)}}, \frac{A_v}{A_{(tv/s)\text{-min}}}\right), s_{max}\right)$$

$s_{req} =$ ▮ $\qquad$ in

Additional Longitudinal Reinforcement:

$$d_{b\text{-long}} := \max\left(0.042 \cdot s_{max}, \frac{3}{8}\right)$$

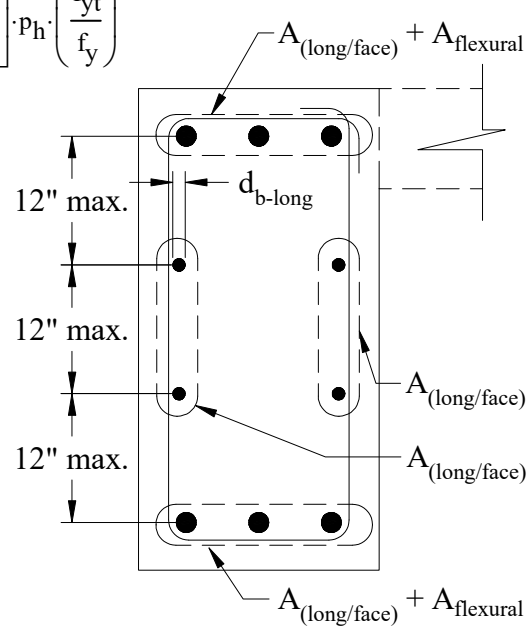
$$A_{long\text{-min}} := \left(\frac{5 \cdot \sqrt{f'_c} \cdot \max(A_{cp1}, A_{cp2})}{f_y}\right) - \max\left[A_{(t/s)}, \left(\frac{25 \cdot b_w}{f_y}\right)\right] \cdot p_h \cdot \left(\frac{f_{yt}}{f_y}\right)$$

$A_{long\text{-min}} = 1.92 \quad in^2$

$$A_{long} := \left[A_{(t/s)} \cdot p_h \cdot \left(\frac{f_{yt}}{f_y}\right) \cdot (\cot(\theta))^2\right]$$

$A_{long} = 0.00 \quad in^2$

$$A_{(long/face)} := \frac{\max(A_{long\text{-min}}, A_{long})}{4}$$



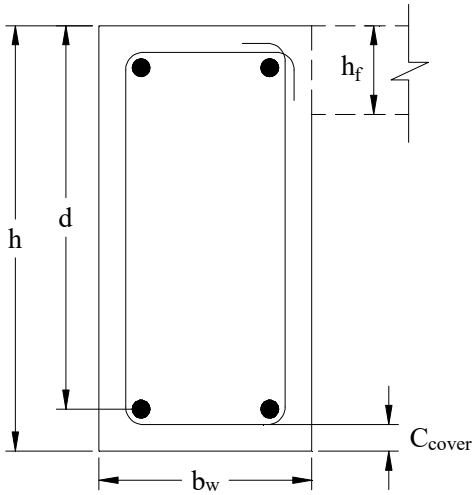
Minimum Bar Diameter: $d_{b\text{-long}} = 0.38$ in

Area of Long. Reinf. per Beam face: $A_{(long/face)} = 0.48$ in^2

Combined Shear & Torsion Design for Reinforced Concrete Beams (Critial Section)

BEAM 2TB-1

Beam Data:



$f'_c := 4000$ psi Compressive Strength of Concrete

$f_y := 60000$ psi Longitudinal Reinforcement Yield Strength

$\lambda := 1.0$ Concrete Weight Modification Factor:

λ = **1.0 for Normal-Weight concrete**
λ = 0.85 for Sand-lightweight concrete
λ = **0.75 for All other lightweight concrete**

$\phi := 0.75$ Shear & Torsion Strength Reduction Factor

$b_w := 8.0$ in Beam Web Width

$h := 12.00$ in Overall Thickness of Member

$d := 10.00$ in Beam Effective Depth (~ h - 2.5)

$h_f := 7.0$ in Flange Depth
(For Isolated members with overhanging flanges and monolithically casted spandrels to slabs)

$C_{cover} := 2.0$ in Concrete Cover

C_{cover} = **1.5 Minimum for Beams**
= 2.0 For Concrete exposed to earth or weather
= **3.0 For Concrete cast against & permanently exposed to earth**

Web Reinforcement Data:

$f_{yt} := 60000$ psi Shear Reinforcement Yield Strength

$A_v := 0.22$ in^2 Shear Area of Reinforcement:

A_v = **0.22 for No. 3 Bars Single Loop**
0.40 For No. 4 Bars Single Loop
0.44 for No. 3 Bars Double Loop
0.80 For No. 4 Bars Double Loop

Torque and Shear Loads:

$T_u := 354.0$ lb-ft Design Factored Torsional Moment (at 'd' from FOS)
For Equilibrium Torsion T_u = Factored Load * Eccentricity
For Compatibility Torsion $T_u = \phi T_{cr}$

$V_u := 2718$ lbs Design Factored Shear (at 'd' from FOS) (lbs)

Torsion Threshold Check:

$x_0 := b_w$ $\quad$ $y_0 := h$

$A_{cp1} := b_w \cdot h$ $\quad$ $p_{cp1} := 2 \cdot (x_0 + y_0)$

$A_{cp1} = 96.0$ Area enclosed by outside perimeter of beam only (in^2)

$p_{cp1} = 40.0$ Outside perimeter of beam only (in^2)

$h_b := h - h_f$

$L_f := if(h_b < 4 \cdot h_f, h_b, 4 \cdot h_f)$

$L_f = 5.0$ Length of overhanging flange (in)

$A_{cp2} := (x_0 \cdot y_0) + (L_f \cdot h_f)$ $\quad$ $p_{cp2} := 2 \cdot (x_0 + y_0) + 2 \cdot (L_f + h_f)$

$A_{cp2} = 131.0$ Area enclosed by outside perimeter of beam and flange (in^2)

$p_{cp2} = 64.0$ Outside perimeter of beam and flange (in^2)

$$T_{cr} := 4 \cdot \lambda \cdot \sqrt{f'_c} \cdot \max\left(\frac{A_{cp1}^2}{p_{cp1}}, \frac{A_{cp2}^2}{p_{cp2}}\right) \cdot \frac{1}{12}$$

$$T_{threshold} := \left(\frac{1}{4}\right) \cdot T_{cr}$$

$T_{cr} = 5652.90$ Section Cracking Torque (lb-ft)

$T_{threshold} = 1413.23$ Section Threshold Torsional Value (lb-ft)

$$T_{design} := \begin{cases} \text{"TORSIONAL EFFECTS NEGLECTED"} \\ \text{"DESIGN FOR TORSION"} \quad \text{if } T_u > T_{threshold} \end{cases}$$

T_{design} = "TORSIONAL EFFECTS NEGLECTED"

Nominal Concrete Shear Strength:

$V_c := 2 \cdot \lambda \cdot \sqrt{f'_c} \cdot b_w \cdot d$

$V_c = 10119.29$ lbs

Section Adequacy for Combined Torsion and Shear Stresses:

$$d_{b\text{-stirrup}} := \begin{cases} 0.5 & \text{if } A_v = 0.40 \\ 0.5 & \text{if } A_v = 0.80 \\ 0.375 & \text{otherwise} \end{cases}$$

$d_{b\text{-stirrup}} = 0.375$ in

$x_1 := b_w - 2 \cdot C_{cover} - d_{b\text{-stirrup}}$

$x_1 = 3.63$ in

$y_1 := h - 2 \cdot C_{cover} - d_{b\text{-stirrup}}$

$y_1 = 7.63$ in

$p_h := 2 \cdot (x_1 + y_1)$

$p_h = 22.50$ in

$A_{oh} := x_1 \cdot y_1$

$A_{oh} = 27.64$ in^2

$$f_{vt} := \sqrt{\left(\frac{V_u}{b_w \cdot d}\right)^2 + \left(\frac{T_u \cdot 12 \cdot p_h}{1.7 \cdot A_{oh}^2}\right)^2}$$

$f_{vt} = 81.05$ psi

$$f_{Vcr} := \phi \cdot \left[\left(\frac{V_c}{b_w \cdot d}\right) + 8 \cdot \sqrt{f'_c}\right]$$

$f_{Vcr} = 474.34$ psi

$$SECTION_{adequacy} := \begin{cases} \text{"INCREASE SECTION DIMENSIONS"} \\ \text{"SECTION O.K."} & \text{if } f_{vt} < f_{Vcr} \end{cases}$$

$SECTION_{adequacy}$ = "SECTION O.K."

Maximum Torsional Reinforcement Spacing:

$$s_{max} := \min\left(\frac{p_h}{8}, 12\right)$$

$s_{max} = 2.8$ in

Minimum Torsional Reinforcement:

$$A_{(tv/s)\text{-min}} := \begin{cases} \dfrac{50 \cdot b_w}{f_{yt}} \\ \left[0.75 \cdot \sqrt{f'_c} \cdot \left(\dfrac{b_w}{f_{yt}}\right)\right] & \text{if } f'_c > 4444.4 \end{cases}$$

$A_{(tv/s)\text{-min}} = 0.0067$ in^2 / in / 2 stirrup legs

Minimum Shear Reinforcement:

$$A_{(v/s)\text{-min}} := \begin{cases} \dfrac{50 \cdot b_w}{f_{yt}} \\ \left[0.75 \cdot \sqrt{f'_c} \cdot \left(\dfrac{b_w}{f_{yt}}\right)\right] & \text{if } f'_c > 4444.4 \end{cases}$$

$A_{(v/s)\text{-min}} = 0.0067$ in^2 / in / 2 stirrup legs

Required Torsional Reinforcement:

$A_o := 0.85 \cdot A_{oh}$ $\qquad \theta := \frac{\pi}{4}$

$$A_{(t/s)} := \begin{cases} \dfrac{\left(\dfrac{T_u}{\phi}\right) \cdot 12}{2 \cdot A_o \cdot f_{yt} \cdot \cot(\theta)} \\ 0 \ \text{ if } \dfrac{T_u}{\phi} < T_{threshold} \end{cases}$$

$A_{(t/s)} = 0.0000$ $\qquad$ in^2 / in / 1 stirrup leg

Required Shear Reinforcement:

$$A_{(v/s)} := \begin{cases} \max\left[\left(\dfrac{\dfrac{V_u}{\phi} - V_c}{f_{yt} \cdot d}\right), A_{(v/s)\text{-min}}\right] \\ A_{(v/s)\text{-min}} \ \text{ if } 0.5 \cdot V_c < \left(\dfrac{V_u}{\phi}\right) \le V_c \\ 0 \ \text{ if } \dfrac{V_u}{\phi} \le 0.5 \cdot V_c \end{cases}$$

$A_{(v/s)} = 0.0000$ $\qquad$ in^2 / in / 2 stirrup legs

Required Combined Stirrup Spacing:

$$s_{req} := \min\left(\min\left(\frac{A_v}{2 \cdot A_{(t/s)} + A_{(v/s)}}, \frac{A_v}{A_{(tv/s)\text{-min}}}\right), s_{max}\right)$$

$s_{req} =$ ▮ $\qquad$ in

Additional Longitudinal Reinforcement:

$$d_{b\text{-long}} := \max\left(0.042 \cdot s_{max}, \frac{3}{8}\right)$$

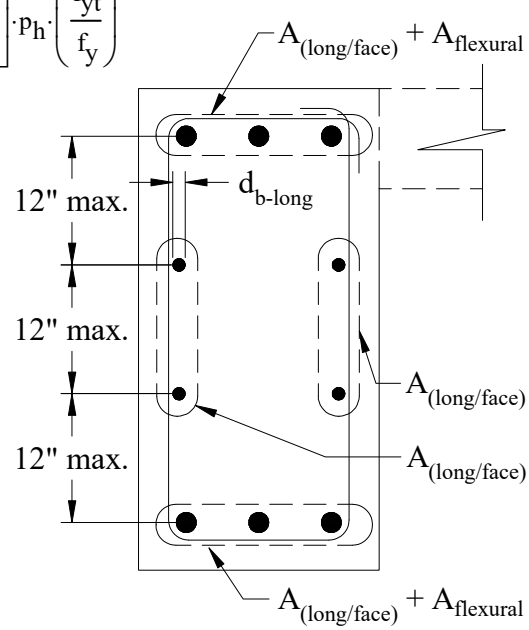
$$A_{long\text{-min}} := \left(\frac{5 \cdot \sqrt{f'_c} \cdot \max(A_{cp1}, A_{cp2})}{f_y}\right) - \max\left[A_{(t/s)}, \left(\frac{25 \cdot b_w}{f_y}\right)\right] \cdot p_h \cdot \left(\frac{f_{yt}}{f_y}\right)$$

$A_{long\text{-min}} = 0.62$ $\quad in^2$

$$A_{long} := \left[A_{(t/s)} \cdot p_h \cdot \left(\frac{f_{yt}}{f_y}\right) \cdot (\cot(\theta))^2\right]$$

$A_{long} = 0.00$ $\quad in^2$

$$A_{(long/face)} := \frac{\max(A_{long\text{-min}}, A_{long})}{4}$$



Minimum Bar Diameter: $d_{b\text{-long}} = 0.38$ in

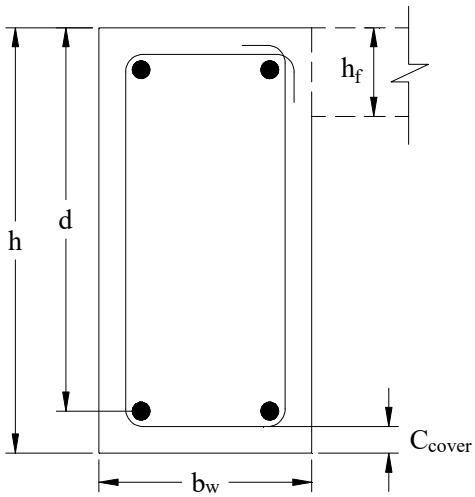
Area of Long. Reinf. per Beam face: $A_{(long/face)} = 0.15$ in^2

Project Name: **Date:**

Combined Shear & Torsion Design for Reinforced Concrete Beams (Critial Section)

BEAM RB-1

Beam Data:



$f'_c := 4000$ psi Compressive Strength of Concrete

$f_y := 60000$ psi Longitudinal Reinforcement Yield Strength

$\lambda := 1.0$ Concrete Weight Modification Factor:

λ = **1.0 for Normal-Weight concrete**
λ = 0.85 for Sand-lightweight concrete
λ = **0.75 for All other lightweight concrete**

$\phi := 0.75$ Shear & Torsion Strength Reduction Factor

$b_w := 8.0$ in Beam Web Width

$h := 24$ in Overall Thickness of Member

$d := 22.5$ in Beam Effective Depth (~ h - 2.5)

$h_f := 0.0$ in Flange Depth
(For Isolated members with overhanging flanges and monolithically casted spandrels to slabs)

$C_{cover} := 2.0$ in Concrete Cover

C_{cover} = **1.5 Minimum for Beams**
= 2.0 For Concrete exposed to earth or weather
= **3.0 For Concrete cast against & permanently exposed to earth**

Web Reinforcement Data:

$f_{yt} := 60000$ psi Shear Reinforcement Yield Strength

$A_v := 0.22$ in^2 Shear Area of Reinforcement:

A_v = **0.22 for No. 3 Bars Single Loop**
0.40 For No. 4 Bars Single Loop
0.44 for No. 3 Bars Double Loop
0.80 For No. 4 Bars Double Loop

Torque and Shear Loads:

$T_u := 4400$ lb-ft Design Factored Torsional Moment (at 'd' from FOS)
For Equilibrium Torsion T_u = Factored Load * Eccentricity
For Compatibility Torsion $T_u = \phi T_{cr}$

$V_u := 2200$ lbs Design Factored Shear (at 'd' from FOS) (lbs)

Torsion Threshold Check:

$x_0 := b_w$ $\quad$ $y_0 := h$

$A_{cp1} := b_w \cdot h$ $\quad$ $p_{cp1} := 2 \cdot (x_0 + y_0)$

$A_{cp1} = 192.0$ Area enclosed by outside perimeter of beam only (in^2)

$p_{cp1} = 64.0$ Outside perimeter of beam only (in^2)

$h_b := h - h_f$

$L_f := \text{if}(h_b < 4 \cdot h_f, h_b, 4 \cdot h_f)$

$L_f = 0.0$ Length of overhanging flange (in)

$A_{cp2} := (x_0 \cdot y_0) + (L_f \cdot h_f)$ $\quad$ $p_{cp2} := 2 \cdot (x_0 + y_0) + 2 \cdot (L_f + h_f)$

$A_{cp2} = 192.0$ Area enclosed by outside perimeter of beam and flange (in^2)

$p_{cp2} = 64.0$ Outside perimeter of beam and flange (in^2)

$T_{cr} := 4 \cdot \lambda \cdot \sqrt{f'_c} \cdot \max\left(\frac{A_{cp1}^2}{p_{cp1}}, \frac{A_{cp2}^2}{p_{cp2}}\right) \cdot \frac{1}{12}$ $\quad$ $T_{threshold} := \left(\frac{1}{4}\right) \cdot T_{cr}$

$T_{cr} = 12143.15$ Section Cracking Torque (lb-ft)

$T_{threshold} = 3035.79$ Section Threshold Torsional Value (lb-ft)

$$T_{design} := \begin{cases} \text{"TORSIONAL EFFECTS NEGLECTED"} \\ \text{"DESIGN FOR TORSION"} \quad \text{if } T_u > T_{threshold} \end{cases}$$

$T_{design} = \text{"DESIGN FOR TORSION"}$

Nominal Concrete Shear Strength:

$V_c := 2 \cdot \lambda \cdot \sqrt{f'_c} \cdot b_w \cdot d$

$V_c = 22768.40$ lbs

Section Adequacy for Combined Torsion and Shear Stresses:

$$d_{b\text{-stirrup}} := \begin{cases} 0.5 & \text{if } A_v = 0.40 \\ 0.5 & \text{if } A_v = 0.80 \\ 0.375 & \text{otherwise} \end{cases}$$

$d_{b\text{-stirrup}} = 0.375$ in

$x_1 := b_w - 2 \cdot C_{cover} - d_{b\text{-stirrup}}$

$x_1 = 3.63$ in

$y_1 := h - 2 \cdot C_{cover} - d_{b\text{-stirrup}}$

$y_1 = 19.63$ in

$p_h := 2 \cdot (x_1 + y_1)$

$p_h = 46.50$ in

$A_{oh} := x_1 \cdot y_1$

$A_{oh} = 71.14$ in^2

$$f_{vt} := \sqrt{\left(\frac{V_u}{b_w \cdot d}\right)^2 + \left(\frac{T_u \cdot 12 \cdot p_h}{1.7 \cdot A_{oh}^2}\right)^2}$$

$f_{vt} = 285.63$ psi

$$f_{Vcr} := \phi \cdot \left[\left(\frac{V_c}{b_w \cdot d}\right) + 8 \cdot \sqrt{f'_c}\right]$$

$f_{Vcr} = 474.34$ psi

$$SECTION_{adequacy} := \begin{cases} \text{"INCREASE SECTION DIMENSIONS"} \\ \text{"SECTION O.K."} & \text{if } f_{vt} < f_{Vcr} \end{cases}$$

$SECTION_{adequacy}$ = "SECTION O.K."

Maximum Torsional Reinforcement Spacing:

$$s_{max} := \min\left(\frac{p_h}{8}, 12\right)$$

$s_{max} = 5.8$ in

Minimum Torsional Reinforcement:

$$A_{(tv/s)\text{-min}} := \begin{cases} \dfrac{50 \cdot b_w}{f_{yt}} \\ \left[0.75 \cdot \sqrt{f'_c} \cdot \left(\dfrac{b_w}{f_{yt}}\right)\right] & \text{if } f'_c > 4444.4 \end{cases}$$

$A_{(tv/s)\text{-min}} = 0.0067$ in^2 / in / 2 stirrup legs

Minimum Shear Reinforcement:

$$A_{(v/s)\text{-min}} := \begin{cases} \dfrac{50 \cdot b_w}{f_{yt}} \\ \left[0.75 \cdot \sqrt{f'_c} \cdot \left(\dfrac{b_w}{f_{yt}}\right)\right] & \text{if } f'_c > 4444.4 \end{cases}$$

$A_{(v/s)\text{-min}} = 0.0067$ in^2 / in / 2 stirrup legs

Required Torsional Reinforcement:

$$A_o := 0.85 \cdot A_{oh} \qquad \theta := \frac{\pi}{4}$$

$$A_{(t/s)} := \begin{cases} \dfrac{\left(\dfrac{T_u}{\phi}\right) \cdot 12}{2 \cdot A_o \cdot f_{yt} \cdot \cot(\theta)} \\ 0 \ \text{ if } \dfrac{T_u}{\phi} < T_{threshold} \end{cases}$$

$A_{(t/s)} = 0.0097$ $\quad in^2$ / in / 1 stirrup leg

Required Shear Reinforcement:

$$A_{(v/s)} := \begin{cases} \max\left[\left(\dfrac{\dfrac{V_u}{\phi} - V_c}{f_{yt} \cdot d}\right), A_{(v/s)\text{-}min}\right] \\ A_{(v/s)\text{-}min} \ \text{ if } 0.5 \cdot V_c < \left(\dfrac{V_u}{\phi}\right) \le V_c \\ 0 \ \text{ if } \dfrac{V_u}{\phi} \le 0.5 \cdot V_c \end{cases}$$

$A_{(v/s)} = 0.0000$ $\quad in^2$ / in / 2 stirrup legs

Required Combined Stirrup Spacing:

$$s_{req} := \min\left(\min\left(\frac{A_v}{2 \cdot A_{(t/s)} + A_{(v/s)}}, \frac{A_v}{A_{(tv/s)\text{-}min}}\right), s_{max}\right)$$

$s_{req} = 5.8$ in

Additional Longitudinal Reinforcement:

$$d_{b\text{-}long} := \max\left(0.042 \cdot s_{max}, \frac{3}{8}\right)$$

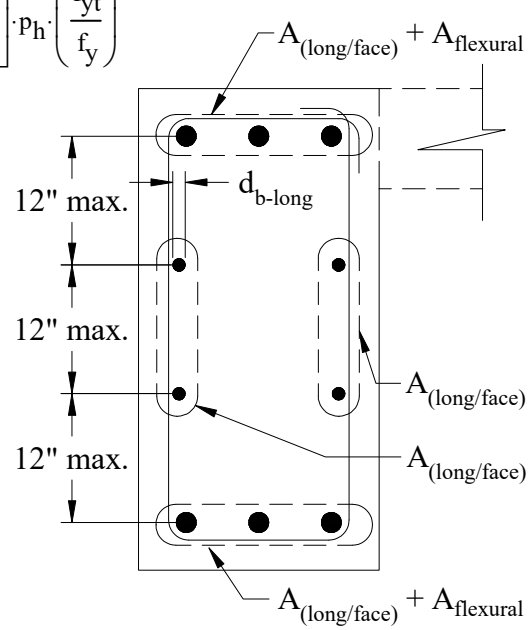
$$A_{long\text{-}min} := \left(\frac{5 \cdot \sqrt{f'_c} \cdot \max(A_{cp1}, A_{cp2})}{f_y}\right) - \max\left[A_{(t/s)}, \left(\frac{25 \cdot b_w}{f_y}\right)\right] \cdot p_h \cdot \left(\frac{f_{yt}}{f_y}\right)$$

$A_{long\text{-}min} = 0.56 \quad in^2$

$$A_{long} := \left[A_{(t/s)} \cdot p_h \cdot \left(\frac{f_{yt}}{f_y}\right) \cdot (\cot(\theta))^2\right]$$

$A_{long} = 0.45 \quad in^2$

$$A_{(long/face)} := \frac{\max(A_{long\text{-}min}, A_{long})}{4}$$



Minimum Bar Diameter: $d_{b\text{-}long} = 0.38$ in

Area of Long. Reinf. per Beam face: $A_{(long/face)} = 0.14$ in^2

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3401 NW 82nd Avenue
Ste. 370 Doral, FL 33122
(305) 599-8133
info@easterneg.com
www.easterneg.com

STEEL COLUMN DESIGN

Steel Column

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: STEEL COLUMN

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-22
Load Combinations Used : IBC 2021

General Information

Steel Section Name : **HSS6x4x1/4**

Analysis Method :	Allowable Strength
Steel Stress Grade	
Fy : Steel Yield	46.0 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height	12.50 ft
Top & Bottom Fixity	Top & Bottom Pinned
Brace condition :	

Unbraced Length for buckling ABOUT X-X Axis = 12.50 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 12.50 ft, K = 1.0

Applied Loads

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

Column self weight included : 195.250 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 12.50 ft, Xecc = 0.0720 in, Yecc = 0.1080 in, D = 45.192, LR = 7.904 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.8473** : 1

Load Combination	+D+Lr	
Location of max.above base	12.416	ft
At maximum location values are . . .		
Pa : Axial	53.291	k
Pn / Omega : Allowabl	66.058	k
Ma-x : Applied	-0.4747	k-ft
Mn-x / Omega : Allowable	19.580	k-ft
Ma-y : Applied	-0.3164	k-ft
Mn-y / Omega : Allowable	14.805	k-ft

PASS Maximum Shear Stress Rati **0.001002** : 1

Load Combination	+D+Lr	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Va : Applied	0.02549	k
Vn / Omega : Allowable	25.423	k

Maximum Load Reactions . .

Top along X-X	0.02549 k
Bottom along X-X	0.02549 k
Top along Y-Y	0.03823 k
Bottom along Y-Y	0.03823 k

Maximum Load Deflections . . .

Along Y-Y -0.01378 in at 7.299 ft above base
for load combination :+D+Lr

Along X-X -0.01729 in at 7.299 ft above base
for load combination :+D+Lr

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.722	PASS	12.42 ft	1.00	1.00	68.18	93.17	0.001	PASS	0.00 ft
+D+Lr	0.847	PASS	12.42 ft	1.00	1.00	68.18	93.17	0.001	PASS	0.00 ft
+D+0.750Lr	0.816	PASS	12.42 ft	1.00	1.00	68.18	93.17	0.001	PASS	0.00 ft
+0.60D	0.433	PASS	12.42 ft	1.00	1.00	68.18	93.17	0.001	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base (k)	X-X Axis Reaction @ Top (k)	Y-Y Axis Reaction @ Base (k)	Y-Y Axis Reaction @ Top (k)	Mx - End Moments @ Base (k-ft)	Mx - End Moments @ Top (k-ft)	My - End Moments @ Base (k-ft)	My - End Moments @ Top (k-ft)
D Only	45.387	0.022	0.022	-0.033	0.033				
+D+Lr	53.291	0.025	0.025	-0.038	0.038				
+D+0.750Lr	51.315	0.025	0.025	-0.037	0.037				
+0.60D	27.232	0.013	0.013	-0.020	0.020				
Lr Only	7.904	0.004	0.004	-0.006	0.006				

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base (k)	X-X Axis Reaction @ Top (k)	Y-Y Axis Reaction @ Base (k)	Y-Y Axis Reaction @ Top (k)	Mx - End Moments @ Base (k-ft)	Mx - End Moments @ Top (k-ft)	My - End Moments @ Base (k-ft)	My - End Moments @ Top (k-ft)
Axial @ Base	Maximum	53.291	0.025	0.025	-0.038	0.038				
"	Minimum	7.904	0.004	0.004	-0.006	0.006				
Reaction, X-X Axis Base	Maximum	53.291	0.025	0.025	-0.038	0.038				
"	Minimum	7.904	0.004	0.004	-0.006	0.006				

Steel Column

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: STEEL COLUMN

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
Reaction, Y-Y Axis Base	Maximum	7.904	0.004	0.004	-0.006	0.006				
"	Minimum	53.291	0.025	0.025	-0.038	0.038				
Reaction, X-X Axis Top	Maximum	53.291	0.025	0.025	-0.038	0.038				
"	Minimum	7.904	0.004	0.004	-0.006	0.006				
Reaction, Y-Y Axis Top	Maximum	45.387	0.022	0.022	-0.033	0.033				
"	Minimum	7.904	0.004	0.004	-0.006	0.006				
Moment, X-X Axis Base	Maximum	45.387		0.022	-0.033	0.033				
"	Minimum	45.387		0.022	-0.033	0.033				
Moment, Y-Y Axis Base	Maximum	45.387	0.022	0.022	-0.033	0.033				
"	Minimum	45.387	0.022	0.022	-0.033	0.033				
Moment, X-X Axis Top	Maximum	45.387	0.022	0.022	-0.033	0.033				
"	Minimum	45.387	0.022	0.022	-0.033	0.033				
Moment, Y-Y Axis Top	Maximum	45.387	0.022	0.022	-0.033	0.033				
"	Minimum	45.387	0.022	0.022	-0.033	0.033				

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	-0.0147 in	7.299 ft	-0.012 in	7.299 ft
+D+Lr	-0.0173 in	7.299 ft	-0.014 in	7.299 ft
+D+0.750Lr	-0.0166 in	7.299 ft	-0.013 in	7.299 ft
+0.60D	-0.0088 in	7.299 ft	-0.007 in	7.299 ft
Lr Only	-0.0026 in	7.299 ft	-0.002 in	7.299 ft

Steel Section Properties : HSS6x4x1/4

Depth	=	6.000 in	I xx	=	20.90 in^4	J	=	23.600 in^4
Design Thick	=	0.233 in	S xx	=	6.96 in^3	Cw	=	10.10 in^6
Width	=	4.000 in	R xx	=	2.200 in			
Wall Thick	=	0.250 in	Zx	=	8.530 in^3			
Area	=	4.300 in^2	I yy	=	11.100 in^4	C	=	10.100 in^3
Weight	=	15.620 plf	S yy	=	5.560 in^3			
			R yy	=	1.610 in			
			Zy	=	6.450 in^3			
Ycg	=	0.000 in						

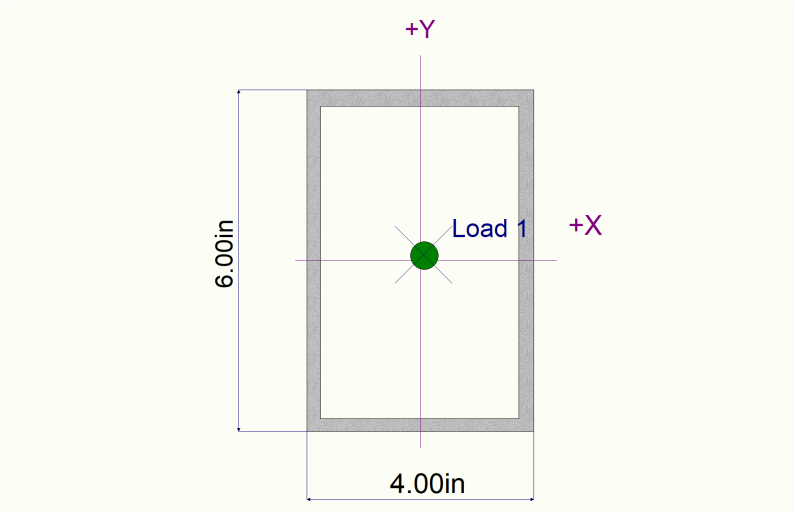
Steel Column

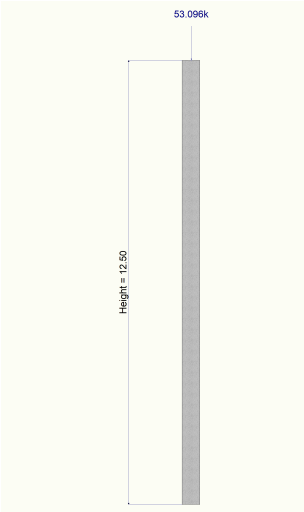
Project File: 24-0609 P8.ec6

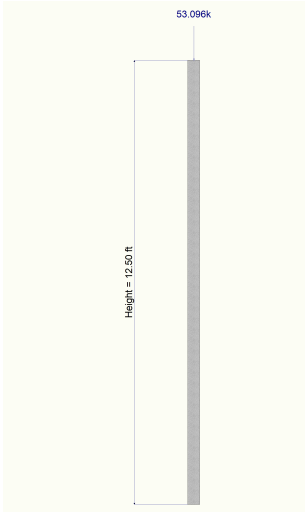
LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: STEEL COLUMN

Sketches







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3401 NW 82nd Avenue
Ste. 370 Doral, FL 33122
(305) 599-8133
info@easterneg.com
www.easterneg.com

STEEL BASE PLATE DESIGN

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Base Plate

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: STEEL PLATE

Code References

Calculations per AISC Design Guide # 1, IBC 2018, CBC 2019, ASCE 7-22, AISC 360-16
Load Combination Set : IBC 2021

General Information

Material Properties

AISC Design Method	Allowable Strength Design			
Steel Plate Fy	=	36 ksi		
Concrete Support f'c	=	4.0 ksi	Ω c : ASD Safety Facto	2.31
Assumed Bearing Area	Full Bearing		Nominal Bearing Fp per J8	3.40 ksi

Column & Plate

Column Properties

Steel Section	HSS6x4x1/4		
Depth	6 in	Area	4.3 in^2
Width	4 in	Ixx	in^4
Flange Thickness	0.233 in	Iyy	in^4
Web Thicknes	in		

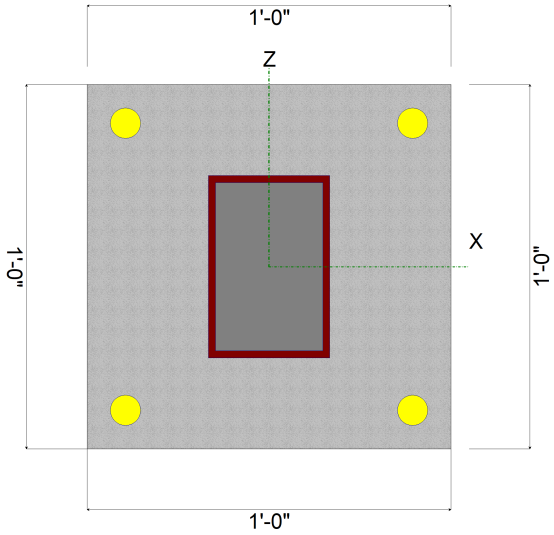
Plate Dimensions

N : Length	12.0	in
B : Width	12.0	in
Thickness	1.0	in

Support Dimensions

Width along "X"	12.0	in
Length along "Z'	12.0	in

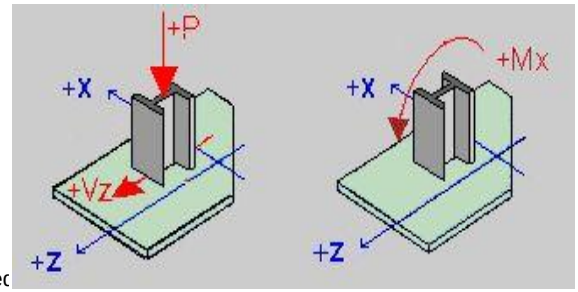
Column assumed welded to base plate



Applied Loads

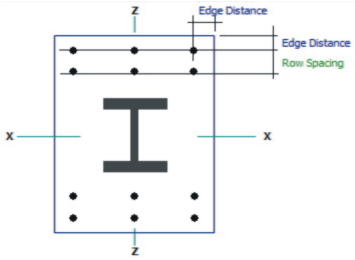
	P-Y	V-Z	M-X
D : Dead Load	45.387 k	k	k-ft
L : Live	k	k	k-ft
Lr : Roof Live	7.904 k	k	k-ft
S : Snow	k	k	k-ft
W : Wind	k	k	k-ft
E : Earthquake	k	k	k-ft
H : Lateral Earth	k	k	k-ft

" P " = Gravity load, "+" sign is downward "+" Moments create higher soil pressure at +Z ed
"+" Shears push plate towards +Z edge



Anchor Bolts

Anchor Bolt or Rod Description		
Max of Tension or Pullout Capacity.....		k
Shear Capacity.....		k
Edge distance : bolt to plate.....	1.250	in
Number of Bolts in each Row.....	2	
Number of Bolt Rows.....	1	



Steel Base Plate

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: STEEL PLATE

GOVERNING DESIGN LOAD CASE SUMMARY

Plate Design Summary

Design Method	**Allowable Strength Design**
Governing Load Combinat	**+D+Lr**
Governing Load Case Typ	**Axial Load Only**
Governing STRESS RATIO	**0.5772**
Design Plate Size	**1'-0" x 1'-0" x 1"**

Pa : Axial Load	0.000	k
Ma : Moment	0.000	k-ft

Ma : Max. Moment	3.110	k-in
fb : Max. Bending Stress	12.442	ksi
Fb : Allowable :	21.557	ksi
Fy / Omega		
Bending Stress Rati	0.577	
	Bending Stress OK	
fu : Max. Plate Bearing Stress	0.370	ksi
Fp : Allowable :	1.472	ksi
Bearing Stress Ratio	0.251	
	Bearing Stress OK	

Load Comb. : D Only

Axial Load Only, No Moment

Loading

Pa : Axial Load	45.387	k
Design Plate Height	12.000	in
Design Plate Width	12.000	in

Will be different from entry if partial bearing used.

A1 : Plate Area	144.000	in^2
A2: Support Area	144.000	in^2
sqrt(A2/A1)	1.000	

Distance for Moment Calculation

" m "	3.150	in
" n "	4.100	in
X	0.000	in^2
Lambda	0.000	
n'	0.000	in
n' * Lambda	0.000	in
L = max(m, n, n")	4.100	in

Bearing Stresses

Fp : Allowable	1.472	ksi
fa : Max. Bearing Pressure	0.315	ksi
Stress Ratio	**0.214**	

Plate Bending Stresses

Mmax = Fu * L^2 / 2	2.649	k-in on 1" strip
fb : Actual	10.597	ksi
Fb : Allowable	21.557	ksi
Stress Ratio	**0.492**	

Load Comb. : +D+Lr

Axial Load Only, No Moment

Loading

Pa : Axial Load	53.291	k
Design Plate Height	12.000	in
Design Plate Width	12.000	in

Will be different from entry if partial bearing used.

A1 : Plate Area	144.000	in^2
A2: Support Area	144.000	in^2
sqrt(A2/A1)	1.000	

Distance for Moment Calculation

" m "	3.150	in
" n "	4.100	in
X	0.000	in^2
Lambda	0.000	
n'	0.000	in
n' * Lambda	0.000	in
L = max(m, n, n")	4.100	in

Bearing Stresses

Fp : Allowable	1.472	ksi
fa : Max. Bearing Pressure	0.370	ksi
Stress Ratio	**0.251**	

Plate Bending Stresses

Mmax = Fu * L^2 / 2	3.110	k-in on 1" strip
fb : Actual	12.442	ksi
Fb : Allowable	21.557	ksi
Stress Ratio	**0.577**	

Steel Base Plate

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: STEEL PLATE

Load Comb. : +D+0.750Lr

Axial Load Only, No Moment

Loading

Pa : Axial Load	51.315	k
Design Plate Height	12.000	in
Design Plate Width	12.000	in

Will be different from entry if partial bearing used.

A1 : Plate Area	144.000	in^2
A2: Support Area	144.000	in^2
sqrt(A2/A1)	1.000	

Distance for Moment Calculation

" m "	3.150	in
" n "	4.100	in
X	0.000	in^2
Lambda	0.000	
n'	0.000	in
n' * Lambda	0.000	in
L = max(m, n, n")	4.100	in

Bearing Stresses

Fp : Allowable	1.472	ksi
fa : Max. Bearing Pressure	0.356	ksi
Stress Ratio	**0.242**	

Plate Bending Stresses

Mmax = Fu * L^2 / 2	2.995	k-in on 1" strip
fb : Actual	11.981	ksi
Fb : Allowable	21.557	ksi
Stress Ratio	**0.556**	

Load Comb. : +0.60D

Axial Load Only, No Moment

Loading

Pa : Axial Load	27.232	k
Design Plate Height	12.000	in
Design Plate Width	12.000	in

Will be different from entry if partial bearing used.

A1 : Plate Area	144.000	in^2
A2: Support Area	144.000	in^2
sqrt(A2/A1)	1.000	

Distance for Moment Calculation

" m "	3.150	in
" n "	4.100	in
X	0.000	in^2
Lambda	0.000	
n'	0.000	in
n' * Lambda	0.000	in
L = max(m, n, n")	4.100	in

Bearing Stresses

Fp : Allowable	1.472	ksi
fa : Max. Bearing Pressure	0.189	ksi
Stress Ratio	**0.128**	

Plate Bending Stresses

Mmax = Fu * L^2 / 2	1.589	k-in on 1" strip
fb : Actual	6.358	ksi
Fb : Allowable	21.557	ksi
Stress Ratio	**0.295**	

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3401 NW 82nd Avenue
Ste. 370 Doral, FL 33122
(305) 599-8133
info@easterneg.com
www.easterneg.com

MASONRY WALL DESIGN

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-G)

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-22
Load Combinations Used : ASCE 7-22

General Information

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-22

Construction Type : Grouted Hollow Concrete Masonry

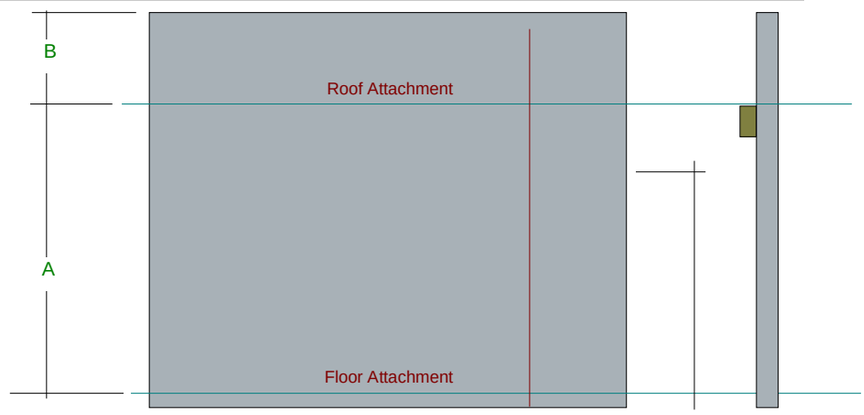
F'm	=	2.0 ksi	Nom. Wall Thickness	8 in	Temp Diff across thickness	=		deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	7.625 in	Min Allow Out-of-plane Defl Ra	=	0.0	
Fr - Rupture	=	123.50 psi	Rebar "d" distance	3.8125 in				
Em = f'm *	=	900.0	Lower Level Rebar . . .		Minimum Vertical Steel %	=	0.0020	
Max % of ρ bal.	=	0.008160	Bar Size	# 5				
Grout Density	=	140 pcf	Bar Spacing	24 in				
Block Weight		Normal Weight						
Wall Weight	=	55.0 psf						

Wall is grouted at rebar cells only

One-Story Wall Dimensions

A Clear Height = 11.60 ft
B Parapet height = ft

Wall Support Condition Top & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . . (*Applied per foot of Strip Width*)			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	2.0 in	4.120		0.350		k/ft
Concentric Load							k/ft

Lateral Loads

Wind Loads :
Full area WIND load psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load					0.1090 k/ft	11.60	ft

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-G)

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .			Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Rat	**0.7302**			
	+0.90D+W	Max Mu	2.373	k-ft	Phi * Mn	3.250 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	243		Allowable Defl. Ratio	240.0
	W Only	Max. Deflection	0.5726	in		
PASS	Axial Load Check	Max Pu / Ag	110.034	psi	Max. Allow. Defl.	0.580 in
	+1.20D+L+W	Location	6.380	ft	0.2 * f'm	400.0 psi
	Reinforcing Limit Check					
		Actual As/bd	0.003388		Max Allow As/bd	0.008163

Maximum Reactions *for Load Combination...*

Top Horizontal	W Only	0.6322 k
Base Horizontal	W Only	0.6322 k
Vertical Reaction	+D+L	5.108 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
+1.20D+1.60L at 11.21 to 11.60	5.530	20.544	0.95	0.92	0.90	3.62	0.155	0.0034	0.0075	0.00
+1.20D+L at 11.21 to 11.60	5.320	20.544	0.95	0.88	0.90	3.57	0.155	0.0034	0.0076	0.00
+1.20D+0.50W at 6.96 to 7.35	5.250	20.544	0.95	1.48	0.90	3.55	0.155	0.0034	0.0076	0.00
+1.20D+L+W at 6.19 to 6.57	5.651	20.544	0.95	2.65	0.90	3.65	0.155	0.0034	0.0075	0.00
+0.90D+W at 6.19 to 6.57	3.976	20.544	0.95	2.37	0.90	3.25	0.155	0.0034	0.0081	0.00
+1.20D+L+E at 11.21 to 11.60	5.320	20.544	0.95	0.88	0.90	3.57	0.155	0.0034	0.0076	0.00
+0.90D+E at 11.21 to 11.60	3.727	20.544	0.95	0.62	0.90	3.19	0.155	0.0034	0.0082	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
D Only at 6.57 to 6.96	4.396	0.95	0.41	353.60	31.96	353.600	0.016	8,547.5
+D+L at 6.57 to 6.96	4.746	0.95	0.44	353.60	32.57	353.600	0.018	7,869.8
+D+0.750L at 6.57 to 6.96	4.659	0.95	0.43	353.60	32.42	353.600	0.017	8,029.1
+D+0.60W at 6.19 to 6.57	4.418	0.95	1.59	353.60	32.00	34.148	0.330	421.9
+D+0.750L+0.450W at 6.19 to 6.57	4.680	0.95	1.29	353.60	32.46	37.757	0.182	764.2
+0.60D+0.60W at 5.80 to 6.19	2.663	0.95	1.36	353.60	28.83	32.524	0.233	598.3
+D+0.70E at 6.57 to 6.96	4.396	0.95	0.41	353.60	31.96	353.600	0.016	8,547.5
+D+0.750L+0.5250E at 6.57 to 6.96	4.659	0.95	0.43	353.60	32.42	353.600	0.017	8,029.1
+0.60D+0.70E at 6.57 to 6.96	2.638	0.95	0.24	353.60	28.79	353.600	0.010	14,322.5
L Only at 6.57 to 6.96	0.350	0.95	0.03	353.60	24.39	353.600	0.001	101861.6
W Only at 5.80 to 6.19	0.000	0.95	1.83	353.60	23.68	24.637	0.573	243.1
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.1 k	0.06 k	4.758 k
+D+L	0.1 k	0.06 k	5.108 k
+D+0.750L	0.1 k	0.06 k	5.021 k
+D+0.60W	0.4 k	0.32 k	4.758 k
+D+0.750L+0.450W	0.3 k	0.22 k	5.020 k

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-G)

+0.60D+0.60W	0.4 k	0.34 k	2.855 k
+D+0.70E	0.1 k	0.06 k	4.758 k
+D+0.750L+0.5250E	0.1 k	0.06 k	5.021 k
+0.60D+0.70E	0.0 k	0.04 k	2.855 k

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
L Only	0.0 k	0.01 k	0.350 k
W Only	0.6 k	0.63 k	0.000 k
E Only	0.0 k	0.00 k	0.000 k

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-1)

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-22
Load Combinations Used : ASCE 7-22

General Information

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-22

Construction Type : Grouted Hollow Concrete Masonry

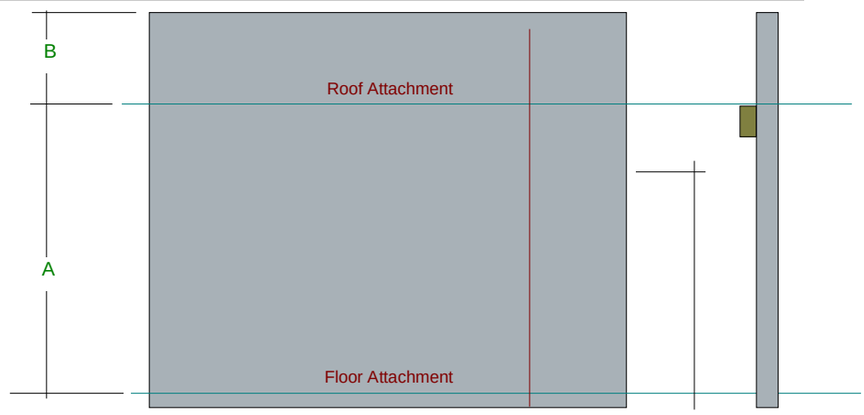
F'm	=	2.0 ksi	Nom. Wall Thickness	8	in	Temp Diff across thickness	=		deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	7.625	in	Min Allow Out-of-plane Defl Ra	=	0.0	
Fr - Rupture	=	123.50 psi	Rebar "d" distance	3.8125	in				
Em = f'm *	=	900.0	Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020	
Max % of ρ bal.	=	0.008337	Bar Size	#	5				
Grout Density	=	140 pcf	Bar Spacing		24 in				
Block Weight		Normal Weight							
Wall Weight	=	55.0 psf							

Wall is grouted at rebar cells only

One-Story Wall Dimensions

A Clear Height = 11.60 ft
B Parapet height = ft

Wall Support Condition Top & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . . (*Applied per foot of Strip Width*)			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	2.0 in	3.580		0.310		k/ft
Concentric Load							k/ft

Lateral Loads

Wind Loads :
Full area WIND load psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load					0.1090 k/ft	11.60	ft

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-1)

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .			Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Rat	**0.7327**			
	+0.90D+W	Max Mu	2.295	k-ft	Phi * Mn	3.133 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	243		Allowable Defl. Ratio	240.0
	W Only	Max. Deflection	0.5726	in		
PASS	Axial Load Check	Max Pu / Ag	96.638	psi	Max. Allow. Defl.	0.580 in
	+1.20D+L+W	Location	6.380	ft	0.2 * f'm	400.0 psi
	Reinforcing Limit Check					
		Actual As/bd	0.003388		Max Allow As/bd	0.008340

Maximum Reactions *for Load Combination...*

Top Horizontal	W Only	0.6322 k
Base Horizontal	W Only	0.6322 k
Vertical Reaction	+D+L	4.528 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
+1.20D+1.60L at 11.21 to 11.60	4.818	20.544	0.95	0.80	0.90	3.45	0.155	0.0034	0.0078	0.00
+1.20D+L at 11.21 to 11.60	4.632	20.544	0.95	0.77	0.90	3.41	0.155	0.0034	0.0078	0.00
+1.20D+0.50W at 6.57 to 6.96	4.628	20.544	0.95	1.39	0.90	3.41	0.155	0.0034	0.0078	0.00
+1.20D+L+W at 6.19 to 6.57	4.963	20.544	0.95	2.53	0.90	3.49	0.155	0.0034	0.0077	0.00
+0.90D+W at 5.80 to 6.19	3.509	20.544	0.95	2.30	0.90	3.14	0.155	0.0034	0.0082	0.00
+1.20D+L+E at 11.21 to 11.60	4.632	20.544	0.95	0.77	0.90	3.41	0.155	0.0034	0.0078	0.00
+0.90D+E at 11.21 to 11.60	3.241	20.544	0.95	0.54	0.90	3.07	0.155	0.0034	0.0083	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
D Only at 6.57 to 6.96	3.856	0.95	0.35	353.60	31.00	353.600	0.014	9,853.0
+D+L at 6.57 to 6.96	4.166	0.95	0.38	353.60	31.56	353.600	0.015	9,059.2
+D+0.750L at 6.57 to 6.96	4.089	0.95	0.38	353.60	31.42	353.600	0.015	9,245.6
+D+0.60W at 5.80 to 6.19	3.899	0.95	1.50	353.60	31.08	33.683	0.298	466.9
+D+0.750L+0.450W at 6.19 to 6.57	4.110	0.95	1.22	353.60	31.46	38.358	0.147	946.5
+0.60D+0.60W at 5.80 to 6.19	2.339	0.95	1.32	353.60	28.23	32.344	0.214	651.2
+D+0.70E at 6.57 to 6.96	3.856	0.95	0.35	353.60	31.00	353.600	0.014	9,853.0
+D+0.750L+0.5250E at 6.57 to 6.96	4.089	0.95	0.38	353.60	31.42	353.600	0.015	9,245.6
+0.60D+0.70E at 6.57 to 6.96	2.314	0.95	0.21	353.60	28.18	353.600	0.008	16,499.1
L Only at 6.57 to 6.96	0.310	0.95	0.03	353.60	24.31	353.600	0.001	115018.9
W Only at 5.80 to 6.19	0.000	0.95	1.83	353.60	23.68	24.637	0.573	243.1
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.1 k	0.05 k	4.218 k
+D+L	0.1 k	0.06 k	4.528 k
+D+0.750L	0.1 k	0.05 k	4.451 k
+D+0.60W	0.4 k	0.33 k	4.218 k
+D+0.750L+0.450W	0.3 k	0.23 k	4.451 k

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-1)

+0.60D+0.60W	0.4 k	0.35 k	2.531 k
+D+0.70E	0.1 k	0.05 k	4.218 k
+D+0.750L+0.5250E	0.1 k	0.05 k	4.451 k
+0.60D+0.70E	0.0 k	0.03 k	2.531 k

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
L Only	0.0 k	0.00 k	0.310 k
W Only	0.6 k	0.63 k	0.000 k
E Only	0.0 k	0.00 k	0.000 k

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-A)

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-22
Load Combinations Used : ASCE 7-22

General Information

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-22

Construction Type : Grouted Hollow Concrete Masonry

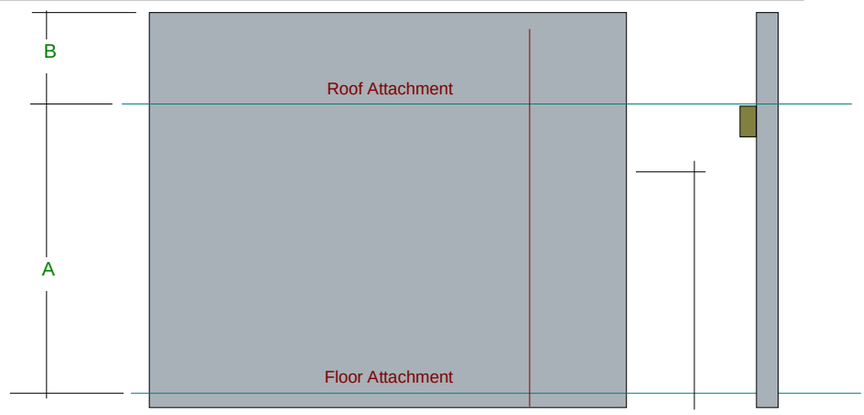
F'm	=	2.0 ksi	Nom. Wall Thickness	8	in	Temp Diff across thickness	=		deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	7.625	in	Min Allow Out-of-plane Defl Ra	=	0.0	
Fr - Rupture	=	123.50 psi	Rebar "d" distance	3.8125	in				
Em = f'm *	=	900.0	Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020	
Max % of ρ bal.	=	0.008196	Bar Size	#	5				
Grout Density	=	140 pcf	Bar Spacing		24 in				
Block Weight		Normal Weight							
Wall Weight	=	55.0 psf							

Wall is grouted at rebar cells only

One-Story Wall Dimensions

A Clear Height = 11.60 ft
B Parapet height = ft

Wall Support Condition Top & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . . (*Applied per foot of Strip Widtl*			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	2.0 in	4.01		0.870		k/ft
Concentric Load							k/ft

Lateral Loads

Wind Loads :
Full area WIND load psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-A)

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .			Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Rat	**0.2733**			
	+1.20D+1.60L	Max Mu	1.034	k-ft	Phi * Mn	3.783 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	7,200		Allowable Defl. Ratio	240.0
	+D+L	Max. Deflection	0.01934	in		
PASS	Axial Load Check	Max Pu / Ag	121.293	psi	Max. Allow. Defl.	0.580 in
	+1.20D+1.60L	Location	11.407	ft	0.2 * f'm	400.0 psi
	Reinforcing Limit Check					
		Actual As/bd	0.003388		Max Allow As/bd	0.008196

Maximum Reactions *for Load Combination...*

Top Horizontal	+D+L	0.07006 k
Base Horizontal	+D+L	0.07006 k
Vertical Reaction	+D+L	5.518 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
+1.20D+1.60L at 11.21 to 11.60	6.230	20.544	0.95	1.03	0.90	3.78	0.155	0.0034	0.0072	0.00
+1.20D+L at 11.21 to 11.60	5.708	20.544	0.95	0.95	0.90	3.66	0.155	0.0034	0.0074	0.00
+1.20D at 11.21 to 11.60	4.838	20.544	0.95	0.80	0.90	3.46	0.155	0.0034	0.0078	0.00
+0.90D at 11.21 to 11.60	3.628	20.544	0.95	0.60	0.90	3.17	0.155	0.0034	0.0082	0.00
+1.20D+L+E at 11.21 to 11.60	5.708	20.544	0.95	0.95	0.90	3.66	0.155	0.0034	0.0074	0.00
+0.90D+E at 11.21 to 11.60	3.628	20.544	0.95	0.60	0.90	3.17	0.155	0.0034	0.0082	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
D Only at 6.57 to 6.96	4.286	0.95	0.40	353.60	31.77	353.600	0.016	8,784.9
+D+L at 6.57 to 6.96	5.156	0.95	0.48	353.60	33.28	353.600	0.019	7,199.5
+D+0.750L at 6.57 to 6.96	4.939	0.95	0.46	353.60	32.91	353.600	0.018	7,540.4
+0.60D at 6.57 to 6.96	2.572	0.95	0.24	353.60	28.66	353.600	0.009	14,718.3
+D+0.70E at 6.57 to 6.96	4.286	0.95	0.40	353.60	31.77	353.600	0.016	8,784.9
+D+0.750L+0.5250E at 6.57 to 6.96	4.939	0.95	0.46	353.60	32.91	353.600	0.018	7,540.4
+0.60D+0.70E at 6.57 to 6.96	2.572	0.95	0.24	353.60	28.66	353.600	0.009	14,718.3
L Only at 6.57 to 6.96	0.870	0.95	0.08	353.60	25.42	353.600	0.003	40,914.4
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.1 k	0.06 k	4.648 k
+D+L	0.1 k	0.07 k	5.518 k
+D+0.750L	0.1 k	0.07 k	5.300 k
+0.60D	0.0 k	0.03 k	2.789 k
+D+0.70E	0.1 k	0.06 k	4.648 k
+D+0.750L+0.5250E	0.1 k	0.07 k	5.300 k
+0.60D+0.70E	0.0 k	0.03 k	2.789 k
L Only	0.0 k	0.01 k	0.870 k
E Only	0.0 k	0.00 k	0.000 k

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-A)

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-22
Load Combinations Used : ASCE 7-22

General Information

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-22

Construction Type : Grouted Hollow Concrete Masonry

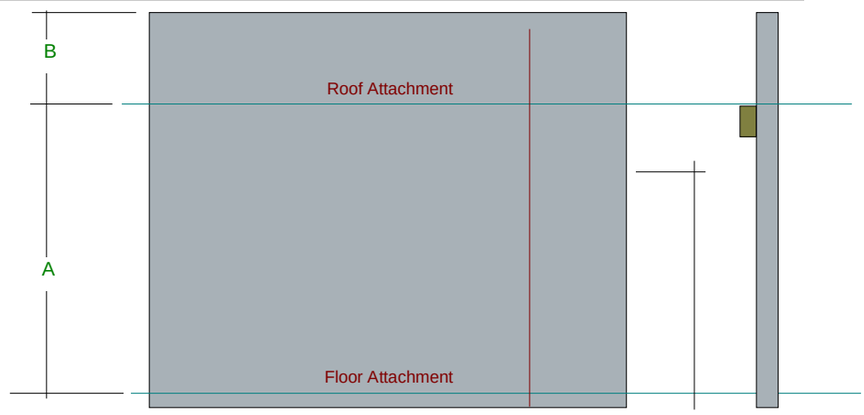
F'm	=	2.0 ksi	Nom. Wall Thickness	8	in	Temp Diff across thickness	=		deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	7.625	in	Min Allow Out-of-plane Defl Ra	=	0.0	
Fr - Rupture	=	123.50 psi	Rebar "d" distance	3.8125	in				
Em = f'm *	=	900.0	Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020	
Max % of ρ bal.	=	0.008934	Bar Size	#	5				
Grout Density	=	140 pcf	Bar Spacing		24 in				
Block Weight		Normal Weight							
Wall Weight	=	55.0 psf							

Wall is grouted at rebar cells only

One-Story Wall Dimensions

A Clear Height = 11.60 ft
B Parapet height = ft

Wall Support Condition Top & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . . (*Applied per foot of Strip Width*)			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	2.0 in	1.760		0.470		k/ft
Concentric Load							k/ft

Lateral Loads

Wind Loads :
Full area WIND load psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load					0.105 k/ft	11.60	ft

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-A)

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .			Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Rat	**0.7244**			
	+0.90D+W	Max Mu	1.982	k-ft	Phi * Mn	2.736 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	263		Allowable Defl. Ratio	240.0
	W Only	Max. Deflection	0.5285	in		
PASS	Axial Load Check	Max Pu / Ag	57.726	psi	Max. Allow. Defl.	0.580 in
	+1.20D+L+W	Location	5.993	ft	0.2 * f'm	400.0 psi
	Reinforcing Limit Check					
		Actual As/bd	0.003388		Max Allow As/bd	0.008936

Maximum Reactions *for Load Combination...*

Top Horizontal	W Only	0.6090 k
Base Horizontal	W Only	0.6090 k
Vertical Reaction	+D+L	2.868 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
+1.20D+1.60L at 11.21 to 11.60	2.890	20.544	0.95	0.48	0.90	2.99	0.155	0.0034	0.0085	0.00
+1.20D+L at 11.21 to 11.60	2.608	20.544	0.95	0.43	0.90	2.92	0.155	0.0034	0.0086	0.00
+1.20D+0.50W at 6.19 to 6.57	2.469	20.544	0.95	1.08	0.90	2.88	0.155	0.0034	0.0086	0.00
+1.20D+L+W at 5.80 to 6.19	2.965	20.544	0.95	2.13	0.90	3.00	0.155	0.0034	0.0084	0.00
+0.90D+W at 5.80 to 6.19	1.871	20.544	0.95	1.98	0.90	2.74	0.155	0.0034	0.0088	0.00
+1.20D+L+E at 11.21 to 11.60	2.608	20.544	0.95	0.43	0.90	2.92	0.155	0.0034	0.0086	0.00
+0.90D+E at 11.21 to 11.60	1.603	20.544	0.95	0.26	0.90	2.67	0.155	0.0034	0.0089	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
D Only at 6.57 to 6.96	2.036	0.95	0.17	353.60	27.66	353.600	0.007	20,153.5
+D+L at 6.57 to 6.96	2.506	0.95	0.22	353.60	28.54	353.600	0.009	15,883.1
+D+0.750L at 6.57 to 6.96	2.389	0.95	0.21	353.60	28.32	353.600	0.008	16,772.6
+D+0.60W at 5.80 to 6.19	2.079	0.95	1.24	353.60	27.74	33.364	0.166	837.8
+D+0.750L+0.450W at 5.80 to 6.19	2.431	0.95	0.98	353.60	28.40	66.702	0.045	3,087.4
+0.60D+0.60W at 5.80 to 6.19	1.247	0.95	1.16	353.60	26.15	33.700	0.128	1,088.9
+D+0.70E at 6.57 to 6.96	2.036	0.95	0.17	353.60	27.66	353.600	0.007	20,153.5
+D+0.750L+0.5250E at 6.57 to 6.96	2.389	0.95	0.21	353.60	28.32	353.600	0.008	16,772.6
+0.60D+0.70E at 6.57 to 6.96	1.222	0.95	0.10	353.60	26.10	353.600	0.004	33,672.1
L Only at 6.57 to 6.96	0.470	0.95	0.05	353.60	24.62	353.600	0.002	75,826.9
W Only at 5.80 to 6.19	0.000	0.95	1.76	353.60	23.68	24.778	0.528	263.4
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.03 k	2.398 k
+D+L	0.0 k	0.03 k	2.868 k
+D+0.750L	0.0 k	0.03 k	2.750 k
+D+0.60W	0.4 k	0.34 k	2.398 k
+D+0.750L+0.450W	0.3 k	0.24 k	2.751 k

Masonry Slender Wall

Project File: 23-0836 Pincrest 6.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: 8"CMU-#5@24 (GL-A)

+0.60D+0.60W	0.4 k	0.35 k	1.439 k
+D+0.70E	0.0 k	0.03 k	2.398 k
+D+0.750L+0.5250E	0.0 k	0.03 k	2.750 k
+0.60D+0.70E	0.0 k	0.02 k	1.439 k

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
L Only	0.0 k	0.01 k	0.470 k
W Only	0.6 k	0.61 k	0.000 k
E Only	0.0 k	0.00 k	0.000 k

Eastern
Engineering Group

3401 NW 82nd Avenue
Ste. 370 Doral, FL 33122
(305) 599-8133
info@easterneg.com
www.easterneg.com

FOOTING DESIGN

Job. No.: **Date:**

Isolated Footing Design for Gravity Columns - ACI 318-19

Input	Value	Unit
ϕ_v	0.75	N/A
Soil All.	2500	psf
F_y	60	ksi
2-way D/C	0.95	N/A

Strength Load Combination Factors						
LRFD1	1.4	DL				
LRFD2	1.2	DL	1.6	LL		
LRFD3	1.2	DL	1.0	LL	1.6	RLL

Notes:
1. All loads are unfactored (service) loads.
2. "d" is determined based on min. punching and one-way shear effective depth.
3. Soil embed. is used for overburden soil load and is measured to the top of footing.
4. Size Effect Factor = 1 per 13.2.6.2

Footing ID	P_D (kips)	P_L (kips)	P_{RL} (kips)	Surcharge Load (psf)	Soil Embd (ft)	C1 (in)	C2 (in)	f'c (psi)	d (in) 1-Way	d (in) 2-Way	Min. Size h (in)	Min. Size B (ft) x L (ft)	No. of Bars ea. way bott.	Bar No.	Max Spacing bott. @ in. o.c. ea. way	Hooked Ends?	Final Size B&L (ft)	Dsgn Check
F4-	102.5	16.9	8.0	90	2	15.0	15.0	3000	10.70	8.94	15.0	7.8 x 7.8	(9)	#5	11.0	NO	8.0	O.K.
C9-	75.8	6.2	6.3	90	2	8.0	24.0	3000	10.20	7.52	15.0	6.4 x 6.4	(7)	#5	12.0	NO	6.5	O.K.
C'4-	60.3	12.4	4.2	90	2	8.0	12.0	3000	9.36	7.46	14.0	6.0 x 6.0	(6)	#5	13.0	NO	6.0	O.K.
F1"-	49.6	8.3	4.0	90	2	21.8	8.0	3000	8.29	5.67	13.0	5.4 x 5.4	(5)	#5	15.0	NO	5.5	O.K.
E6'-	38.8	5.1	3.1	90	2	12.0	8.0	3000	7.42	5.18	12.0	4.7 x 4.7	(5)	#5	13.0	NO	5.0	O.K.
F2"-	38.4	7.5	2.9	90	2	12.0	8.0	3000	7.49	5.31	12.0	4.8 x 4.8	(5)	#5	13.0	NO	5.0	O.K.
F3'-	38.6	6.8	3.6	90	2	12.0	8.0	3000	7.49	5.36	12.0	4.8 x 4.8	(5)	#5	13.0	NO	5.0	O.K.
B3-	25.6	13.6	0.2	90	2	15.0	15.0	3000	6.70	3.66	12.0	4.4 x 4.4	(4)	#5	16.0	NO	4.5	O.K.
E8-	34.6	1.1	2.9	90	2	8.0	33.0	3000	7.15	3.31	12.0	4.3 x 4.3	(4)	#5	16.0	NO	4.5	O.K.
F1'-	35.8	5.3	2.8	90	2	12.0	8.0	3000	7.38	4.92	12.0	4.5 x 4.5	(4)	#5	16.0	NO	4.5	O.K.
F1'"-	29.2	4.7	2.3	90	2	12.0	8.0	3000	6.89	4.21	12.0	4.1 x 4.1	(4)	#5	16.0	NO	4.5	O.K.
F2'-	33.6	5.8	2.8	90	2	12.0	8.0	3000	7.29	4.76	12.0	4.4 x 4.4	(4)	#5	16.0	NO	4.5	O.K.
A"4-	27.7	4.4	1.7	90	2	8.0	12.0	3000	6.67	3.97	12.0	4.0 x 4.0	(4)	#5	14.0	NO	4.0	O.K.
C'7-	29.4	2.7	2.7	90	2	8.0	12.0	3000	6.83	4.12	12.0	4.0 x 4.0	(4)	#5	14.0	NO	4.0	O.K.
D6'-	25.8	4.5	2.2	90	2	8.0	12.0	3000	6.57	3.85	12.0	3.9 x 3.9	(4)	#5	14.0	NO	4.0	O.K.
A9-	23.0	1.0	1.6	90	2	8.0	16.0	3000	6.15	2.85	12.0	3.5 x 3.5	(3)	#5	18.0	NO	3.5	O.K.
A'4-	19.8	2.7	1.0	90	2	8.0	12.0	3000	5.74	2.91	12.0	3.4 x 3.4	(3)	#5	18.0	NO	3.5	O.K.
A'6-	20.8	1.9	2.0	90	2	8.0	12.0	3000	5.97	3.09	12.0	3.4 x 3.4	(3)	#5	18.0	NO	3.5	O.K.
C6-	15.4	5.1	0.9	90	2	8.0	12.0	3000	5.75	2.75	12.0	3.2 x 3.2	(3)	#5	18.0	NO	3.5	O.K.
D'6'-	17.0	4.7	0.7	90	2	12.0	8.0	3000	5.84	2.88	12.0	3.3 x 3.3	(3)	#5	18.0	NO	3.5	O.K.
C6'-	13.7	0.6	1.6	90	2	12.0	8.0	3000	4.98	2.18	12.0	2.8 x 2.8	(3)	#5	15.0	NO	3.0	O.K.
D8'-	12.4	0.7	0.9	90	2	12.0	8.0	3000	4.75	1.95	12.0	2.6 x 2.6	(3)	#5	15.0	NO	3.0	O.K.
E8'	14.1	0.5	1.2	90	2	8.0	12.0	3000	5.00	2.16	12.0	2.8 x 2.8	(3)	#5	15.0	NO	3.0	O.K.
G8'-	14.3	0.3	1.1	90	0	12.0	8.0	3000	4.90	2.17	12.0	2.7 x 2.7	(3)	#5	15.0	NO	3.0	O.K.
D9-	10.8	0.2	0.7	90	2	8.0	18.0	3000	4.51	1.48	12.0	2.4 x 2.4	(3)	#5	12.0	NO	2.5	O.K.
G7"-	9.7	0.3	0.7	90	2	12.0	8.0	3000	4.27	1.61	12.0	2.3 x 2.3	(3)	#5	12.0	NO	2.5	O.K.
A3-	4.7	1.7	0.0	90	2	12.0	8.0	3000	3.34	1.05	12.0	1.8 x 1.8	(2)	#5	18.0	NO	2.0	O.K.
D'7"-	2.4	0.3	0.3	90	2	12.0	8.0	3000	1.75	0.36	12.0	1.2 x 1.2	(2)	#5	12.0	NO	1.5	O.K.

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 | Eastern Engineering Group | (c) ENERCALC INC 1983-2023

DESCRIPTION: F-6.67x3.5

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength	3.0	ksi
fy : Rebar Yield	60.0	ksi
Ec : Concrete Elastic Modulus	3,122.0	ksi
Concrete Density	150.0	pcf
ϕ : Phi Values Flexure :	0.90	
Shear :	0.750	

Analysis/Design Settings

Calculate footing weight as dead load ?	Yes
Calculate Pedestal weight as dead load ?	No
Min Steel % Bending Reinf (based on 'd')	
Min Allow % Temp Reinf (based on thick)	0.00180
Min. Overturning Safety Factor	1.0: 1
Min. Sliding Safety Factor	1.0: 1

Soil Information

Allowable Soil Bearing	2.50	ksf
Increase Bearing By Footing Weight	No	
Soil Passive Sliding Resistance	250.0	pcf
(Uses entry for "Footing base depth below soil surface" for force)		
Coefficient of Soil/Concrete Friction	0.30	

Soil Bearing Increase

Footing base depth below soil surface	2.330	ft
Increases based on footing Depth		
Allowable pressure increase per foot		ksf
when base of footing is below		ft
Increases based on footing Width . . .		
Allowable pressure increase per foot		ksf
when maximum length or width is greater tha		ft
Maximum Allowed Bearing Pressure	10.0	ksf
(A value of zero implies no limit)		
Adjusted Allowable Soil Bearing	2.50	ksf

(Allowable Soil Bearing adjusted for footing weight and depth & width increases as specified by user.)

Dimensions & Reinforcing

Distance Left of Column #1	=	1.750 ft
Between Columns	=	3.250 ft
Distance Right of Column #2	=	1.750 ft
Total Footing Length	=	6.750 ft
Footing Width	=	3.50 ft
Footing Thickness	=	12.0 in

Pedestal dimensions...

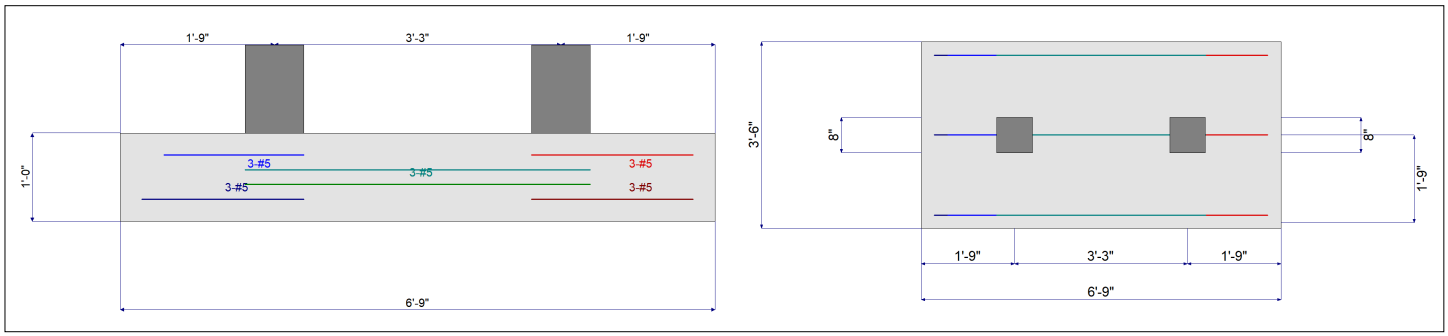
		Col #1	Col #2	
Sq. Dim.	=	8.0	8.0	in
Height	=	12.0	12.0	in

Rebar Center to Concrete Edge @ Top	=	3.0 in
Rebar Center to Concrete Edge @ Bottom	=	3.0 in

Bars left of Col #1	Count	Size #	As Provided	As Req'd
Bottom Bars	3.0	5	0.930	0.9072 in^2
Top Bars	3.0	5	0.930	0.0 in^2
Bars Btwn Cols				
Bottom Bars	3.0	5	0.930	0.9072 in^2
Top Bars	3.0	5	0.930	0.0 in^2
Bars Right of Col #2				
Bottom Bars	3.0	5	0.930	0.9072 in^2
Top Bars	3.0	5	0.930	0.0 in^2

Applied Loads

Applied @ Left Column		D	Lr	L	S	W	E	H	
Axial Load Downward	=	13.953	0.9160	4.755					k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Applied @ Right Column									
Axial Load Downward	=	13.767	1.567	0.650					k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Overburden	=	0.090							



Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: F-6.67x3.5

DESIGN SUMMARY

Design OK

Factor of Safety		Item	Applied	Capacity	Governing Load Combination
PASS	No OTM	Overturning	0.0 k-ft	0.0 k-ft	No OTM
PASS	No Sliding	Sliding	0.0 k	12.592 k	No Sliding
PASS	No Uplift	Uplift	0.0 k	0.0 k	No Uplift

Utilization Ratio		Item	Applied	Capacity	Governing Load Combination
PASS	0.8109	Soil Bearing	2.027 ksf	2.50 ksf	+D+L
PASS	0.1656	1-way Shear - Col #1	13.609 psi	82.158 psi	+1.20D+0.50Lr+1.60L
PASS	0.1234	1-way Shear - Col #2	10.141 psi	82.158 psi	+1.40D
PASS	0.2005	2-way Punching - Col #1	32.949 psi	164.317 psi	+1.20D+0.50Lr+1.60L
PASS	0.2080	2-way Punching - Col #2	34.180 psi	164.317 psi	+1.20D+0.50Lr+1.60L
PASS	No Bending	Flexure - Left of Col #1 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.2024	Flexure - Left of Col #1 - Bottom	7.404 k-ft	36.575 k-ft	+1.20D+0.50Lr+1.60L
PASS	No Bending	Flexure - Between Cols - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.2150	Flexure - Between Cols - Bottom	7.864 k-ft	36.575 k-ft	+1.20D+0.50Lr+1.60L
PASS	No Bending	Flexure - Right of Col #2 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.1517	Flexure - Right of Col #2 - Bottom	5.550 k-ft	36.575 k-ft	+1.40D

Soil Bearing

Load Combination...	Total Bearing	Eccentricity from Ftg CL	Actual Soil Bearing Stress @ Left Edge	@ Right Edge	Allowable	Actual / Allow Ratio
D Only	36.30 k	-0.008 ft	1.55 ksf	1.53 ksf	2.50 ksf	0.619
+D+L	41.71 k	-0.167 ft	2.03 ksf	1.50 ksf	2.50 ksf	0.811
+D+Lr	38.79 k	0.019 ft	1.61 ksf	1.67 ksf	2.50 ksf	0.668
+D+0.750Lr+0.750L	42.22 k	-0.107 ft	1.96 ksf	1.62 ksf	2.50 ksf	0.783
+D+0.750L	40.36 k	-0.131 ft	1.91 ksf	1.51 ksf	2.50 ksf	0.763
+0.60D	22.98 k	-0.008 ft	0.98 ksf	0.97 ksf	2.50 ksf	0.392

Overturning Stability

Load Combination...	Moments about Left Edge k-ft Overturning	Resisting	Ratio	Moments about Right Edg k-ft Overturning	Resisting	Ratio
D Only	0.00	0.00	999.000	0.00	0.00	999.000
+D+L	0.00	0.00	999.000	0.00	0.00	999.000
+D+Lr	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750Lr+0.750L	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750L	0.00	0.00	999.000	0.00	0.00	999.000
+0.60D	0.00	0.00	999.000	0.00	0.00	999.000

Sliding Stability

Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio
D Only	0.00 k	12.59 k	999
+D+L	0.00 k	14.21 k	999
+D+Lr	0.00 k	13.34 k	999
+D+0.750Lr+0.750L	0.00 k	14.37 k	999
+D+0.750L	0.00 k	13.81 k	999
+0.60D	0.00 k	8.20 k	999

Load Combination...	One Way Shear Phi Vn	vu @ Col #1	vu @ Col #2	Punching Shear Phi Vn	vu @ Col #1	vu @ Col #2
+1.40D	82.16 psi	10.32 psi	10.14 psi	164.32 psi	25.34 psi	25.39 psi
+1.20D+0.50Lr+1.60L	82.16 psi	13.61 psi	9.16 psi	164.32 psi	32.95 psi	34.18 psi
+1.20D+1.60L	82.16 psi	13.39 psi	8.72 psi	164.32 psi	32.34 psi	33.63 psi
+1.20D+1.60Lr+0.50L	82.16 psi	10.96 psi	10.11 psi	164.32 psi	26.99 psi	27.22 psi
+1.20D+1.60Lr	82.16 psi	9.54 psi	10.10 psi	164.32 psi	23.67 psi	23.51 psi
+1.20D+0.50L	82.16 psi	10.27 psi	8.70 psi	164.32 psi	25.04 psi	25.47 psi
+1.20D	82.16 psi	8.85 psi	8.69 psi	164.32 psi	21.72 psi	21.76 psi
+1.20D+0.50Lr+0.50L	82.16 psi	10.48 psi	9.14 psi	164.32 psi	25.65 psi	26.02 psi
+0.90D	82.16 psi	6.63 psi	6.52 psi	164.32 psi	16.29 psi	16.32 psi

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 | Eastern Engineering Group | (c) ENERCALC INC 1983-2023

DESCRIPTION: F12.0 x 8.0

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength	3.0	ksi
fy : Rebar Yield	60.0	ksi
Ec : Concrete Elastic Modulus	3,122.0	ksi
Concrete Density	150.0	pcf
ϕ : Phi Values Flexure :	0.90	
Shear :	0.750	

Analysis/Design Settings

Calculate footing weight as dead load ?	Yes
Calculate Pedestal weight as dead load ?	No
Min Steel % Bending Reinf (based on 'd')	
Min Allow % Temp Reinf (based on thick)	0.00180
Min. Overturning Safety Factor	1.0: 1
Min. Sliding Safety Factor	1.0: 1

Soil Information

Allowable Soil Bearing	2.50	ksf
Increase Bearing By Footing Weight	No	
Soil Passive Sliding Resistance	250.0	pcf
(Uses entry for "Footing base depth below soil surface" for force)		
Coefficient of Soil/Concrete Friction	0.30	

Soil Bearing Increase

Footing base depth below soil surface	2.583	ft
Increases based on footing Depth		
Allowable pressure increase per foot		ksf
when base of footing is below		ft
Increases based on footing Width . . .		
Allowable pressure increase per foot		ksf
when maximum length or width is greater tha		ft
Maximum Allowed Bearing Pressure	10.0	ksf
(A value of zero implies no limit)		
Adjusted Allowable Soil Bearing	2.50	ksf

(Allowable Soil Bearing adjusted for footing weight and depth & width increases as specified by user.)

Dimensions & Reinforcing

Distance Left of Column #1	=	4.250 ft
Between Columns	=	5.0 ft
Distance Right of Column #2	=	2.750 ft
Total Footing Length	=	12.0 ft
Footing Width	=	8.0 ft
Footing Thickness	=	15.0 in

Pedestal dimensions...

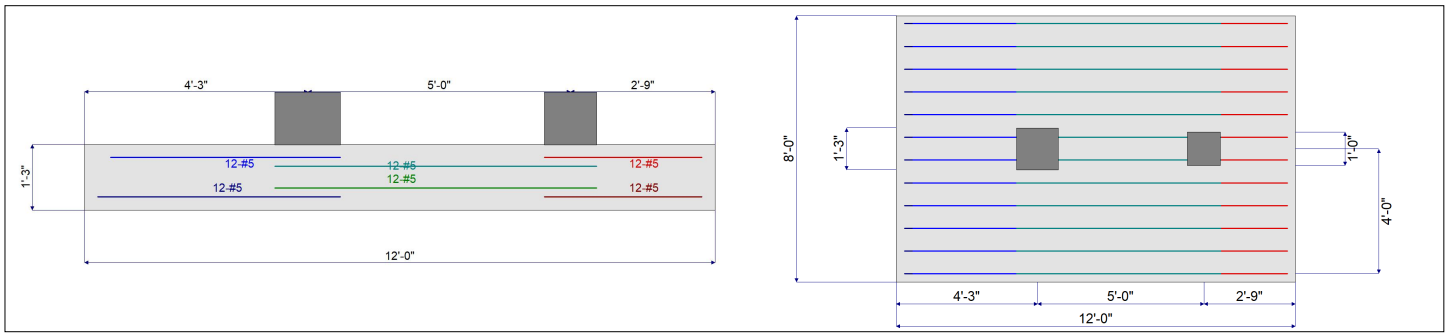
		Col #1	Col #2	
Sq. Dim.	=	15.0	12.0	in
Height	=	12.0	12.0	in

Rebar Center to Concrete Edge @ Top	=	3.0	in	
Rebar Center to Concrete Edge @ Bottom	=	3.0	in	

Bars left of Col #1	Count	Size #	As Provided	As Req'd
Bottom Bars	12.0	5	3.720	3.037 in^2
Top Bars	12.0	5	3.720	0.0 in^2
Bars Btwn Cols				
Bottom Bars	12.0	5	3.720	3.534 in^2
Top Bars	12.0	5	3.720	0.0 in^2
Bars Right of Col #2				
Bottom Bars	12.0	5	3.720	2.592 in^2
Top Bars	12.0	5	3.720	0.0 in^2

Applied Loads

		D	Lr	L	S	W	E	H	
Applied @ Left Column									
Axial Load Downward	=	100.587	8.033	16.855					k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Applied @ Right Column									
Axial Load Downward	=	38.391	3.610	6.758					k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Overburden	=	0.090							



Combined Footing

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: F12.0 x 8.0

DESIGN SUMMARY

Design OK

Factor of Safety		Item	Applied	Capacity	Governing Load Combination
PASS	No OTM	Overturning	0.0 k-ft	0.0 k-ft	No OTM
PASS	No Sliding	Sliding	0.0 k	58.621 k	No Sliding
PASS	No Uplift	Uplift	0.0 k	0.0 k	No Uplift

Utilization Ratio		Item	Applied	Capacity	Governing Load Combination
PASS	0.9728	Soil Bearing	2.432 ksf	2.50 ksf	+D+0.750Lr+0.750L
PASS	0.5558	1-way Shear - Col #1	45.666 psi	82.158 psi	+1.20D+0.50Lr+1.60L
PASS	0.1958	1-way Shear - Col #2	16.090 psi	82.158 psi	+1.20D+0.50Lr+1.60L
PASS	0.6504	2-way Punching - Col #1	106.879 psi	164.317 psi	+1.20D+0.50Lr+1.60L
PASS	0.7523	2-way Punching - Col #2	123.620 psi	164.317 psi	+1.20D+0.50Lr+1.60L
PASS	No Bending	Flexure - Left of Col #1 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.6695	Flexure - Left of Col #1 - Bottom	129.382 k-ft	193.249 k-ft	+1.20D+0.50Lr+1.60L
PASS	No Bending	Flexure - Between Cols - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.7206	Flexure - Between Cols - Bottom	139.249 k-ft	193.249 k-ft	+1.20D+0.50Lr+1.60L
PASS	No Bending	Flexure - Right of Col #2 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.1879	Flexure - Right of Col #2 - Bottom	36.312 k-ft	193.249 k-ft	+1.20D+0.50Lr+1.60L

Soil Bearing

Load Combination...	Total Bearing	Eccentricity from Ftg CL	Actual Soil Bearing Stress @ Left Edge	@ Right Edge	Allowable	Actual / Allow Ratio
D Only	177.72 k	-0.289 ft	2.12 ksf	1.58 ksf	2.50 ksf	0.847
+D+L	201.33 k	-0.293 ft	2.40 ksf	1.79 ksf	2.50 ksf	0.961
+D+Lr	189.36 k	-0.284 ft	2.25 ksf	1.69 ksf	2.50 ksf	0.901
+D+0.750Lr+0.750L	204.16 k	-0.288 ft	2.43 ksf	1.82 ksf	2.50 ksf	0.973
+D+0.750L	195.43 k	-0.292 ft	2.33 ksf	1.74 ksf	2.50 ksf	0.933
+0.60D	111.56 k	-0.277 ft	1.32 ksf	1.00 ksf	2.50 ksf	0.529

Overturning Stability

Load Combination...	Moments about Left Edge k-ft Overturning	Resisting	Ratio	Moments about Right Edg k-ft Overturning	Resisting	Ratio
D Only	0.00	0.00	999.000	0.00	0.00	999.000
+D+L	0.00	0.00	999.000	0.00	0.00	999.000
+D+Lr	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750Lr+0.750L	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750L	0.00	0.00	999.000	0.00	0.00	999.000
+0.60D	0.00	0.00	999.000	0.00	0.00	999.000

Sliding Stability

Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio
D Only	0.00 k	58.62 k	999
+D+L	0.00 k	65.71 k	999
+D+Lr	0.00 k	62.11 k	999
+D+0.750Lr+0.750L	0.00 k	66.55 k	999
+D+0.750L	0.00 k	63.93 k	999
+0.60D	0.00 k	37.13 k	999

	One Way Shear			Punching Shear		
Load Combination...	Phi Vn	vu @ Col #1	vu @ Col #2	Phi Vn	vu @ Col #1	vu @ Col #2
+1.40D	82.16 psi	42.41 psi	14.76 psi	164.32 psi	98.94 psi	114.54 psi
+1.20D+0.50Lr+1.60L	82.16 psi	45.67 psi	16.09 psi	164.32 psi	106.88 psi	123.62 psi
+1.20D+1.60L	82.16 psi	44.47 psi	15.61 psi	164.32 psi	104.02 psi	120.33 psi
+1.20D+1.60Lr+0.50L	82.16 psi	42.73 psi	15.12 psi	164.32 psi	99.96 psi	115.62 psi
+1.20D+1.60Lr	82.16 psi	40.19 psi	14.20 psi	164.32 psi	93.95 psi	108.69 psi
+1.20D+0.50L	82.16 psi	38.89 psi	13.58 psi	164.32 psi	90.81 psi	105.10 psi
+1.20D	82.16 psi	36.36 psi	12.66 psi	164.32 psi	84.81 psi	98.18 psi
+1.20D+0.50Lr+0.50L	82.16 psi	40.09 psi	14.06 psi	164.32 psi	93.67 psi	108.39 psi
+0.90D	82.16 psi	27.27 psi	9.49 psi	164.32 psi	63.61 psi	73.63 psi

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: F7.0 x5.0 (8-12)

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength	3.0	ksi
fy : Rebar Yield	60.0	ksi
Ec : Concrete Elastic Modulus	3,122.0	ksi
Concrete Density	150.0	pcf
ϕ : Phi Values Flexure :	0.90	
Shear :	0.750	

Analysis/Design Settings

Calculate footing weight as dead load ?	Yes
Calculate Pedestal weight as dead load ?	No
Min Steel % Bending Reinf (based on 'd')	
Min Allow % Temp Reinf (based on thick)	0.00180
Min. Overturning Safety Factor	1.0: 1
Min. Sliding Safety Factor	1.0: 1

Soil Information

Allowable Soil Bearing	2.50	ksf
Increase Bearing By Footing Weight	No	
Soil Passive Sliding Resistance	250.0	pcf
(Uses entry for "Footing base depth below soil surface" for force)		
Coefficient of Soil/Concrete Friction	0.30	

Soil Bearing Increase

Footing base depth below soil surface	2.330	ft
Increases based on footing Depth		
Allowable pressure increase per foot		ksf
when base of footing is below		ft
Increases based on footing Width . . .		
Allowable pressure increase per foot		ksf
when maximum length or width is greater tha		ft
Maximum Allowed Bearing Pressure	10.0	ksf
(A value of zero implies no limit)		
Adjusted Allowable Soil Bearing	2.50	ksf

(Allowable Soil Bearing adjusted for footing weight and depth & width increases as specified by user.)

Dimensions & Reinforcing

Distance Left of Column #1	=	2.291 ft
Between Columns	=	2.416 ft
Distance Right of Column #2	=	2.291 ft
Total Footing Length	=	6.998 ft
Footing Width	=	5.50 ft
Footing Thickness	=	12.0 in

Pedestal dimensions...

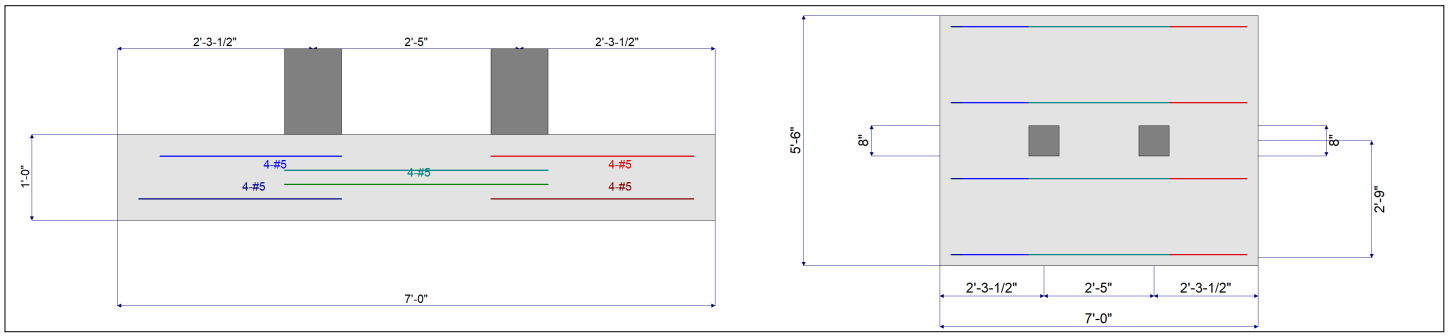
		Col #1	Col #2	
Sq. Dim.	=	8.0	8.0	in
Height	=	12.0	12.0	in

Rebar Center to Concrete Edge @ Top	=	3.0	in	
Rebar Center to Concrete Edge @ Bottom	=	3.0	in	

Bars left of Col #1	Count	Size #	As Provided	As Req'd
Bottom Bars	4.0	5	1.240	1.426 in^2
Top Bars	4.0	5	1.240	0.0 in^2
Bars Btwn Cols				
Bottom Bars	4.0	5	1.240	1.426 in^2
Top Bars	4.0	5	1.240	0.0 in^2
Bars Right of Col #2				
Bottom Bars	4.0	5	1.240	1.426 in^2
Top Bars	4.0	5	1.240	0.0 in^2

Applied Loads

Applied @ Left Column		D	Lr	L	S	W	E	H	
Axial Load Downward	=	34.801	2.915	1.109					k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Applied @ Right Column									
Axial Load Downward	=	14.232	1.163	0.5660					k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Overburden	=	0.090							



Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.04.09 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: F7.0 x5.0 (8-12)

DESIGN SUMMARY

Design OK

Factor of Safety		Item	Applied	Capacity	Governing Load Combination
PASS	No OTM	Overturning	0.0 k-ft	0.0 k-ft	No OTM
PASS	No Sliding	Sliding	0.0 k	21.624 k	No Sliding
PASS	No Uplift	Uplift	0.0 k	0.0 k	No Uplift

Utilization Ratio		Item	Applied	Capacity	Governing Load Combination
PASS	0.9404	Soil Bearing	2.351 ksf	2.50 ksf	+D+0.750Lr+0.750L
PASS	0.3288	1-way Shear - Col #1	27.014 psi	82.158 psi	+1.40D
PASS	0.1543	1-way Shear - Col #2	12.680 psi	82.158 psi	+1.40D
PASS	0.4359	2-way Punching - Col #1	71.629 psi	164.317 psi	+1.40D
PASS	0.4467	2-way Punching - Col #2	73.393 psi	164.317 psi	+1.40D
PASS	No Bending	Flexure - Left of Col #1 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.5097	Flexure - Left of Col #1 - Bottom	24.967 k-ft	48.987 k-ft	+1.40D
PASS	No Bending	Flexure - Between Cols - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.5751	Flexure - Between Cols - Bottom	28.174 k-ft	48.987 k-ft	+1.40D
PASS	No Bending	Flexure - Right of Col #2 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.2423	Flexure - Right of Col #2 - Bottom	11.868 k-ft	48.987 k-ft	+1.40D

Soil Bearing

Load Combination...	Total Bearing	Eccentricity from Ftg CL	Actual Soil Bearing Stress @ Left Edge	@ Right Edge	Allowable	Actual / Allow Ratio
D Only	63.14 k	-0.394 ft	2.19 ksf	1.09 ksf	2.50 ksf	0.877
+D+L	64.82 k	-0.393 ft	2.25 ksf	1.12 ksf	2.50 ksf	0.900
+D+Lr	67.22 k	-0.401 ft	2.35 ksf	1.15 ksf	2.50 ksf	0.938
+D+0.750Lr+0.750L	67.46 k	-0.399 ft	2.35 ksf	1.15 ksf	2.50 ksf	0.940
+D+0.750L	64.40 k	-0.393 ft	2.24 ksf	1.11 ksf	2.50 ksf	0.894
+0.60D	39.87 k	-0.374 ft	1.37 ksf	0.70 ksf	2.50 ksf	0.547

Overturning Stability

Load Combination...	Moments about Left Edge k-ft Overturning	Resisting	Ratio	Moments about Right Edg k-ft Overturning	Resisting	Ratio
D Only	0.00	0.00	999.000	0.00	0.00	999.000
+D+L	0.00	0.00	999.000	0.00	0.00	999.000
+D+Lr	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750Lr+0.750L	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750L	0.00	0.00	999.000	0.00	0.00	999.000
+0.60D	0.00	0.00	999.000	0.00	0.00	999.000

Sliding Stability

Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio
D Only	0.00 k	21.62 k	999
+D+L	0.00 k	22.13 k	999
+D+Lr	0.00 k	22.85 k	999
+D+0.750Lr+0.750L	0.00 k	22.92 k	999
+D+0.750L	0.00 k	22.00 k	999
+0.60D	0.00 k	13.98 k	999

Load Combination...	One Way Shear Phi Vn	vu @ Col #1	vu @ Col #2	Punching Shear Phi Vn	vu @ Col #1	vu @ Col #2
+1.40D	82.16 psi	27.01 psi	12.68 psi	164.32 psi	71.63 psi	73.39 psi
+1.20D+0.50Lr+1.60L	82.16 psi	24.96 psi	11.80 psi	164.32 psi	66.22 psi	67.84 psi
+1.20D+1.60L	82.16 psi	24.15 psi	11.43 psi	164.32 psi	64.04 psi	65.61 psi
+1.20D+1.60Lr+0.50L	82.16 psi	26.06 psi	12.24 psi	164.32 psi	69.20 psi	70.90 psi
+1.20D+1.60Lr	82.16 psi	25.75 psi	12.07 psi	164.32 psi	68.38 psi	70.06 psi
+1.20D+0.50L	82.16 psi	23.47 psi	11.04 psi	164.32 psi	62.22 psi	63.75 psi
+1.20D	82.16 psi	23.16 psi	10.87 psi	164.32 psi	61.40 psi	62.91 psi
+1.20D+0.50Lr+0.50L	82.16 psi	24.28 psi	11.42 psi	164.32 psi	64.40 psi	65.99 psi
+0.90D	82.16 psi	17.37 psi	8.15 psi	164.32 psi	46.05 psi	47.18 psi

Wall Footing

Project File: Enercalc.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: WF-36

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	150.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
AutoCalc Footing Weight as DL :		Yes

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Reference Depth below Surface	=	2.0 ft
Allow. Pressure Increase per foot of depth	=	ksf
when base footing is below	=	ft

Increases based on footing Width

Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft

Adjusted Allowable Bearing Pressure = 2.0 ksf

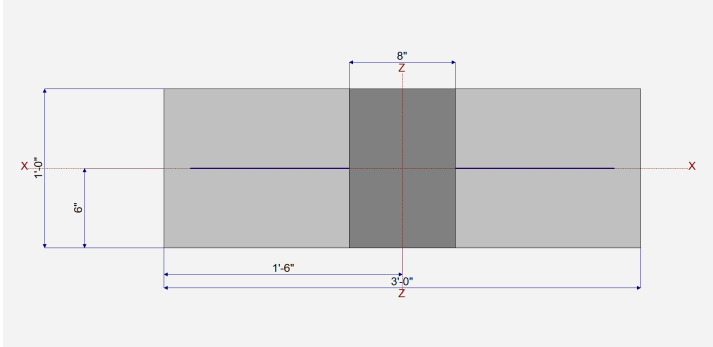
Dimensions

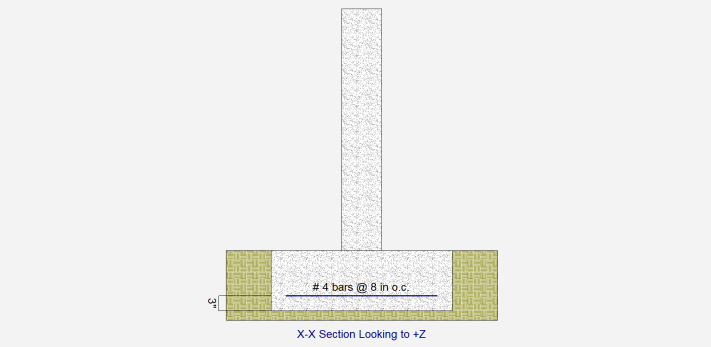
Footing Width	=	3.0 ft
Wall Thickness	=	8.0 in
Wall center offset from center of footing	=	0 in

Footing Thickness	=	12.0 in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in

Reinforcing

Bars along X-X Axis		
Bar spacing	=	8.00
Reinforcing Bar Size	=	# 4





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	4.10	0.2630	0.350					k
OB : Overburden	=								ksf
V-x	=								k
M-zz	=								k-ft

Vx applied = in above top of footing

Project Title:
Engineer:
Project ID:
Project Descr:

Wall Footing

Project File: Enercalc.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: WF-36

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8350	Soil Bearing	1.670 ksf	2.0 ksf	+D+0.750Lr+0.750L
PASS	0.1230	Z Flexure (+X)	1.445 k-ft	11.753 k-ft	+1.40D
PASS	0.07904	Z Flexure (-X)	0.9290 k-ft	11.753 k-ft	+0.90D
PASS	0.1005	1-way Shear (+X)	8.257 psi	82.158 psi	+1.40D
PASS	0.1005	1-way Shear (-X)	8.257 psi	82.158 psi	+1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio
, D Only	2.0 ksf	0.0 in	1.517 ksf	1.517 ksf	0.758
, +D+L	2.0 ksf	0.0 in	1.633 ksf	1.633 ksf	0.817
, +D+Lr	2.0 ksf	0.0 in	1.604 ksf	1.604 ksf	0.802
, +D+0.750Lr+0.750L	2.0 ksf	0.0 in	1.670 ksf	1.670 ksf	0.835
, +D+0.750L	2.0 ksf	0.0 in	1.604 ksf	1.604 ksf	0.802
, +0.60D	2.0 ksf	0.0 in	0.910 ksf	0.910 ksf	0.455

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
, +1.40D	1.445	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.40D	1.445	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50Lr+1.60L	1.395	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50Lr+1.60L	1.395	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60L	1.366	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60L	1.366	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60Lr+0.50L	1.374	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60Lr+0.50L	1.374	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60Lr	1.334	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60Lr	1.334	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50L	1.278	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50L	1.278	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D	1.239	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D	1.239	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50Lr+0.50L	1.308	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50Lr+0.50L	1.308	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +0.90D	0.929	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +0.90D	0.929	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK

One Way Shear

Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	8.257 psi	8.257 psi	8.257 psi	82.158 psi	0.1005	OK
+1.20D+0.50Lr+1.60L	7.974 psi	7.974 psi	7.974 psi	82.158 psi	0.09706	OK
+1.20D+1.60L	7.804 psi	7.804 psi	7.804 psi	82.158 psi	0.09498	OK
+1.20D+1.60Lr+0.50L	7.85 psi	7.85 psi	7.85 psi	82.158 psi	0.09555	OK
+1.20D+1.60Lr	7.623 psi	7.623 psi	7.623 psi	82.158 psi	0.09279	OK

Wall Footing

Project File: Enercalc.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: WF-36

One Way Shear Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.20D+0.50L	7.305 psi	7.305 psi	7.305 psi	82.158 psi	0.08891	OK
+1.20D	7.078 psi	7.078 psi	7.078 psi	82.158 psi	0.08615	OK
+1.20D+0.50Lr+0.50L	7.475 psi	7.475 psi	7.475 psi	82.158 psi	0.09098	OK
+0.90D	5.308 psi	5.308 psi	5.308 psi	82.158 psi	0.06461	OK

Wall Footing

Project File: enercalc.ec6

LIC# : KW-06018068, Build:20.23.08.30 | Eastern Engineering Group | (c) ENERCALC INC 1983-2023

DESCRIPTION: WF-48

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	150.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
AutoCalc Footing Weight as DL :		Yes

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Reference Depth below Surface	=	2.0 ft
Allow. Pressure Increase per foot of depth	=	ksf
when base footing is below	=	ft

Increases based on footing Width

Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft

Adjusted Allowable Bearing Pressure = 2.0 ksf

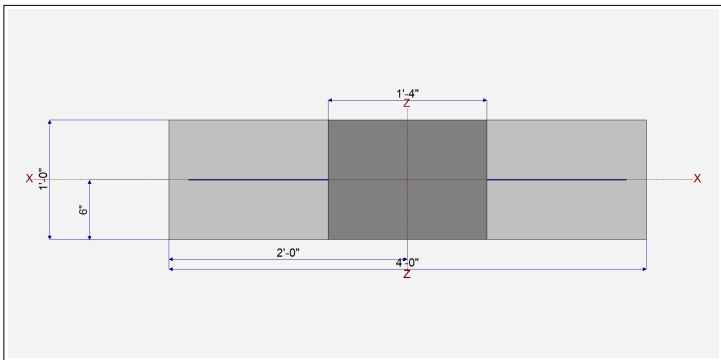
Dimensions

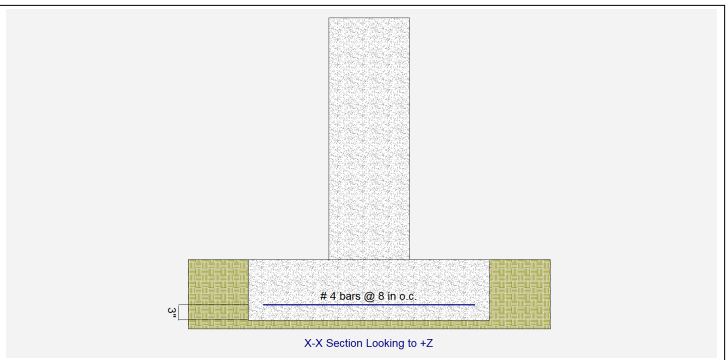
Footing Width	=	4.0 ft
Wall Thickness	=	16.0 in
Wall center offset from center of footing	=	0 in

Footing Thickness	=	12.0 in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in

Reinforcing

Bars along X-X Axis		
Bar spacing	=	8.00
Reinforcing Bar Size	=	# 4





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	5.80	0.240	0.32					k
OB : Overburden	=								ksf
V-x	=								k
M-zz	=								k-ft

Vx applied = in above top of footing

Project Title:
Engineer:
Project ID:
Project Descr:

Wall Footing

Project File: enercalc.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: WF-48

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8525	Soil Bearing	1.705 ksf	2.0 ksf	+D+0.750Lr+0.750L
PASS	0.1694	Z Flexure (+X)	1.991 k-ft	11.753 k-ft	+1.40D
PASS	0.1089	Z Flexure (-X)	1.280 k-ft	11.753 k-ft	+0.90D
PASS	0.1414	1-way Shear (+X)	11.615 psi	82.158 psi	+1.40D
PASS	0.1414	1-way Shear (-X)	11.615 psi	82.158 psi	+1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio
, D Only	2.0 ksf	0.0 in	1.60 ksf	1.60 ksf	0.800
, +D+L	2.0 ksf	0.0 in	1.680 ksf	1.680 ksf	0.840
, +D+Lr	2.0 ksf	0.0 in	1.660 ksf	1.660 ksf	0.830
, +D+0.750Lr+0.750L	2.0 ksf	0.0 in	1.705 ksf	1.705 ksf	0.853
, +D+0.750L	2.0 ksf	0.0 in	1.660 ksf	1.660 ksf	0.830
, +0.60D	2.0 ksf	0.0 in	0.960 ksf	0.960 ksf	0.480

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
, +1.40D	1.991	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.40D	1.991	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50Lr+1.60L	1.847	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50Lr+1.60L	1.847	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60L	1.82	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60L	1.82	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60Lr+0.50L	1.828	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60Lr+0.50L	1.828	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60Lr	1.792	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+1.60Lr	1.792	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50L	1.742	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50L	1.742	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D	1.707	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D	1.707	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50Lr+0.50L	1.769	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +1.20D+0.50Lr+0.50L	1.769	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +0.90D	1.28	-X	Bottom	0.2592	Min Temp %	0.3	11.753	OK
, +0.90D	1.28	+X	Bottom	0.2592	Min Temp %	0.3	11.753	OK

One Way Shear

Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	11.615 psi	11.615 psi	11.615 psi	82.158 psi	0.1414	OK
+1.20D+0.50Lr+1.60L	10.775 psi	10.775 psi	10.775 psi	82.158 psi	0.1311	OK
+1.20D+1.60L	10.619 psi	10.619 psi	10.619 psi	82.158 psi	0.1293	OK
+1.20D+1.60Lr+0.50L	10.661 psi	10.661 psi	10.661 psi	82.158 psi	0.1298	OK
+1.20D+1.60Lr	10.453 psi	10.453 psi	10.453 psi	82.158 psi	0.1272	OK

Wall Footing

Project File: enercalc.ec6

LIC# : KW-06018068, Build:20.23.08.30 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: WF-48

One Way Shear Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.20D+0.50L	10.163 psi	10.163 psi	10.163 psi	82.158 psi	0.1237	OK
+1.20D	9.956 psi	9.956 psi	9.956 psi	82.158 psi	0.1212	OK
+1.20D+0.50Lr+0.50L	10.319 psi	10.319 psi	10.319 psi	82.158 psi	0.1256	OK
+0.90D	7.467 psi	7.467 psi	7.467 psi	82.158 psi	0.09088	OK

Eastern
Engineering Group

3401 NW 82nd Avenue
Ste. 370 Doral, FL 33122
(305) 599-8133
info@easterneg.com
www.easterneg.com

PARAPET DESIGN

Masonry Slender Wall

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.07.08 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: Parapet

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16

Construction Type : Grouted Hollow Concrete Masonry

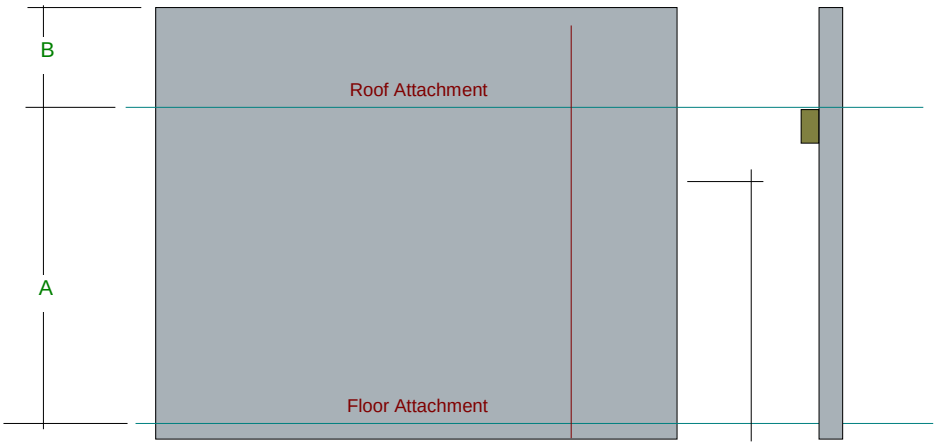
F'm	=	1.50 ksi	Nom. Wall Thickness	8 in	Temp Diff across thickness	=	deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	7.625 in	Min Allow Out-of-plane Defl Ra	=	0.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance	3.750 in			
Em = f'm *	=	900.0	Lower Level Rebar . . .		Minimum Vertical Steel %	=	0.0020
Max % of ρ bal.	=	0.007137	Bar Size #	5			
Grout Density	=	140 pcf	Bar Spacing	16 in			
Block Weight		Normal Weight					
Wall Weight	=	63.0 psf					

Wall is grouted at rebar cells only

One-Story Wall Dimensions

A Clear Height = 2 ft
B Parapet height = ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :

Full area WIND load 203.3 psf

Seismic Loads :

Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight

Seismic Wall Lateral Load 0 psf

Fp 1.0 = 0.0 psf

Masonry Slender Wall

Project File: 24-0609 P8.ec6

LIC# : KW-06018068, Build:20.24.07.08 Eastern Engineering Group (c) ENERCALC INC 1983-2023

DESCRIPTION: Parapet

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +0.90D+W	Maximum Bending Stress Rat	**0.1237**		
		Max Mu	-0.4066 k-ft	Phi * Mn	3.288 k-ft
PASS	Service Deflection Check W Only	Actual Defl. Ratio L/	35472	Allowable Defl. Ratio	150.0
		Max. Deflection	0.001353 in		/2 for Cantilever
PASS	Axial Load Check +1.20D+W	Max Pu / Ag	2.437 psi	Max. Allow. Defl.	0.320 in
		Location	0.03333 ft	0.2 * f'm	300.0 psi
	Reinforcing Limit Check	Actual As/bd	0.0050	Max Allow As/bd	0.007137

Maximum Reactions *for Load Combination...*

Top Horizontal		0.0 k
Base Horizontal	W Only	0.4066 k
Vertical Reaction	D Only	0.1260 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 0.07	0.151	18.612	0.50	0.20	0.90	3.30	0.233	0.0050	0.0071	3.00
+1.20D+W at 0.00 to 0.07	0.151	18.612	0.50	0.41	0.90	3.30	0.233	0.0050	0.0071	3.00
+0.90D+W at 0.00 to 0.07	0.113	18.612	0.50	0.41	0.90	3.29	0.233	0.0050	0.0071	3.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+0.60W at 1.93 to 2.00	0.004	0.50	0.00	376.00	41.56	376.000	0.001	59,119.7
+D+0.450W at 1.93 to 2.00	0.004	0.50	0.00	376.00	41.56	376.000	0.001	78,826.3
+0.60D+0.60W at 1.93 to 2.00	0.003	0.50	0.00	376.00	41.56	376.000	0.001	59,120.1
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
W Only at 1.93 to 2.00	0.000	0.50	0.00	376.00	41.55	376.000	0.001	35,472.4
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	0.126 k
+D+0.60W	0.2 k	0.00 k	0.126 k
+D+0.450W	0.2 k	0.00 k	0.126 k
+0.60D+0.60W	0.2 k	0.00 k	0.076 k
+D+0.70E	0.0 k	0.00 k	0.126 k
+D+0.5250E	0.0 k	0.00 k	0.126 k
+0.60D+0.70E	0.0 k	0.00 k	0.076 k
W Only	0.4 k	0.00 k	0.000 k

Masonry Slender Wall

DESCRIPTION: Parapet

E Only	0.0 k	0.00 k	0.000 k