Michael Baker
INTERNATIONAL

Creech DRP Phase 2

Aircraft Maintenance Facility (AMF)

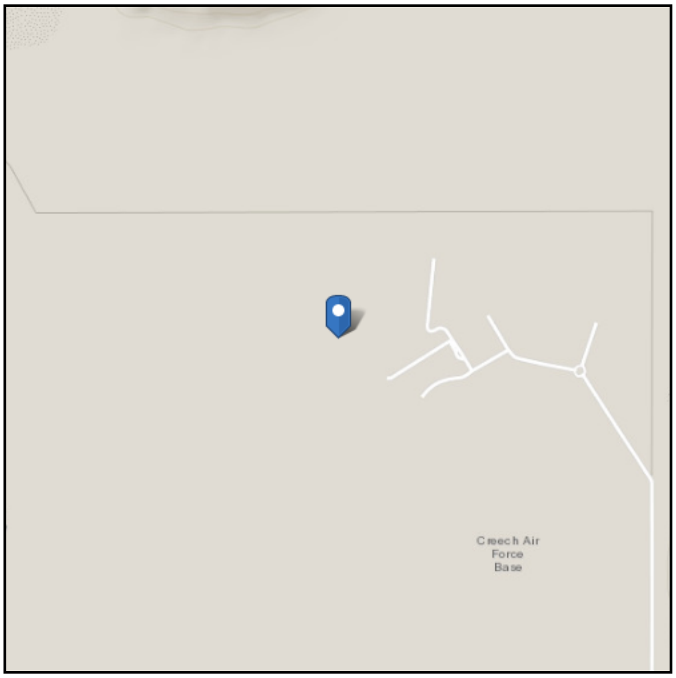
Structural Calculations

Criteria and Model Information

ASCE Hazards Report

Standard:	ASCE/SEI 7-22	**Latitude:**	36.592935
Risk Category:	II	**Longitude:**	-115.66473
Soil Class:	Default	**Elevation:**	3096.745107028911 ft (NAVD 88)

Address:
No Address at This Location



Wind

Results:

Wind Speed	98 Vmph
10-year MRI	69 Vmph
25-year MRI	75 Vmph
50-year MRI	80 Vmph
100-year MRI	84 Vmph
300-year MRI	92 Vmph
700-year MRI	98 Vmph
1,700-year MRI	105 Vmph
3,000-year MRI	108 Vmph
10,000-year MRI	117 Vmph
100,000-year MRI	135 Vmph
1,000,000-year MRI	153 Vmph

Data Source:	ASCE/SEI 7-22, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed:	Thu Nov 06 2025

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-22 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years). Values for 10-year MRI, 25-year MRI, 50-year MRI and 100-year MRI are Service Level wind speeds, all other wind speeds are Ultimate wind speeds.

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-22 Section 26.2.

Seismic

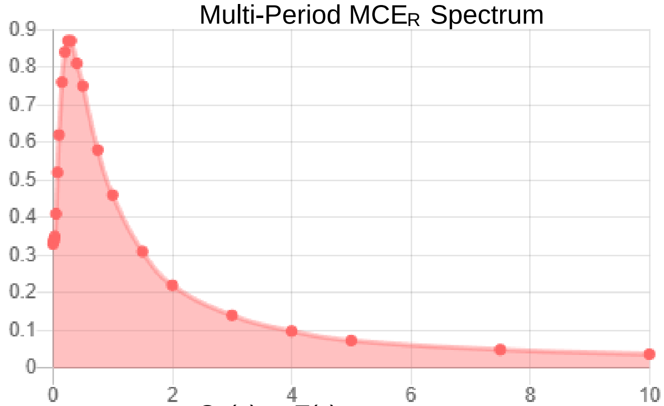
Site Soil Class: Default

Results:

PGA_M :	0.31	T_L :	6
S_{MS} :	0.79	S_S :	0.58
S_{M1} :	0.46	S_1 :	0.17
S_{DS} :	0.52	V_{S30} :	260
S_{D1} :	0.3		

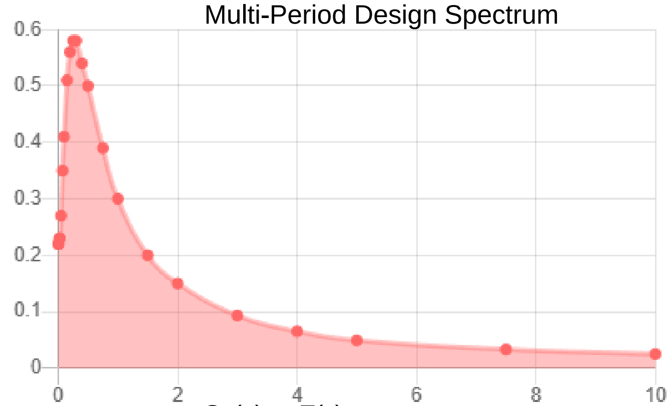
Seismic Design Category: D

Multi-Period MCE_R Spectrum



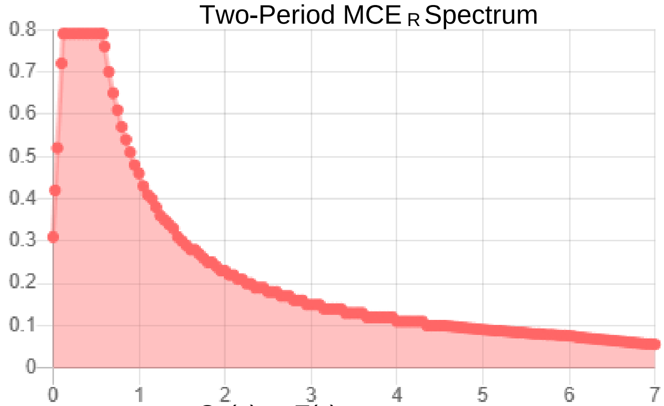
S_a(g) vs T(s)

Multi-Period Design Spectrum



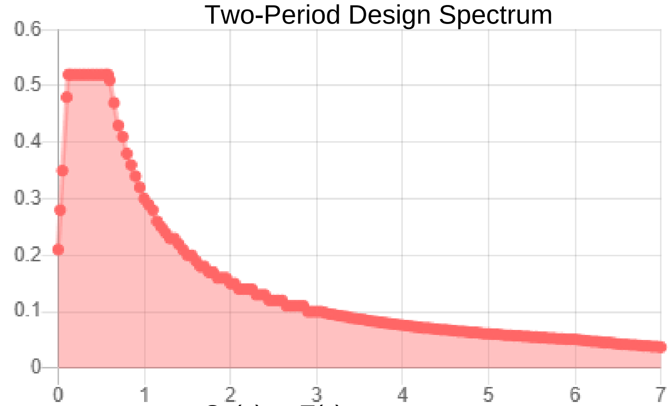
S_a(g) vs T(s)

Two-Period MCE_R Spectrum



S_a(g) vs T(s)

Two-Period Design Spectrum



S_a(g) vs T(s)

MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Thu Nov 06 2025**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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Ice

Results:

Ice Thickness:	N/A
Concurrent Temperature:	N/A
3-s Gust Speed	N/A
Data Source:	Standard ASCE/SEI 7-22, Figs. 10-2 through 10-8
Date Accessed:	Thu Nov 06 2025

Ice thicknesses on structures in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

Values provided are equivalent radial ice thicknesses due to freezing rain for 250, 500, 1,000, and 1,400-year mean recurrence intervals along with concurrent 3-s gust speeds and concurrent air temperatures. The shading indicates special icing regions, with elevations above 2,100 ft (640 m) in the east, 6,000 ft (1829 m) in the west, and 1,600 ft (488 m) in Alaska, with sparse weather station data for determining design ice loads. In these regions, as well as in regions with complex terrain causing unusual icing conditions and regions where snow or in-cloud icing results in larger loads, the mapped values should be adjusted based on a combination of local historical records and experience, reanalysis data, and numerical weather prediction systems.

Snow

Results:

Ground Snow Load, p_g :	20 lb/ft^2
20-year MRI Value:	3.88 lb/ft^2
Winter Wind Parameter:	0.35
Mapped Elevation:	3109.2 ft
Data Source:	ASCE/SEI 7-22, Figures 7.6-1 and 7.6-2 A-D
Date Accessed:	Thu Nov 06 2025

Values provided are ground snow loads. In areas designated "case study required," extreme local variations in ground snow loads preclude mapping at this scale. Site-specific case studies are required to establish ground snow loads at elevations not covered.

Snow load values are mapped to a 0.5 mile resolution. This resolution can create a mismatch between the mapped elevation and the site-specific elevation in topographically complex areas. Engineers should consult the local authority having jurisdiction in locations where the reported ‘elevation’ and ‘mapped elevation’ differ significantly from each other.

Ground Snow Loads for IRC only, $p_{g(asd)}$:	14.0 lb/ft^2

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Code Search

Code: International Building Code 2024

Occupancy:

Occupancy Group = B Business

Risk Category & Importance Factors:

Risk Category =	II
Wind Factor =	1.00
Snow Factor =	1.00
Seismic Importance factor =	1.00

Type of Construction:

Fire Rating:

Roof =	0.0 hr
Floor =	0.0 hr

Building Geometry:

Roof angle (θ)	1.00 / 12	4.8 deg
Building length	103.0 ft	
Least width	43.0 ft	
Mean Roof Ht (h)	11.0 ft	
Parapet ht above grd	0.0 ft	
Minimum parapet ht	0.0 ft	
hb for Elevated bldg	0.0 ft	

Live Loads:

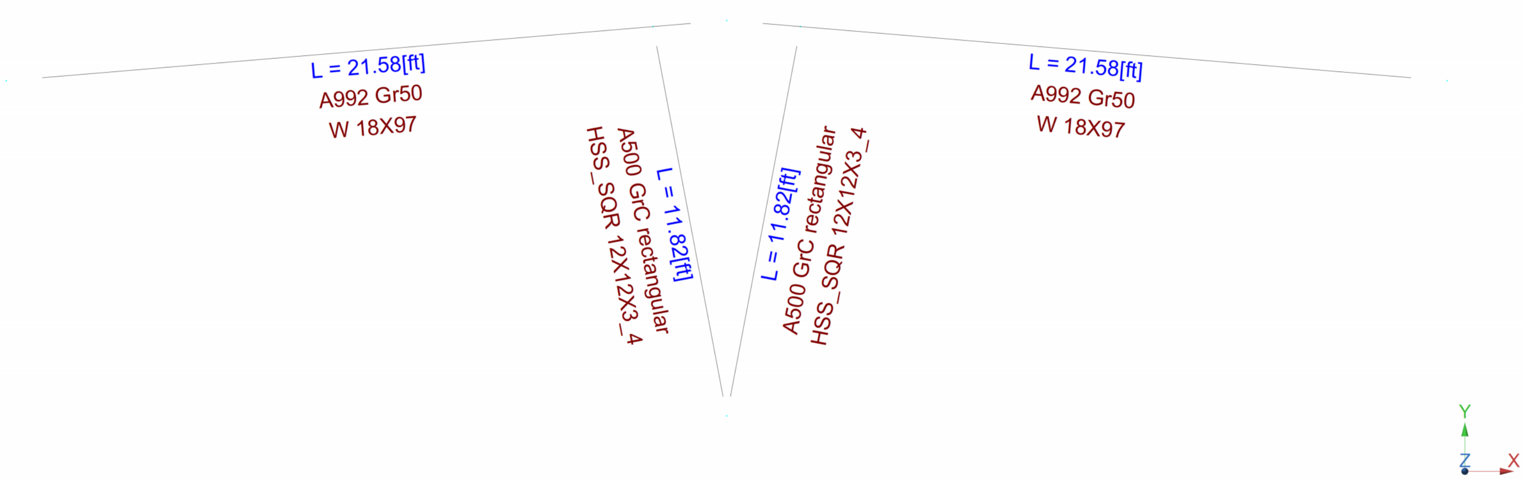
Roof
0 to 200 sf: 20 psf
200 to 600 sf: 24 - 0.02Area, but not less than 12 psf
over 600 sf: 12 psf

Roofs used for roof gardens 100 psf

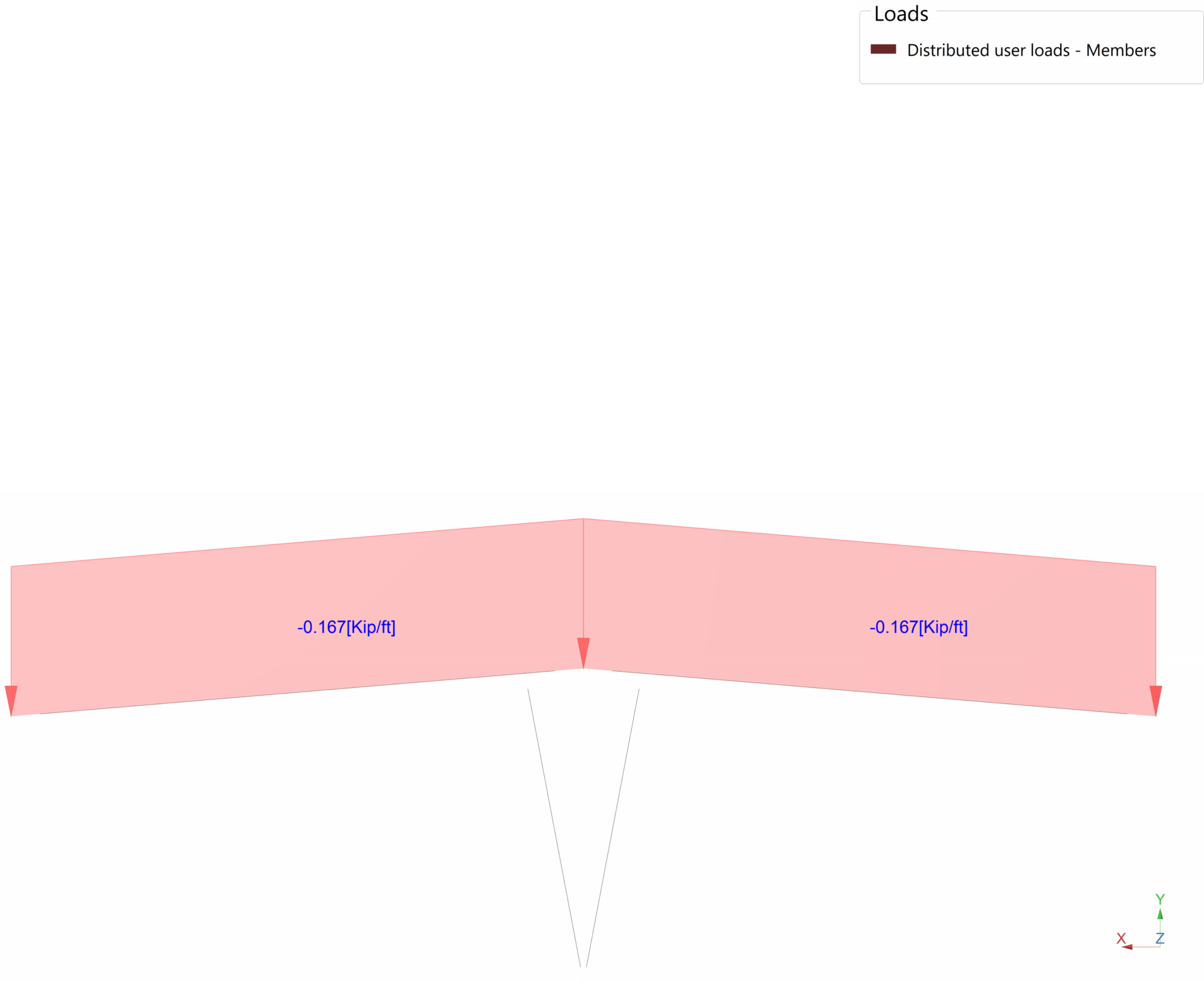
Floor:

Typical Floor	50 psf
Partitions	15 psf
Corridors above first floor	80 psf
Lobbies & first floor corridors	100 psf
Stairs and exit ways	100 psf

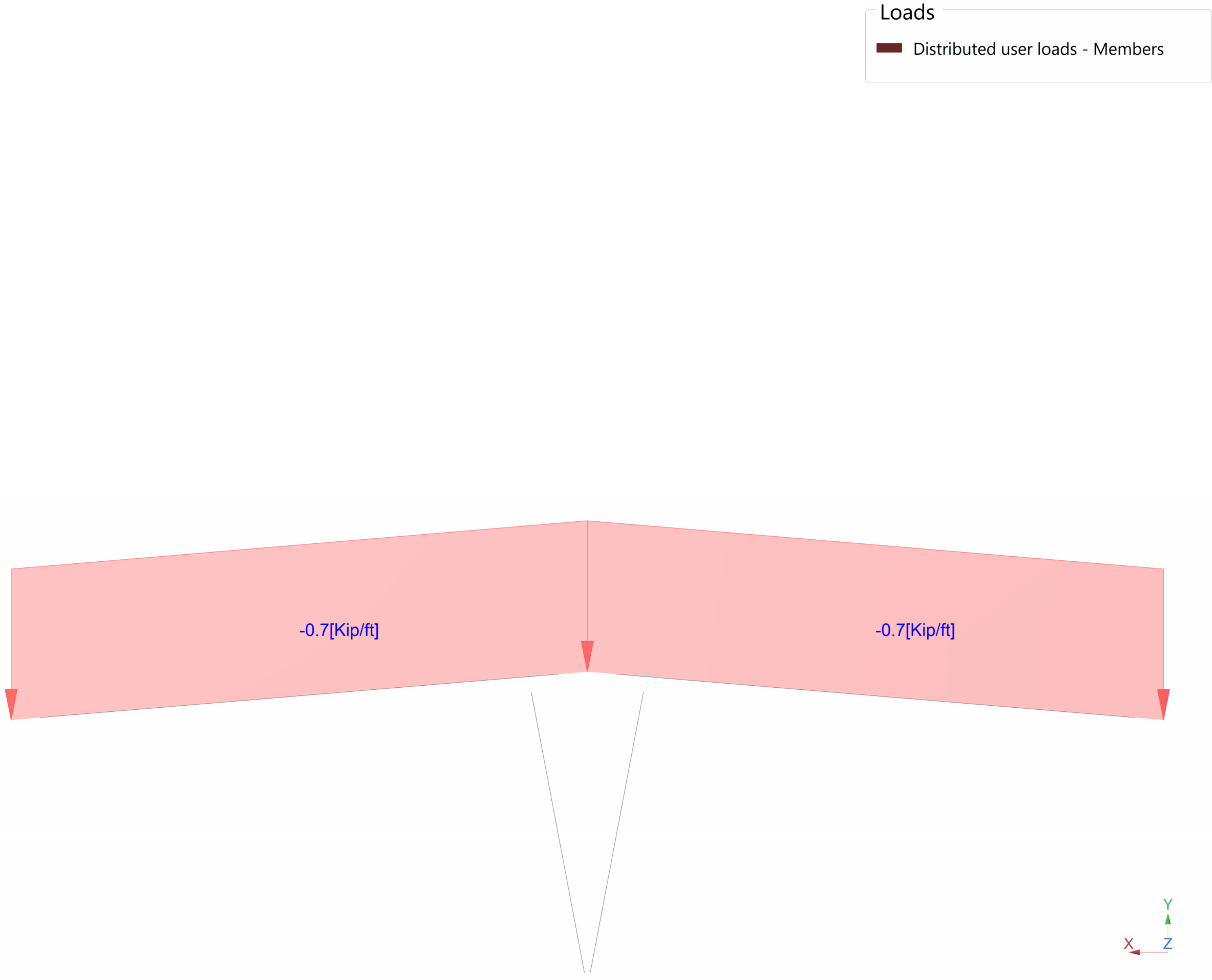
AEG - 3D RENDERED VIEW



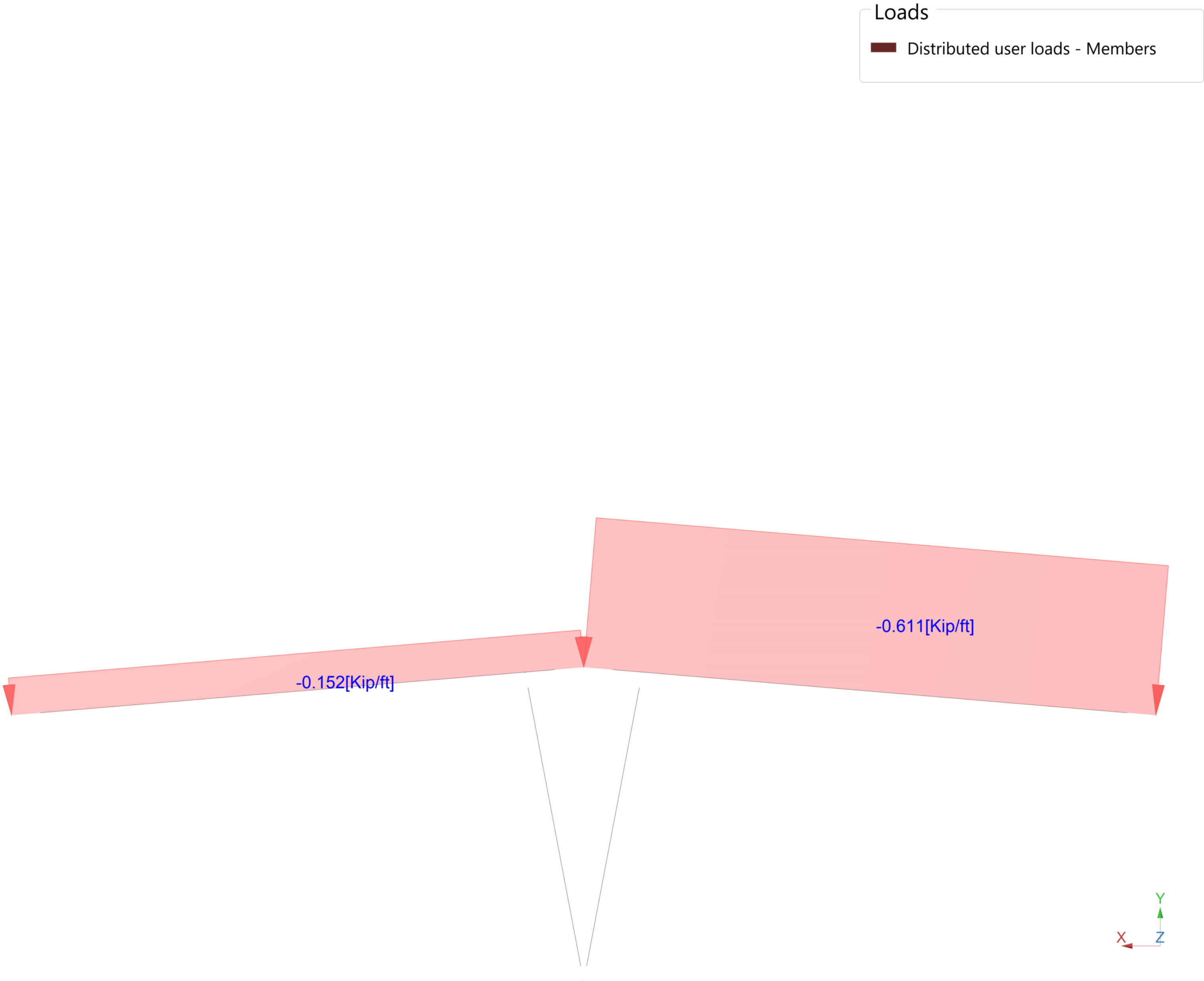
AEG - MEMBER PROPERTIES



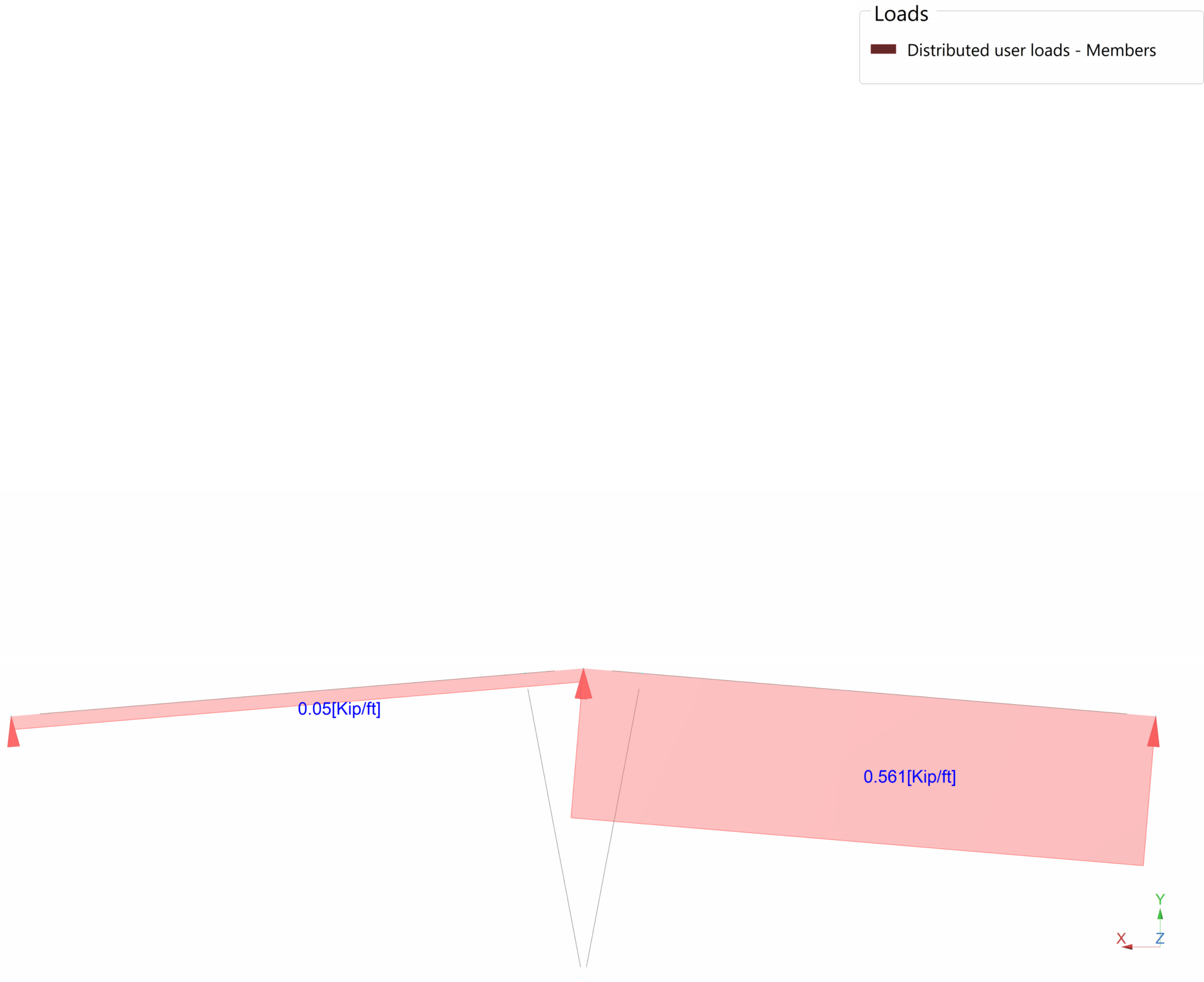
AEG - DEAD LOADING



AEG - LIVE ROOF LOADING



AEG - WIND LOADING



AEG - WIND UPLIFT LOADING

RAM Elements **Michael Baker**

Current Date: 11/6/2025 4:07 PM
Units system: English
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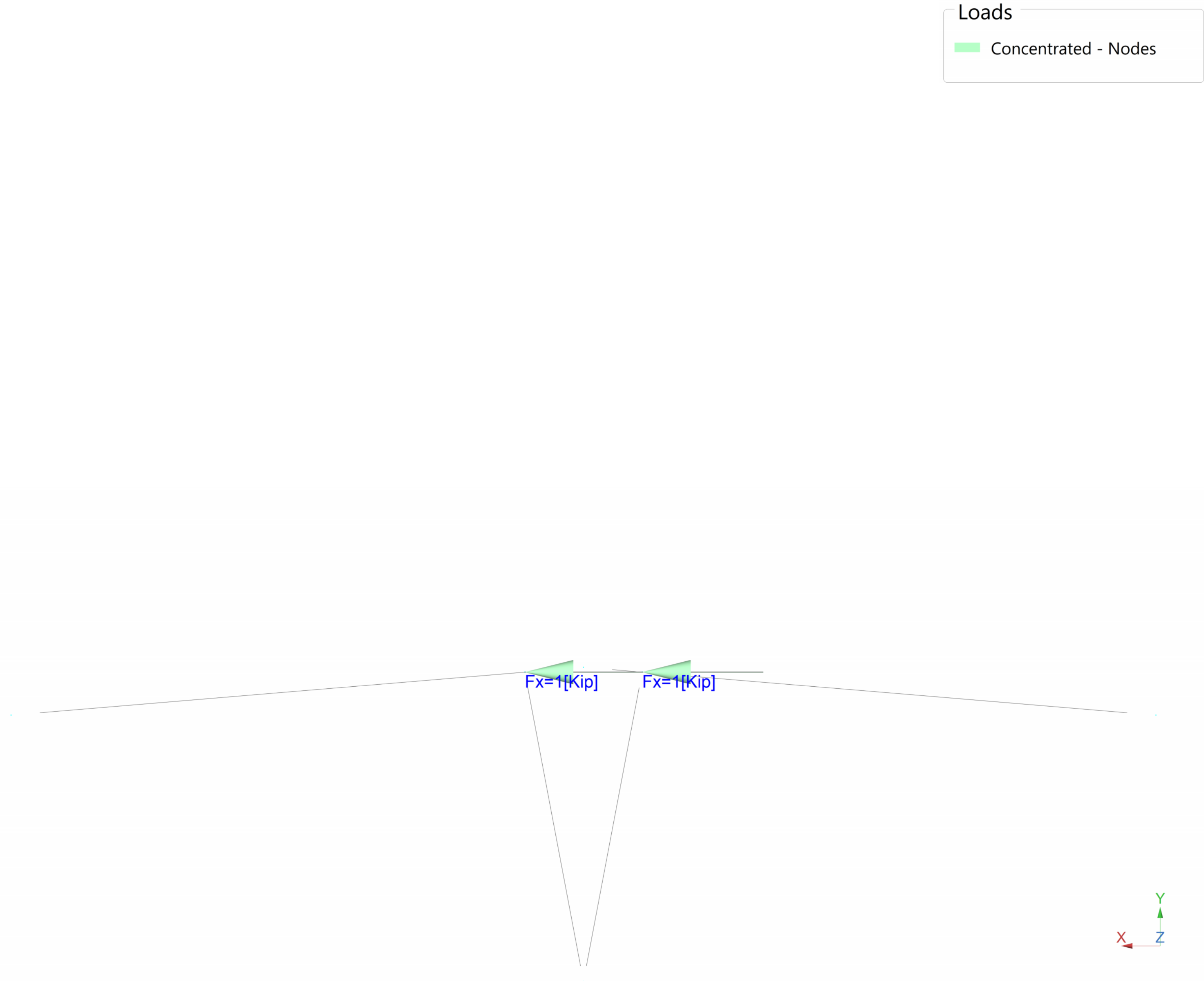
Load condition: EQx=Seismic Load X



AEG - EQX LOADING

Michael Baker

Current Date: 11/6/2025 4:07 PM
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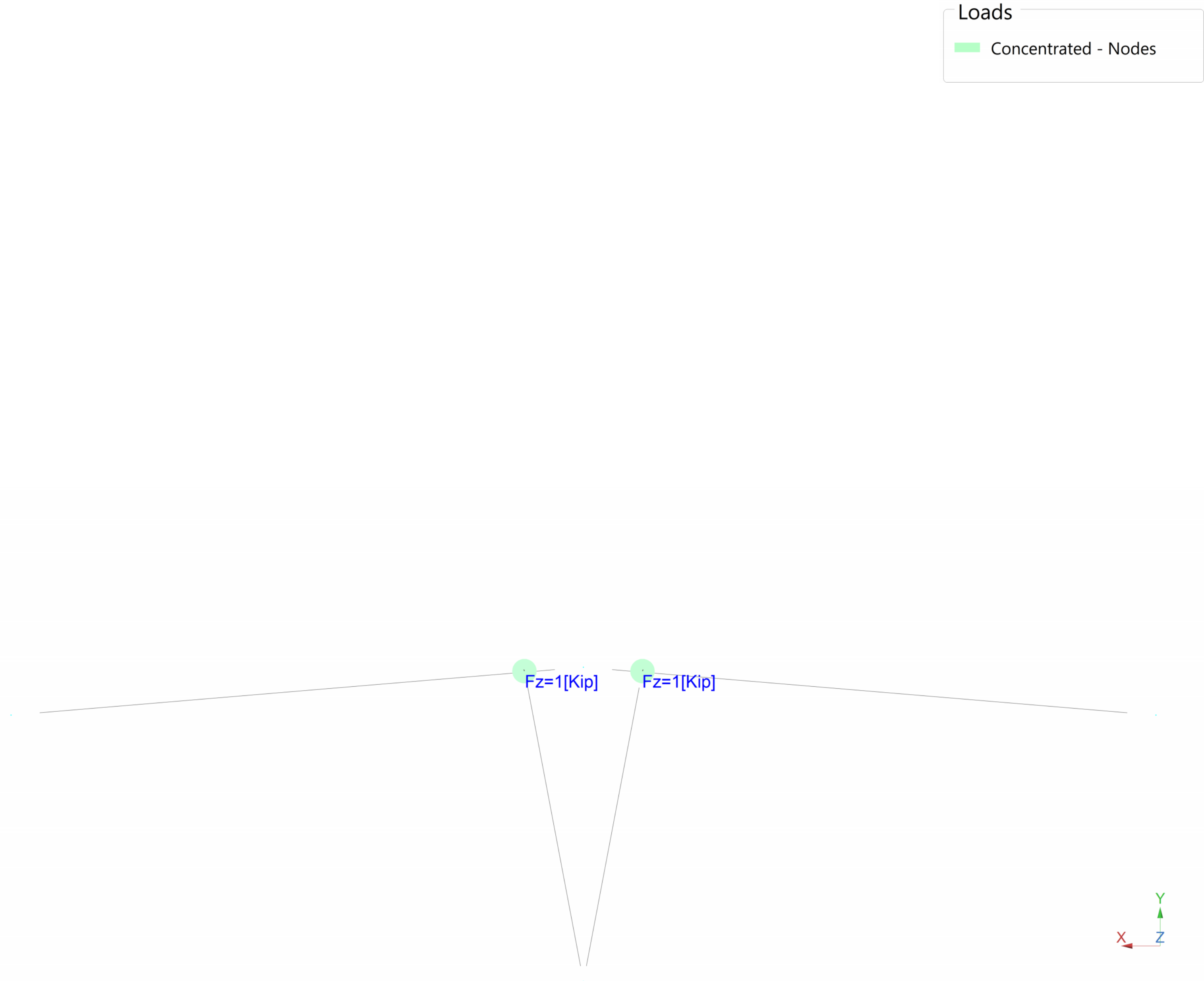
File name: C:\Users\allison.valencia\Michael Baker International\196483 Creech DRP Part 2 - General 1\05_Deliverables\07_Design Data\05_Struc\Equipment Canopy\Ca
Load condition: EQz=Seismic Load Z



AEG - EQZ LOADING

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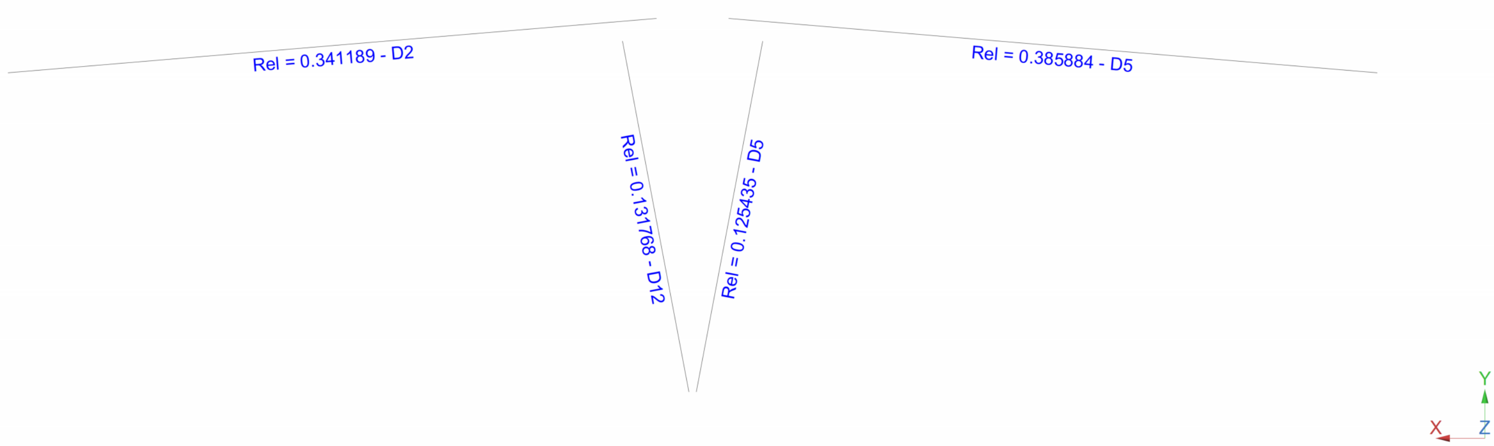
Framing and Column Calculations



AEG - UTILIZATION RATIO

RAM Elements **Michael Baker**

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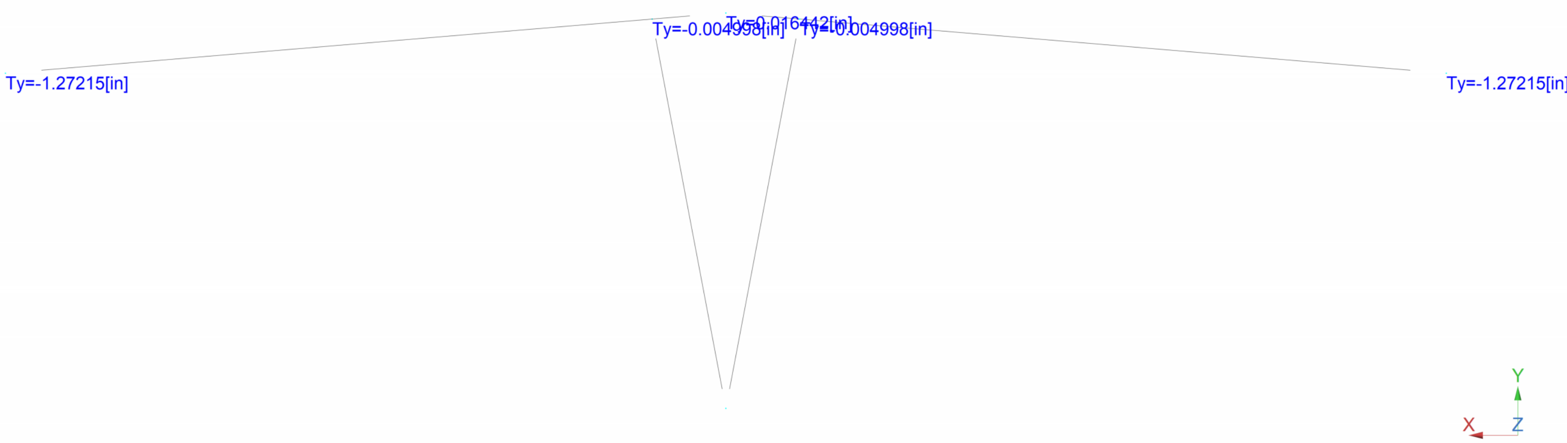
Load condition: D2=1.2DL+1.6LLr



AEG - NODAL DEFLECTION

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Steel Code Check
Summary - Group by section

Load conditions to be included in design :

D1=1.4DL
D2=1.2DL+1.6LLr
D3=1.2DL+0.5PosW
D4=1.2DL+PosW
D5=1.2DL+LLr+PosW
D6=0.9DL+PosW
D7=1.2DL+EQx
D8=1.2DL+LLr+EQx
D9=0.9DL+EQx
D10=1.2DL+0.5NegW
D11=1.2DL+NegW
D12=1.2DL+NegW+LLr
D13=0.9DL+NegW
D14=1.2DL+EQz
D15=1.2DL+EQz+LLr
D16=0.9DL+EQz

Description	Section	Member	Ctrl Eq.	Ratio	Status	Reference
	HSS_SQR 12X12X3_4	**3**	D12 at 100.00%	0.13	OK	
	W 18X97	**1**	D5 at 89.76%	**0.39**	**OK**	

RAM Elements **Michael Baker**

Current Date: 11/6/2025 4:13 PM
Units system: English
File name: C:\Users\allison.valencia\Michael Baker International\196483 Creech DRP Part 2 - General 1\05_Deliverables\07_Design Data\05_Struc\Equipment Canopy\Canopy Pricing Model.retx

Steel Code Check
Comprehensive Report

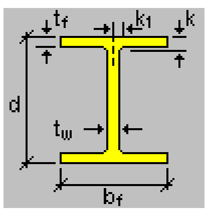
AISC 360-2022 LRFD (Hot-rolled)

Member : 1 - OK

Section information

Section name: W 18X97 **(US)**

Dimensions



bf	=	11.100	[in]	Width
d	=	18.600	[in]	Depth
k	=	1.270	[in]	Distance k
k1	=	1.125	[in]	Distance k1
tf	=	0.870	[in]	Flange thickness
tw	=	0.535	[in]	Web thickness

Properties	**Unit**	**Major axis**	**Minor axis**
Gross area of the section. (Ag)	[in2]	28.500	
Moment of Inertia (local axes) (I)	[in4]	1750.000	201.000
Moment of Inertia (principal axes) (I')	[in4]	1750.000	201.000
Bending constant for moments (principal axis) (J')	[in]	0.000	0.000
Radius of gyration (local axes) (r)	[in]	7.836	2.656
Radius of gyration (principal axes) (r')	[in]	7.836	2.656
Saint-Venant torsion constant. (J)	[in4]	5.860	
Section warping constant. (Cw)	[in6]	15800.000	
Distance from centroid to shear center (principal axis) (xo,yo)	[in]	0.000	0.000
Top elastic section modulus of the section (local axis) (Ssup)	[in3]	188.000	36.100
Bottom elastic section modulus of the section (local axis) (Sinf)	[in3]	188.000	36.100
Top elastic section modulus of the section (principal axis) (S'sup)	[in3]	188.000	36.100
Bottom elastic section modulus of the section (principal axis) (S'inf)	[in3]	188.000	36.100
Plastic section modulus (local axis) (Z)	[in3]	211.000	55.300
Plastic section modulus (principal axis) (Z')	[in3]	211.000	55.300
Polar radius of gyration. (ro)	[in]	8.274	
Area for shear (Aw)	[in2]	19.310	9.950
Torsional constant. (C)	[in3]	6.641	

Material : A992 Gr50

Properties	Unit	Value
Yield stress (Fy):	[Kip/in2]	50.00
Tensile strength (Fu):	[Kip/in2]	65.00
Elasticity Modulus (E):	[Kip/in2]	29000.00
Shear modulus for steel (G):	[Kip/in2]	11153.85

Design Criteria

Description	Unit	Value
Length for tension slenderness ratio (L)	[ft]	21.58

Distance between member lateral bracing points

Length (Lb) [ft]	
Top	Bottom
21.58	21.58

Laterally unbraced length

Length [ft]			Effective length factor		
Major axis(L33)	Minor axis(L22)	Torsional axis(Lt)	Major axis(K33)	Minor axis(K22)	Torsional axis(Kt)
21.58	21.58	21.58	1.0	1.0	1.0

Additional assumptions

Continuous lateral torsional restraint	No
Tension field action	No
Continuous flexural torsional restraint	No
Effective length factor value type	None
Major axis frame type	Sway
Minor axis frame type	Sway

Design Checks

Axial Tension Design ✔

Axial tension

Ratio	:	0.00			
Capacity	:	1282.50 [Kip]	Reference	:	Cl.D2
Demand	:	5.97 [Kip]	Ctrl Eq.	:	D2 at 100.00%

Intermediate results	Unit	Value	Reference
Factored axial tension capacity(ϕP_n):	[Kip]	1282.50	Cl.D2
Nominal axial tension capacity (P_n)	[Kip]	1425.00	Eq.D2-1

Axial Compression Design ✔

Compression in the major axis 33

Ratio	:	0.00			
Capacity	:	1184.11 [Kip]	Reference	:	Cl.E3
Demand	:	0.00 [Kip]	Ctrl Eq.	:	D6 at 0.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Non slender	
Unstiffened element slenderness (λ)	--	6.38	
Unstiffened element limiting slenderness (λ_r)	--	13.49	Table.B4.1a.Case1
Stiffened element classification	--	Non slender	
Stiffened element slenderness (λ)	--	30.02	
Stiffened element limiting slenderness (λ_r)	--	35.88	Table.B4.1a.Case5
Factored flexural buckling strength(ϕP_{n33}):	[Kip]	1184.11	Cl.E3
Effective length (KL_{33})	[ft]	21.58	Cl.E2
Effective slenderness ($(KL/r)_{33}$)	--	33.04	Cl.E2
Elastic critical buckling stress (F_{e33})	[Kip/in2]	262.19	Eq.E3-4
Effective area of the cross section based on the effective width (A...	[in2]	28.50	
Nominal stress for flexural buckling (F_{n33})	[Kip/in2]	46.16	Eq.E3-2
Nominal flexural buckling strength (P_{n33})	[Kip]	1315.68	Eq.E3-1

Compression in the minor axis 22

Ratio	:	0.00			
Capacity	:	640.11 [Kip]	Reference	:	Cl.E3
Demand	:	0.00 [Kip]	Ctrl Eq.	:	D6 at 0.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Non slender	
Unstiffened element slenderness (λ)	--	6.38	
Unstiffened element limiting slenderness (λ_r)	--	13.49	Table.B4.1a.Case1
Stiffened element classification	--	Non slender	
Stiffened element slenderness (λ)	--	30.02	
Stiffened element limiting slenderness (λ_r)	--	35.88	Table.B4.1a.Case5
Factored flexural buckling strength(ϕP_{n22}):	[Kip]	640.11	Cl.E3
Effective length (KL_{22})	[ft]	21.58	Cl.E2
Effective slenderness ($(KL/r)_{22}$)	--	97.49	Cl.E2
Elastic critical buckling stress (F_{e22})	[Kip/in2]	30.11	Eq.E3-4
Effective area of the cross section based on the effective width (A...	[in2]	28.50	
Nominal stress for flexural buckling (F_{n22})	[Kip/in2]	24.96	Eq.E3-2
Nominal flexural buckling strength (P_{n22})	[Kip]	711.23	Eq.E3-1
Factored torsional or flexural-torsional buckling strength(ϕP_{n11}):	[Kip]	943.10	Cl.E4
Effective length (KL_{11})	[ft]	21.58	Cl.E2
Torsional or flexural-torsional elastic buckling stress (F_{e11})	[Kip/in2]	68.08	Eq.E4-2
Effective area of the cross section based on the effective width (A...	[in2]	28.50	
Nominal stress for torsional or flexural-torsional buckling (F_{n11})	[Kip/in2]	36.77	Eq.E3-2
Nominal torsional or flexural-torsional buckling strength (P_{n11})	[Kip]	1047.89	Eq.E4-1

Flexural Design ✔

Bending about major axis, M33

Ratio	:	0.38			
Capacity	:	791.25 [Kip*ft]	Reference	:	Cl.F2.1
Demand	:	-304.29 [Kip*ft]	Ctrl Eq.	:	D5 at 89.76%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Compact	
Unstiffened element slenderness (λ)	--	6.38	
Limiting slenderness for noncompact unstiffened element (λ_r)	--	24.08	
Limiting slenderness for compact unstiffened element (λ_p)	--	9.15	
Stiffened element classification	--	Compact	
Stiffened element slenderness (λ)	--	30.02	
Limiting slenderness for noncompact stiffened element (λ_r)	--	137.27	
Limiting slenderness for compact stiffened element (λ_p)	--	90.55	
Factored yielding strength(ϕM_n):	[Kip*ft]	791.25	Cl.F2.1
Yielding (M_n)	[Kip*ft]	879.17	Eq.F2-1
Factored lateral-torsional buckling strength(ϕM_n):	[Kip*ft]	791.25	Cl.F2.2
Limiting laterally unbraced length for yielding (L_p)	[ft]	9.38	Eq.F2-5
Effective radius of gyration used in the determination of Lr (r_{ts})	[in]	3.08	Eq.F2-7
Lateral-torsional factor (c)	--	1.00	Eq.F2-8a
Limiting laterally unbraced length for inelastic lateral-torsional bucklin...	[ft]	30.33	Eq.F2-6
Lateral-torsional buckling modification factor (C_b)	--	2.06	Eq.F1-1
Nominal lateral-torsional buckling moment strength (M_n)	[Kip*ft]	879.17	Eq.F2-2

Bending about minor axis, M22

Ratio	: 0.00		
Capacity	: 207.38 [Kip*ft]	Reference	: Cl.F6.1
Demand	: 0.00 [Kip*ft]	Ctrl Eq.	: D1 at 0.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Compact	
Unstiffened element slenderness (λ)	--	6.38	
Limiting slenderness for noncompact unstiffened element (λ_r)	--	24.08	
Limiting slenderness for compact unstiffened element (λ_p)	--	9.15	
Stiffened element classification	--	Compact	
Stiffened element slenderness (λ)	--	30.02	
Limiting slenderness for noncompact stiffened element (λ_r)	--	137.27	
Limiting slenderness for compact stiffened element (λ_p)	--	90.55	
Factored yielding strength about a geometric axis(ϕM_n):	[Kip*ft]	207.38	Cl.F6.1
Yielding (M_n)	[Kip*ft]	230.42	Eq.F6-1

Shear Design ✔

Shear in major axis 33

Ratio	: 0.00		
Capacity	: 521.48 [Kip]	Reference	: Cl.G1
Demand	: 0.00 [Kip]	Ctrl Eq.	: D1 at 0.00%

Intermediate results	Unit	Value	Reference
Factored shear capacity(ϕV_n):	[Kip]	521.48	Cl.G1
Web buckling coefficient (k_v)	--	1.20	Cl.G6
Web buckling coefficient (C_v)	--	1.00	Eq.G2-9
Nominal shear strength (V_n)	[Kip]	579.42	Eq.G6-1

Shear in minor axis 22

Ratio	:	0.11			
Capacity	:	298.50 [Kip]	Reference	:	Cl.G1
Demand	:	31.44 [Kip]	Ctrl Eq.	:	D5 at 89.76%

Intermediate results	Unit	Value	Reference
Factored shear capacity(ϕV_n):	[Kip]	298.50	Cl.G1
Web buckling coefficient (k_v)	--	5.34	Eq.G2-5
Web buckling coefficient (C_v)	--	1.00	-
Nominal shear strength (V_n)	[Kip]	298.50	Eq.G2-1

Combined Actions Design ✔

Combined flexure and axial

Ratio	:	0.39			
Ctrl Eq.	:	D5 at 89.76%	Reference	:	Eq.H1-1b

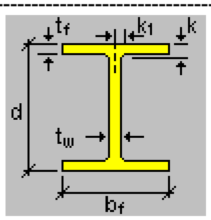
Intermediate results	Unit	Value	Reference
Interaction of flexure and axial force:	--	0.39	Eq.H1-1b
Available flexural strength about strong axis (M_{c33})	[Kip*ft]	791.25	Cl.H1.1
Available flexural strength about weak axis (M_{c22})	[Kip*ft]	207.38	Cl.H1.1
Available axial strength (P_c)	[Kip]	1282.50	Cl.H1.1

Member : 2 - OK

Section information

Section name: W 18X97 **(US)**

Dimensions



bf	=	11.100	[in]	Width
d	=	18.600	[in]	Depth
k	=	1.270	[in]	Distance k
k1	=	1.125	[in]	Distance k1
tf	=	0.870	[in]	Flange thickness
tw	=	0.535	[in]	Web thickness

Properties	Unit	Major axis	Minor axis
Gross area of the section. (Ag)	[in2]	28.500	
Moment of Inertia (local axes) (I)	[in4]	1750.000	201.000
Moment of Inertia (principal axes) (I')	[in4]	1750.000	201.000
Bending constant for moments (principal axis) (J')	[in]	0.000	0.000
Radius of gyration (local axes) (r)	[in]	7.836	2.656
Radius of gyration (principal axes) (r')	[in]	7.836	2.656
Saint-Venant torsion constant. (J)	[in4]	5.860	

Section warping constant. (Cw)	[in6]	15800.000	
Distance from centroid to shear center (principal axis) (xo,yo)	[in]	0.000	0.000
Top elastic section modulus of the section (local axis) (Ssup)	[in3]	188.000	36.100
Bottom elastic section modulus of the section (local axis) (Sinf)	[in3]	188.000	36.100
Top elastic section modulus of the section (principal axis) (S'sup)	[in3]	188.000	36.100
Bottom elastic section modulus of the section (principal axis) (S'inf)	[in3]	188.000	36.100
Plastic section modulus (local axis) (Z)	[in3]	211.000	55.300
Plastic section modulus (principal axis) (Z')	[in3]	211.000	55.300
Polar radius of gyration. (ro)	[in]	8.274	
Area for shear (Aw)	[in2]	19.310	9.950
Torsional constant. (C)	[in3]	6.641	

Material : A992 Gr50

Properties	Unit	Value
Yield stress (Fy):	[Kip/in2]	50.00
Tensile strength (Fu):	[Kip/in2]	65.00
Elasticity Modulus (E):	[Kip/in2]	29000.00
Shear modulus for steel (G):	[Kip/in2]	11153.85

Design Criteria

Description	Unit	Value
Length for tension slenderness ratio (L)	[ft]	21.58

Distance between member lateral bracing points

Length (Lb) [ft]	
Top	Bottom
21.58	21.58

Laterally unbraced length

Length [ft]			Effective length factor		
Major axis(L33)	Minor axis(L22)	Torsional axis(Lt)	Major axis(K33)	Minor axis(K22)	Torsional axis(Kt)
21.58	21.58	21.58	1.0	1.0	1.0

Additional assumptions

Continuous lateral torsional restraint	No
Tension field action	No
Continuous flexural torsional restraint	No
Effective length factor value type	None
Major axis frame type	Sway
Minor axis frame type	Sway

Design Checks

Axial Tension Design ✔

Axial tension

Ratio	:	0.01			
Capacity	:	1282.50 [Kip]	Reference	:	Cl.D2
Demand	:	6.77 [Kip]	Ctrl Eq.	:	D5 at 0.00%

Intermediate results	Unit	Value	Reference
Factored axial tension capacity(ϕP_n):	[Kip]	1282.50	Cl.D2
Nominal axial tension capacity (P_n)	[Kip]	1425.00	Eq.D2-1

Axial Compression Design ✔

Compression in the major axis 33

Ratio	: 0.00		
Capacity	: 1184.11 [Kip]	Reference	: Cl.E3
Demand	: 1.43 [Kip]	Ctrl Eq.	: D13 at 10.24%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Non slender	
Unstiffened element slenderness (λ)	--	6.38	
Unstiffened element limiting slenderness (λ_r)	--	13.49	Table.B4.1a.Case1
Stiffened element classification	--	Non slender	
Stiffened element slenderness (λ)	--	30.02	
Stiffened element limiting slenderness (λ_r)	--	35.88	Table.B4.1a.Case5
Factored flexural buckling strength(ϕP_{n33}):	[Kip]	1184.11	Cl.E3
Effective length (KL_{33})	[ft]	21.58	Cl.E2
Effective slenderness ($(KL/r)_{33}$)	--	33.04	Cl.E2
Elastic critical buckling stress (F_{e33})	[Kip/in2]	262.19	Eq.E3-4
Effective area of the cross section based on the effective width (A...	[in2]	28.50	
Nominal stress for flexural buckling (F_{n33})	[Kip/in2]	46.16	Eq.E3-2
Nominal flexural buckling strength (P_{n33})	[Kip]	1315.68	Eq.E3-1

Compression in the minor axis 22

Ratio	: 0.00		
Capacity	: 640.11 [Kip]	Reference	: Cl.E3
Demand	: 1.43 [Kip]	Ctrl Eq.	: D13 at 10.24%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Non slender	
Unstiffened element slenderness (λ)	--	6.38	
Unstiffened element limiting slenderness (λ_r)	--	13.49	Table.B4.1a.Case1
Stiffened element classification	--	Non slender	
Stiffened element slenderness (λ)	--	30.02	
Stiffened element limiting slenderness (λ_r)	--	35.88	Table.B4.1a.Case5
Factored flexural buckling strength(ϕP_{n22}):	[Kip]	640.11	Cl.E3
Effective length (KL_{22})	[ft]	21.58	Cl.E2
Effective slenderness ($(KL/r)_{22}$)	--	97.49	Cl.E2
Elastic critical buckling stress (F_{e22})	[Kip/in2]	30.11	Eq.E3-4
Effective area of the cross section based on the effective width (A...	[in2]	28.50	
Nominal stress for flexural buckling (F_{n22})	[Kip/in2]	24.96	Eq.E3-2
Nominal flexural buckling strength (P_{n22})	[Kip]	711.23	Eq.E3-1
Factored torsional or flexural-torsional buckling strength(ϕP_{n11}):	[Kip]	943.10	Cl.E4
Effective length (KL_{11})	[ft]	21.58	Cl.E2
Torsional or flexural-torsional elastic buckling stress (F_{e11})	[Kip/in2]	68.08	Eq.E4-2
Effective area of the cross section based on the effective width (A...	[in2]	28.50	
Nominal stress for torsional or flexural-torsional buckling (F_{n11})	[Kip/in2]	36.77	Eq.E3-2
Nominal torsional or flexural-torsional buckling strength (P_{n11})	[Kip]	1047.89	Eq.E4-1

Flexural Design ✔

Bending about major axis, M33

Ratio	:	0.34			
Capacity	:	791.25 [Kip*ft]	Reference	:	Cl.F2.1
Demand	:	-268.21 [Kip*ft]	Ctrl Eq.	:	D2 at 10.24%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Compact	
Unstiffened element slenderness (λ)	--	6.38	
Limiting slenderness for noncompact unstiffened element (λ_r)	--	24.08	
Limiting slenderness for compact unstiffened element (λ_p)	--	9.15	
Stiffened element classification	--	Compact	
Stiffened element slenderness (λ)	--	30.02	
Limiting slenderness for noncompact stiffened element (λ_r)	--	137.27	
Limiting slenderness for compact stiffened element (λ_p)	--	90.55	
Factored yielding strength(ϕM_n):	[Kip*ft]	791.25	Cl.F2.1
Yielding (M_n)	[Kip*ft]	879.17	Eq.F2-1
Factored lateral-torsional buckling strength(ϕM_n):	[Kip*ft]	791.25	Cl.F2.2
Limiting laterally unbraced length for yielding (L_p)	[ft]	9.38	Eq.F2-5
Effective radius of gyration used in the determination of Lr (r_{ts})	[in]	3.08	Eq.F2-7
Lateral-torsional factor (c)	--	1.00	Eq.F2-8a
Limiting laterally unbraced length for inelastic lateral-torsional bucklin...	[ft]	30.33	Eq.F2-6
Lateral-torsional buckling modification factor (C_b)	--	2.06	Eq.F1-1
Nominal lateral-torsional buckling moment strength (M_n)	[Kip*ft]	879.17	Eq.F2-2

Bending about minor axis, M22

Ratio	:	0.00			
Capacity	:	207.38 [Kip*ft]	Reference	:	Cl.F6.1
Demand	:	0.00 [Kip*ft]	Ctrl Eq.	:	D1 at 0.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Compact	
Unstiffened element slenderness (λ)	--	6.38	
Limiting slenderness for noncompact unstiffened element (λ_r)	--	24.08	
Limiting slenderness for compact unstiffened element (λ_p)	--	9.15	
Stiffened element classification	--	Compact	
Stiffened element slenderness (λ)	--	30.02	
Limiting slenderness for noncompact stiffened element (λ_r)	--	137.27	
Limiting slenderness for compact stiffened element (λ_p)	--	90.55	
Factored yielding strength about a geometric axis(ϕM_n):	[Kip*ft]	207.38	Cl.F6.1
Yielding (M_n)	[Kip*ft]	230.42	Eq.F6-1

Shear Design ✔

Shear in major axis 33

Ratio	:	0.00			
Capacity	:	521.48 [Kip]	Reference	:	Cl.G1
Demand	:	0.00 [Kip]	Ctrl Eq.	:	D1 at 0.00%

Intermediate results	Unit	Value	Reference
Factored shear capacity(ϕV_n):	[Kip]	521.48	Cl.G1
Web buckling coefficient (k_v)	--	1.20	Cl.G6
Web buckling coefficient (C_v)	--	1.00	Eq.G2-9
Nominal shear strength (V_n)	[Kip]	579.42	Eq.G6-1

Shear in minor axis 22

Ratio	:	0.09			
Capacity	:	298.50 [Kip]	Reference	:	Cl.G1
Demand	:	27.71 [Kip]	Ctrl Eq.	:	D2 at 10.24%

Intermediate results	Unit	Value	Reference
Factored shear capacity(ϕV_n):	[Kip]	298.50	Cl.G1
Web buckling coefficient (k_v)	--	5.34	Eq.G2-5
Web buckling coefficient (C_v)	--	1.00	-
Nominal shear strength (V_n)	[Kip]	298.50	Eq.G2-1

Combined Actions Design ✔

Combined flexure and axial

Ratio	:	0.34			
Ctrl Eq.	:	D2 at 10.24%	Reference	:	Eq.H1-1b

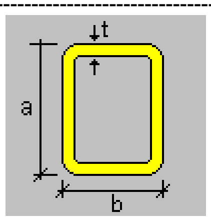
Intermediate results	Unit	Value	Reference
Interaction of flexure and axial force:	--	0.34	Eq.H1-1b
Available flexural strength about strong axis (M_{c33})	[Kip*ft]	791.25	Cl.H1.1
Available flexural strength about weak axis (M_{c22})	[Kip*ft]	207.38	Cl.H1.1
Available axial strength (P_c)	[Kip]	1282.50	Cl.H1.1

Member : 3 - OK

Section information

Section name: HSS_SQR 12X12X3_4 **(US)**

Dimensions



a	=	12.000	[in]	Height
b	=	12.000	[in]	Width
T	=	0.698	[in]	Thickness

Properties	Unit	Major axis	Minor axis
Gross area of the section. (Ag)	[in2]	30.300	
Moment of Inertia (local axes) (I)	[in4]	631.000	631.000
Moment of Inertia (principal axes) (I')	[in4]	631.000	631.000
Bending constant for moments (principal axis) (J')	[in]	0.000	0.000
Radius of gyration (local axes) (r)	[in]	4.563	4.563
Radius of gyration (principal axes) (r')	[in]	4.563	4.563
Saint-Venant torsion constant. (J)	[in4]	1030.000	
Section warping constant. (Cw)	[in6]	32.504	
Distance from centroid to shear center (principal axis) (xo,yo)	[in]	0.000	0.000
Top elastic section modulus of the section (local axis) (Ssup)	[in3]	105.000	105.000
Bottom elastic section modulus of the section (local axis) (Sinf)	[in3]	105.000	105.000
Top elastic section modulus of the section (principal axis) (S'sup)	[in3]	105.000	105.000
Bottom elastic section modulus of the section (principal axis) (S'inf)	[in3]	105.000	105.000
Plastic section modulus (local axis) (Z)	[in3]	127.000	127.000
Plastic section modulus (principal axis) (Z')	[in3]	127.000	127.000
Polar radius of gyration. (ro)	[in]	6.450	
Area for shear (Aw)	[in2]	13.829	13.829
Torsional constant. (C)	[in3]	176.972	

Material : A500 GrC rectangular

Properties	Unit	Value
Yield stress (Fy):	[Kip/in2]	50.00
Tensile strength (Fu):	[Kip/in2]	62.00
Elasticity Modulus (E):	[Kip/in2]	29000.00
Shear modulus for steel (G):	[Kip/in2]	11153.85

Design Criteria

Description	Unit	Value
Length for tension slenderness ratio (L)	[ft]	11.82

Distance between member lateral bracing points

Length (Lb) [ft]	
Top	Bottom
11.82	11.82

Laterally unbraced length

Length [ft]			Effective length factor		
Major axis(L33)	Minor axis(L22)	Torsional axis(Lt)	Major axis(K33)	Minor axis(K22)	Torsional axis(Kt)
11.82	11.82	11.82	1.0	1.0	1.0

Additional assumptions

Continuous lateral torsional restraint	No
Tension field action	No
Continuous flexural torsional restraint	No
Effective length factor value type	None
Major axis frame type	Sway
Minor axis frame type	Sway

Design Checks

Axial Tension Design ✔

Axial tension

Ratio	:	0.01			
Capacity	:	1363.50 [Kip]	Reference	:	Cl.D2
Demand	:	10.29 [Kip]	Ctrl Eq.	:	D6 at 0.00%

Intermediate results	Unit	Value	Reference
Factored axial tension capacity(ϕP_n):	[Kip]	1363.50	Cl.D2
Nominal axial tension capacity (P_n)	[Kip]	1515.00	Eq.D2-1

Axial Compression Design ✔

Compression in the major axis 33

Ratio	:	0.03			
Capacity	:	1270.47 [Kip]	Reference	:	Cl.E3
Demand	:	43.64 [Kip]	Ctrl Eq.	:	D12 at 100.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Non slender	
Unstiffened element slenderness (λ)	--	14.19	
Unstiffened element limiting slenderness (λ_r)	--	33.72	Table.B4.1a.Case6
Stiffened element classification	--	Non slender	
Stiffened element slenderness (λ)	--	14.19	
Stiffened element limiting slenderness (λ_r)	--	33.72	Table.B4.1a.Case6
Factored flexural buckling strength(ϕP_{n33}):	[Kip]	1270.47	Cl.E3
Effective length (KL_{33})	[ft]	11.82	Cl.E2
Effective slenderness ($(KL/r)_{33}$)	--	31.09	Cl.E2
Elastic critical buckling stress (F_{e33})	[Kip/in2]	296.14	Eq.E3-4
Effective area of the cross section based on the effective width (A...	[in2]	30.30	
Nominal stress for flexural buckling (F_{n33})	[Kip/in2]	46.59	Eq.E3-2
Nominal flexural buckling strength (P_{n33})	[Kip]	1411.63	Eq.E3-1

Compression in the minor axis 22

Ratio	:	0.03			
Capacity	:	1270.47 [Kip]	Reference	:	Cl.E3
Demand	:	43.64 [Kip]	Ctrl Eq.	:	D12 at 100.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Non slender	
Unstiffened element slenderness (λ)	--	14.19	
Unstiffened element limiting slenderness (λ_r)	--	33.72	Table.B4.1a.Case6
Stiffened element classification	--	Non slender	
Stiffened element slenderness (λ)	--	14.19	
Stiffened element limiting slenderness (λ_r)	--	33.72	Table.B4.1a.Case6
Factored flexural buckling strength(ϕP_{n22}):	[Kip]	1270.47	Cl.E3
Effective length (KL_{22})	[ft]	11.82	Cl.E2
Effective slenderness ($(KL/r)_{22}$)	--	31.09	Cl.E2
Elastic critical buckling stress (F_{e22})	[Kip/in2]	296.14	Eq.E3-4
Effective area of the cross section based on the effective width (A...	[in2]	30.30	
Nominal stress for flexural buckling (F_{n22})	[Kip/in2]	46.59	Eq.E3-2

Nominal flexural buckling strength (P_{n22})	[Kip]	1411.63	Eq.E3-1

Flexural Design ✔

Bending about major axis, M33

Ratio	: 0.11		
Capacity	: 476.25 [Kip*ft]	Reference	: Cl.F7.1
Demand	: -54.58 [Kip*ft]	Ctrl Eq.	: D12 at 100.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Compact	
Unstiffened element slenderness (λ)	--	14.19	
Limiting slenderness for noncompact unstiffened element (λ_r)	--	33.72	
Limiting slenderness for compact unstiffened element (λ_p)	--	26.97	
Stiffened element classification	--	Compact	
Stiffened element slenderness (λ)	--	14.19	
Limiting slenderness for noncompact stiffened element (λ_r)	--	137.27	
Limiting slenderness for compact stiffened element (λ_p)	--	58.28	
Factored yielding strength(ϕM_n):	[Kip*ft]	476.25	Cl.F7.1
Yielding (M_n)	[Kip*ft]	529.17	Eq.F7-1

Bending about minor axis, M22

Ratio	: 0.03		
Capacity	: 476.25 [Kip*ft]	Reference	: Cl.F7.1
Demand	: -11.92 [Kip*ft]	Ctrl Eq.	: D15 at 100.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Compact	
Unstiffened element slenderness (λ)	--	14.19	
Limiting slenderness for noncompact unstiffened element (λ_r)	--	33.72	
Limiting slenderness for compact unstiffened element (λ_p)	--	26.97	
Stiffened element classification	--	Compact	
Stiffened element slenderness (λ)	--	14.19	
Limiting slenderness for noncompact stiffened element (λ_r)	--	137.27	
Limiting slenderness for compact stiffened element (λ_p)	--	58.28	
Factored yielding strength about a geometric axis(ϕM_n):	[Kip*ft]	476.25	Cl.F7.1
Yielding (M_n)	[Kip*ft]	529.17	Eq.F7-1

Shear Design ✔

Shear in major axis 33

Ratio	: 0.00		
Capacity	: 373.38 [Kip]	Reference	: Cl.G1
Demand	: 1.00 [Kip]	Ctrl Eq.	: D15 at 0.00%

Intermediate results	Unit	Value	Reference
Factored shear capacity(ϕV_n):	[Kip]	373.38	Cl.G1
Web buckling coefficient (k_v)	--	5.00	Cl.G4
Web buckling coefficient (C_v)	--	1.00	Eq.G2-9
Nominal shear strength (V_n)	[Kip]	414.86	Eq.G4-1

Shear in minor axis 22

Ratio	: 0.01		
Capacity	: 373.38 [Kip]	Reference	: Cl.G1
Demand	: 4.69 [Kip]	Ctrl Eq.	: D11 at 100.00%

Intermediate results	Unit	Value	Reference
Factored shear capacity(ϕV_n):	[Kip]	373.38	Cl.G1
Web buckling coefficient (k_v)	--	5.00	Cl.G4
Web buckling coefficient (C_v)	--	1.00	Eq.G2-9
Nominal shear strength (V_n)	[Kip]	414.86	Eq.G4-1

Torsion Design ✔

Torsion

Ratio	: 0.00		
Capacity	: 398.19 [Kip*ft]	Reference	: Cl.H3.1
Demand	: 0.00 [Kip*ft]	Ctrl Eq.	: D1 at 0.00%

Intermediate results	Unit	Value	Reference
Factored torsion capacity(ϕT_n):	[Kip*ft]	398.19	Cl.H3.1
Critical torsional buckling stress (F_{cr})	[Kip/in2]	30.00	Eq.H3-3
Nominal torsion capacity (T_n)	[Kip*ft]	442.43	Eq.H3-1

Combined Actions Design ✔

Combined flexure and axial

Ratio	: 0.13		
Ctrl Eq.	: D12 at 100.00%	Reference	: Eq.H1-1b

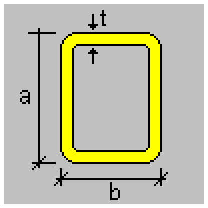
Intermediate results	Unit	Value	Reference
Interaction of flexure and axial force:	--	0.13	Eq.H1-1b
Available flexural strength about strong axis (M_{c33})	[Kip*ft]	476.25	Cl.H1.1
Available flexural strength about weak axis (M_{c22})	[Kip*ft]	476.25	Cl.H1.1
Available axial strength (P_c)	[Kip]	1270.47	Cl.H1.1

Member : 4 - OK

Section information

Section name: HSS_SQR 12X12X3_4 **(US)**

Dimensions



a	=	12.000	[in]	Height
b	=	12.000	[in]	Width
T	=	0.698	[in]	Thickness

Properties	Unit	Major axis	Minor axis
Gross area of the section. (Ag)	[in2]	30.300	
Moment of Inertia (local axes) (I)	[in4]	631.000	631.000
Moment of Inertia (principal axes) (I')	[in4]	631.000	631.000
Bending constant for moments (principal axis) (J')	[in]	0.000	0.000
Radius of gyration (local axes) (r)	[in]	4.563	4.563
Radius of gyration (principal axes) (r')	[in]	4.563	4.563
Saint-Venant torsion constant. (J)	[in4]	1030.000	
Section warping constant. (Cw)	[in6]	32.504	
Distance from centroid to shear center (principal axis) (xo,yo)	[in]	0.000	0.000
Top elastic section modulus of the section (local axis) (Ssup)	[in3]	105.000	105.000
Bottom elastic section modulus of the section (local axis) (Sinf)	[in3]	105.000	105.000
Top elastic section modulus of the section (principal axis) (S'sup)	[in3]	105.000	105.000
Bottom elastic section modulus of the section (principal axis) (S'inf)	[in3]	105.000	105.000
Plastic section modulus (local axis) (Z)	[in3]	127.000	127.000
Plastic section modulus (principal axis) (Z')	[in3]	127.000	127.000
Polar radius of gyration. (ro)	[in]	6.450	
Area for shear (Aw)	[in2]	13.829	13.829
Torsional constant. (C)	[in3]	176.972	

Material : A500 GrC rectangular

Properties	Unit	Value
Yield stress (Fy):	[Kip/in2]	50.00
Tensile strength (Fu):	[Kip/in2]	62.00
Elasticity Modulus (E):	[Kip/in2]	29000.00
Shear modulus for steel (G):	[Kip/in2]	11153.85

Design Criteria

Description	Unit	Value
Length for tension slenderness ratio (L)	[ft]	11.82

Distance between member lateral bracing points

Length (Lb) [ft]	
Top	Bottom
11.82	11.82

Laterally unbraced length

Length [ft]			Effective length factor		
Major axis(L33)	Minor axis(L22)	Torsional axis(Lt)	Major axis(K33)	Minor axis(K22)	Torsional axis(Kt)
11.82	11.82	11.82	1.0	1.0	1.0

Additional assumptions

Continuous lateral torsional restraint	No
Tension field action	No
Continuous flexural torsional restraint	No
Effective length factor value type	None
Major axis frame type	Sway
Minor axis frame type	Sway

Design Checks

Axial Tension Design ✔

Axial tension

Ratio	: 0.02		
Capacity	: 1363.50 [Kip]	Reference	: Cl.D2
Demand	: 28.03 [Kip]	Ctrl Eq.	: D13 at 100.00%

Intermediate results	**Unit**	**Value**	**Reference**
Factored axial tension capacity(ϕP_n):	[Kip]	1363.50	Cl.D2
Nominal axial tension capacity (P_n)	[Kip]	1515.00	Eq.D2-1

Axial Compression Design ✔

Compression in the major axis 33

Ratio	: 0.04		
Capacity	: 1270.47 [Kip]	Reference	: Cl.E3
Demand	: 55.97 [Kip]	Ctrl Eq.	: D5 at 0.00%

Intermediate results	**Unit**	**Value**	**Reference**
Section classification			
Unstiffened element classification	--	Non slender	
Unstiffened element slenderness (λ)	--	14.19	
Unstiffened element limiting slenderness (λ_r)	--	33.72	Table.B4.1a.Case6
Stiffened element classification	--	Non slender	
Stiffened element slenderness (λ)	--	14.19	
Stiffened element limiting slenderness (λ_r)	--	33.72	Table.B4.1a.Case6
Factored flexural buckling strength(ϕP_{n33}):	[Kip]	1270.47	Cl.E3
Effective length (KL_{33})	[ft]	11.82	Cl.E2
Effective slenderness ($(KL/r)_{33}$)	--	31.09	Cl.E2
Elastic critical buckling stress (F_{e33})	[Kip/in2]	296.14	Eq.E3-4
Effective area of the cross section based on the effective width (A...	[in2]	30.30	
Nominal stress for flexural buckling (F_{n33})	[Kip/in2]	46.59	Eq.E3-2
Nominal flexural buckling strength (P_{n33})	[Kip]	1411.63	Eq.E3-1

Compression in the minor axis 22

Ratio	: 0.04			
Capacity	: 1270.47 [Kip]	Reference	:	Cl.E3
Demand	: 55.97 [Kip]	Ctrl Eq.	:	D5 at 0.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Non slender	
Unstiffened element slenderness (λ)	--	14.19	
Unstiffened element limiting slenderness (λ_r)	--	33.72	Table.B4.1a.Case6
Stiffened element classification	--	Non slender	
Stiffened element slenderness (λ)	--	14.19	
Stiffened element limiting slenderness (λ_r)	--	33.72	Table.B4.1a.Case6
Factored flexural buckling strength(ϕP_{n22}):	[Kip]	1270.47	Cl.E3
Effective length (KL_{22})	[ft]	11.82	Cl.E2
Effective slenderness ($(KL/r)_{22}$)	--	31.09	Cl.E2
Elastic critical buckling stress (F_{e22})	[Kip/in2]	296.14	Eq.E3-4
Effective area of the cross section based on the effective width (A...	[in2]	30.30	
Nominal stress for flexural buckling (F_{n22})	[Kip/in2]	46.59	Eq.E3-2
Nominal flexural buckling strength (P_{n22})	[Kip]	1411.63	Eq.E3-1

Flexural Design ✔

Bending about major axis, M33

Ratio	: 0.11			
Capacity	: 476.25 [Kip*ft]	Reference	:	Cl.F7.1
Demand	: 54.04 [Kip*ft]	Ctrl Eq.	:	D12 at 0.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Compact	
Unstiffened element slenderness (λ)	--	14.19	
Limiting slenderness for noncompact unstiffened element (λ_r)	--	33.72	
Limiting slenderness for compact unstiffened element (λ_p)	--	26.97	
Stiffened element classification	--	Compact	
Stiffened element slenderness (λ)	--	14.19	
Limiting slenderness for noncompact stiffened element (λ_r)	--	137.27	
Limiting slenderness for compact stiffened element (λ_p)	--	58.28	
Factored yielding strength(ϕM_n):	[Kip*ft]	476.25	Cl.F7.1
Yielding (M_n)	[Kip*ft]	529.17	Eq.F7-1

Bending about minor axis, M22

Ratio	: 0.03			
Capacity	: 476.25 [Kip*ft]	Reference	:	Cl.F7.1
Demand	: -11.92 [Kip*ft]	Ctrl Eq.	:	D15 at 0.00%

Intermediate results	Unit	Value	Reference
Section classification			
Unstiffened element classification	--	Compact	
Unstiffened element slenderness (λ)	--	14.19	
Limiting slenderness for noncompact unstiffened element (λ_r)	--	33.72	
Limiting slenderness for compact unstiffened element (λ_p)	--	26.97	
Stiffened element classification	--	Compact	
Stiffened element slenderness (λ)	--	14.19	
Limiting slenderness for noncompact stiffened element (λ_r)	--	137.27	

Limiting slenderness for compact stiffened element (λ_p)	--	58.28	
Factored yielding strength about a geometric axis(ϕM_n):	[Kip*ft]	476.25	Cl.F7.1
Yielding (M_n)	[Kip*ft]	529.17	Eq.F7-1

Shear Design ✔

Shear in major axis 33

Ratio	:	0.00			
Capacity	:	373.38 [Kip]	Reference	:	Cl.G1
Demand	:	1.00 [Kip]	Ctrl Eq.	:	D16 at 0.00%

Intermediate results	Unit	Value	Reference
Factored shear capacity(ϕV_n):	[Kip]	373.38	Cl.G1
Web buckling coefficient (k_v)	--	5.00	Cl.G4
Web buckling coefficient (C_v)	--	1.00	Eq.G2-9
Nominal shear strength (V_n)	[Kip]	414.86	Eq.G4-1

Shear in minor axis 22

Ratio	:	0.01			
Capacity	:	373.38 [Kip]	Reference	:	Cl.G1
Demand	:	4.72 [Kip]	Ctrl Eq.	:	D12 at 100.00%

Intermediate results	Unit	Value	Reference
Factored shear capacity(ϕV_n):	[Kip]	373.38	Cl.G1
Web buckling coefficient (k_v)	--	5.00	Cl.G4
Web buckling coefficient (C_v)	--	1.00	Eq.G2-9
Nominal shear strength (V_n)	[Kip]	414.86	Eq.G4-1

Torsion Design ✔

Torsion

Ratio	:	0.00			
Capacity	:	398.19 [Kip*ft]	Reference	:	Cl.H3.1
Demand	:	0.00 [Kip*ft]	Ctrl Eq.	:	D1 at 0.00%

Intermediate results	Unit	Value	Reference
Factored torsion capacity(ϕT_n):	[Kip*ft]	398.19	Cl.H3.1
Critical torsional buckling stress (F_{cr})	[Kip/in2]	30.00	Eq.H3-3
Nominal torsion capacity (T_n)	[Kip*ft]	442.43	Eq.H3-1

Combined Actions Design ✔

Combined flexure and axial

Ratio	:	0.13			
Ctrl Eq.	:	D5 at 0.00%	Reference	:	Eq.H1-1b

Intermediate results	Unit	Value	Reference
Interaction of flexure and axial force:	--	0.13	Eq.H1-1b
Available flexural strength about strong axis (M_{c33})	[Kip*ft]	476.25	Cl.H1.1
Available flexural strength about weak axis (M_{c22})	[Kip*ft]	476.25	Cl.H1.1
Available axial strength (P_c)	[Kip]	1270.47	Cl.H1.1

Michael Baker INTERNATIONAL

Foundation Calculations

FOOTING ANALYSIS

In accordance with ACI318-19 (22)

Tedds calculation version 3.3.11

Summary results

Overall design status PASS

Overall design utilisation 0.584

Description	Unit	Applied	Resisting	FoS	Result
Uplift verification	kips	24.5			Pass
Overturning stability, x	kip_ft	113.41	-194.36	1.71	Pass
Overturning stability, y	kip_ft	31.68	-129.58	4.09	Pass
Sliding stability, x	kips	0.6	20.3	33.884	Pass
Description	**Unit**	**Applied**	**Resisting**	**Utilization**	**Result**
Soil bearing	ksf	0.617	3	0.206	Pass
Description	**Unit**	**Required**	**Provided**	**Utilization**	**Result**
Moment, positive, x-direction	kip_ft	97.3	434.6	0.224	Pass
Moment, positive, y-direction	kip_ft	44.5	705.0	0.063	Pass
Shear, one-way, x-direction	kips	24.7	100.7	0.245	Pass
Shear, one-way, y-direction	kips	13.5	150.7	0.090	Pass
Shear, two-way, Col 1	psi	20.748	189.737	0.122	Pass
Min.area of reinf, bot., x-direction	in^2	4.147	4.800		Pass
Max.reinf.spacing, bot, x-direction	in	18.0	12.7		Pass
Min.area of reinf, bot., y-direction	in^2	6.221	7.800		Pass
Max.reinf.spacing, bot, y-direction	in	18.0	11.4		Pass

Pad footing details

Length of footing L_x = **12** ft

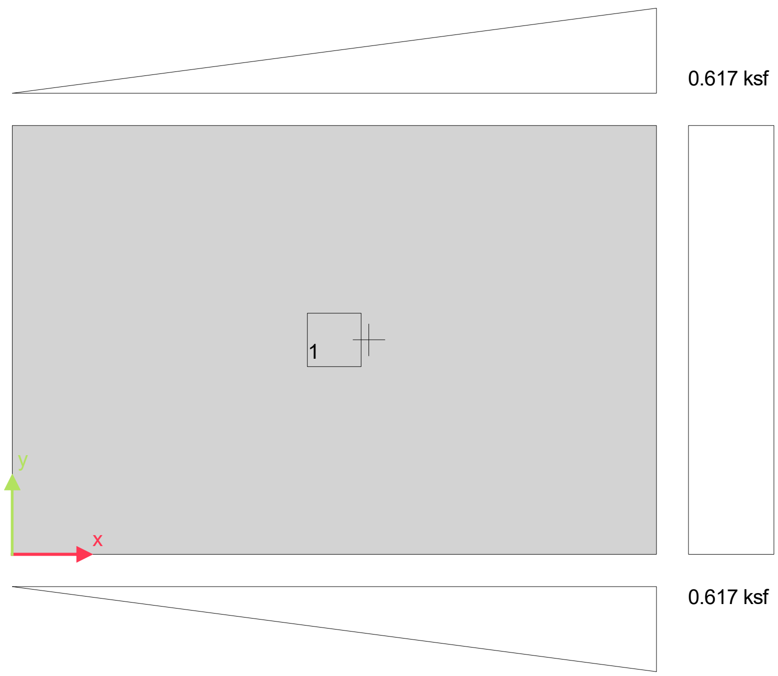
Width of footing L_y = **8** ft

Footing area $A = L_x \times L_y$ = **96** ft^2

Depth of footing h = **24** in

Depth of soil over footing h_{soil} = **12** in

Density of concrete γ_{conc} = **150.0** lb/ft^3



Column no.1 details

Length of column	l_{x1} = **12.00** in
Width of column	l_{y1} = **12.00** in
position in x-axis	x_1 = **72.00** in
position in y-axis	y_1 = **48.00** in

Soil properties

Gross allowable bearing pressure	q_{allow_Gross} = **3** ksf
Density of soil	γ_{soil} = **120.0** lb/ft^3
Angle of internal friction	ϕ_b = **30.0** deg
Design base friction angle	δ_{bb} = **19.8** deg
Coefficient of base friction	$\tan(\delta_{bb})$ = **0.360**
Passive pressure coefficient (User defined)	$K_P = K_P$ = **3**
Passive dynamic pressure coefficient (Defined)	$K_{PE} = K_{PE}$ = **2.5**
Self weight	$F_{swt} = h \times \gamma_{conc}$ = **300** psf
Soil weight	$F_{soil} = h_{soil} \times \gamma_{soil}$ = **120** psf

Column no.1 loads

Dead load in z	F_{Dz1} = **13.8** kips
Live roof load in z	F_{Lrz1} = **30.2** kips
Wind load in z	F_{Wz1} = **-13.2** kips
Wind load in x	F_{Wx1} = **1.0** kips
Seismic load in x	F_{Ex1} = **2.0** kips
Wind load moment in x	M_{Wx1} = **107.8** kip_ft
Seismic load moment in x	M_{Ex1} = **23.2** kip_ft

Footing analysis for soil and stability

Load combinations per ASCE 7-22

1.0D (0.187)

1.0D + 1.0L (0.187)

1.0D + 1.0Lr (0.292)

1.0D + 0.7S (0.187)

1.0D + 1.0R (0.187)

1.0D + 0.75L + 0.75Lr (0.266)

1.0D + 0.75L + 0.525S (0.187)

1.0D + 0.75L + 0.75R (0.187)

1.0D + 0.6W (0.350)

$(1.0 + 0.14 \times S_{DS})$D + 0.7E (0.236)

1.0D + 0.75L + 0.75Lr + 0.45W (0.331)

1.0D + 0.75L + 0.525S + 0.45W (0.263)

1.0D + 0.75L + 0.75R + 0.45W (0.263)

$(1.0 + 0.105 \times S_{DS})$D + 0.75L + 0.1S + 0.525E (0.224)

0.6D + 0.6W (0.584)

$(0.6 - 0.14 \times S_{DS})$D + 0.7E (0.130)

Combination 15 results: 0.6D + 0.6W

Forces on footing

Force in x-axis — $F_{dx} = \gamma_W \times F_{Wx1} =$ **0.6** kips

Force in z-axis — $F_{dz} = \gamma_D \times A \times (F_{swt} + F_{soil}) + \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil}) + \gamma_W \times F_{Wz1} =$ **24.5** kips

Moments on footing

Moment in x-axis, about x is 0 — $M_{dx} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times x_1) + \gamma_W \times (F_{Wz1} \times x_1 + M_{Wx1} + F_{Wx1} \times (h)) =$ **212.7** kip_ft

Moment in y-axis, about y is 0 — $M_{dy} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1) + \gamma_W \times (F_{Wz1} \times y_1) =$ **97.9** kip_ft

Uplift verification

Vertical force — $F_{dz} =$ **24.474** kips

PASS - Footing is not subject to uplift

Stability against overturning in x direction, moment about x is 0

Overturning moment — $M_{OTx0} = \gamma_W \times (F_{Wz1} \times x_1) =$ **-47.52** kip_ft

Resisting moment — $M_{Rx0} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times x_1) + \gamma_W \times (M_{Wx1} + F_{Wx1} \times (h)) =$ **260.26** kip_ft

Factor of safety — $abs(M_{Rx0} / M_{OTx0}) =$ **5.477**

PASS - Overturning moment safety factor exceeds the minimum of 1.00

Stability against overturning in x direction, moment about x is L_x

Overturning moment — $M_{OTxL} = \gamma_W \times (F_{Wz1} \times (x_1 - L_x) + M_{Wx1} + F_{Wx1} \times (h)) =$ **113.41** kip_ft

Resisting moment — $M_{RxL} = -1 \times (\gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2)) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times (x_1 - L_x)) =$ **-194.36** kip_ft

Factor of safety — $abs(M_{RxL} / M_{OTxL}) =$ **1.714**

PASS - Overturning moment safety factor exceeds the minimum of 1.00

Stability against overturning in y direction, moment about y is 0

Overturning moment $M_{OTy0} = \gamma_W \times (F_{Wz1} \times y_1) = \mathbf{-31.68}$ kip_ft

Resisting moment $M_{Ry0} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1) = \mathbf{129.58}$ kip_ft

Factor of safety $abs(M_{Ry0} / M_{OTy0}) = \mathbf{4.090}$

PASS - Overturning moment safety factor exceeds the minimum of 1.00

Stability against overturning in y direction, moment about y is L_y

Overturning moment $M_{OTyL} = \gamma_W \times (F_{Wz1} \times (y_1 - L_y)) = \mathbf{31.68}$ kip_ft

Resisting moment $M_{RyL} = -1 \times (\gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2)) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times (y_1 - L_y)) = \mathbf{-129.58}$ kip_ft

Factor of safety $abs(M_{RyL} / M_{OTyL}) = \mathbf{4.090}$

PASS - Overturning moment safety factor exceeds the minimum of 1.00

Stability against sliding

Resistance due to base friction $F_{RFriction} = max(F_{dz}, 0\ kN) \times tan(\delta_{bb}) = \mathbf{8.811}$ kips

Stability against sliding in x direction

Resistance from passive soil pressure $F_{RxPass} = 0.5 \times K_P \times (h^2 + 2 \times h \times h_{soil}) \times L_y \times \gamma_{soil} = \mathbf{11.52}$ kips

Total sliding resistance $F_{Rx} = F_{RFriction} + F_{RxPass} = \mathbf{20.331}$ kips

Factor of safety $abs(F_{RTx} / F_{dx}) = \mathbf{33.88}$

PASS - Sliding factor of safety exceeds the minimum of 1.50

Bearing resistance

Eccentricity of base reaction

Eccentricity of base reaction in x-axis $e_{dx} = M_{dx} / F_{dz} - L_x / 2 = \mathbf{32.308}$ in

Eccentricity of base reaction in y-axis $e_{dy} = M_{dy} / F_{dz} - L_y / 2 = \mathbf{0}$ in

Length of bearing in x-axis $L'_{xd} = min(L_x, 3 \times (L_x / 2 - abs(e_{dx}))) = \mathbf{119.076}$ in

Pad base pressures

$q_1 = \mathbf{0}$ ksf

$q_2 = \mathbf{0}$ ksf

$q_3 = \mathbf{0.617}$ ksf

$q_4 = \mathbf{0.617}$ ksf

Minimum base pressure $q_{min} = min(q_1, q_2, q_3, q_4) = \mathbf{0}$ ksf

Maximum base pressure $q_{max} = max(q_1, q_2, q_3, q_4) = \mathbf{0.617}$ ksf

Allowable bearing capacity

Allowable bearing capacity $q_{allow} = q_{allow\_Gross} = \mathbf{3}$ ksf

$q_{max} / q_{allow} = \mathbf{0.206}$

PASS - Allowable bearing capacity exceeds design base pressure

FOOTING DESIGN

In accordance with ACI318-19 (22)

Tedds calculation version 3.3.11

Material details

Compressive strength of concrete $f'_c = \mathbf{4000}$ psi

Yield strength of reinforcement $f_y = \mathbf{60000}$ psi

Compression-controlled strain limit (21.2.2) ε_{ty} = **0.00200**

Cover to top of footing c_{nom_t} = **3** in

Cover to side of footing c_{nom_s} = **3** in

Cover to bottom of footing c_{nom_b} = **3** in

Concrete type Normal weight

Concrete modification factor λ = **1.00**

Column type Concrete

Analysis and design of concrete footing

Load combinations per ASCE 7-22

1.4D (0.063)

1.2D + 1.6L + 0.5Lr (0.101)

1.2D + 1.6L + 0.3S (0.061)

1.2D + 1.6L + 0.5R (0.061)

1.2D + 1.0L + 1.6Lr (0.207)

1.2D + 1.0L + 1.0S (0.122)

1.2D + 1.0L + 1.6R (0.122)

1.2D + 1.6Lr + 0.5W (0.245)

1.2D + 1.0S + 0.5W (0.122)

1.2D + 1.6R + 0.5W (0.122)

1.2D + 1.0L + 0.5Lr + 1.0W (0.177)

1.2D + 1.0L + 0.3S + 1.0W (0.129)

1.2D + 1.0L + 0.5R + 1.0W (0.129)

$(1.2 + 0.2 \times S_{DS})$D + 1.0L + 0.15S + 1.0E (0.122)

0.9D + 1.0W (0.127)

$(0.9 - 0.2 \times S_{DS})$D + 1.0E (0.122)

Combination 8 results: 1.2D + 1.6Lr + 0.5W

Forces on footing

Ultimate force in x-axis $F_{ux} = \gamma_W \times F_{Wx1}$ = **0.5** kips

Ultimate force in z-axis $F_{uz} = \gamma_D \times A \times (F_{swt} + F_{soil}) + \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil}) + \gamma_{Lr} \times F_{Lrz1} + \gamma_W \times F_{Wz1}$ = **106.5** kips

Moments on footing

Ultimate moment in x-axis, about x is 0 $M_{ux} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times x_1) + \gamma_{Lr} \times (F_{Lrz1} \times x_1) + \gamma_W \times (F_{Wz1} \times x_1 + M_{Wx1} + F_{Wx1} \times (h))$ = **694.1** kip_ft

Ultimate moment in y-axis, about y is 0 $M_{uy} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1) + \gamma_{Lr} \times (F_{Lrz1} \times y_1) + \gamma_W \times (F_{Wz1} \times y_1)$ = **426.1** kip_ft

Eccentricity of base reaction

Eccentricity of base reaction in x-axis $e_{ux} = M_{ux} / F_{uz} - L_x / 2$ = **6.186** in

Eccentricity of base reaction in y-axis $e_{uy} = M_{uy} / F_{uz} - L_y / 2$ = **0** in

Pad base pressures

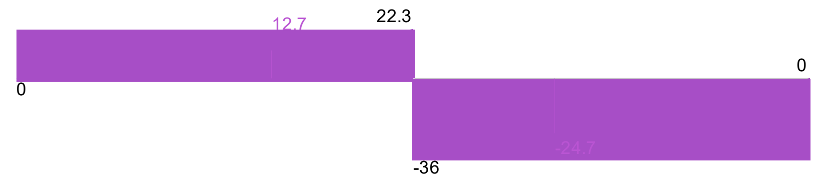
$q_{u1} = F_{uz} \times (1 - 6 \times e_{ux} / L_x - 6 \times e_{uy} / L_y) / (L_x \times L_y)$ = **0.824** ksf

$q_{u2} = F_{uz} \times (1 - 6 \times e_{ux} / L_x + 6 \times e_{uy} / L_y) / (L_x \times L_y)$ = **0.824** ksf

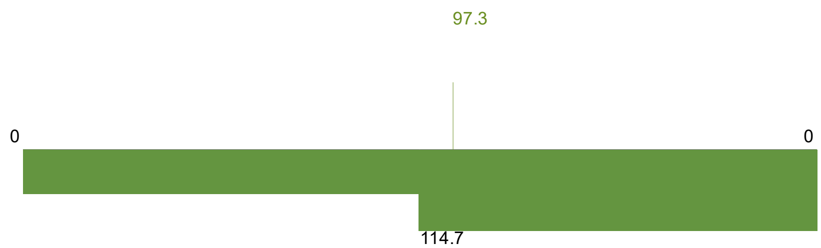
$q_{u3} = F_{uz} \times (1 + 6 \times e_{ux} / L_x - 6 \times e_{uy} / L_y) / (L_x \times L_y)$ = **1.396** ksf

	$q_{u4} = F_{uz} \times (1 + 6 \times e_{ux} / L_x + 6 \times e_{uy} / L_y) / (L_x \times L_y)$ = **1.396** ksf
Minimum ultimate base pressure	$q_{umin} = \min(q_{u1},q_{u2},q_{u3},q_{u4})$ = **0.824** ksf
Maximum ultimate base pressure	$q_{umax} = \max(q_{u1},q_{u2},q_{u3},q_{u4})$ = **1.396** ksf

Shear diagram, x axis (kips)



Moment diagram, x axis (kip_ft)



Moment design, x direction, positive moment

Ultimate bending moment	$M_{u.x.max}$ = **97.312** kip_ft
Tension reinforcement provided	8 No.7 bottom bars (12.7 in c/c)
Area of tension reinforcement provided	$A_{sx.bot.prov}$ = **4.8** in^2
Minimum area of reinforcement (8.6.1.1)	$A_{s.min} = 0.0018 \times L_y \times h$ = **4.147** in^2

PASS - Area of reinforcement provided exceeds minimum

Maximum spacing of reinforcement (8.7.2.2)	$s_{max} = \min(2 \times h, 18 \text{ in})$ = **18** in

PASS - Maximum permissible reinforcement spacing exceeds actual spacing

Depth to tension reinforcement	$d = h - c_{nom\_b} - \phi_{x.bot} / 2$ = **20.562** in
Depth of compression block	$a = A_{sx.bot.prov} \times f_y / (0.85 \times f'_c \times L_y)$ = **0.882** in
Neutral axis factor	β_1 = **0.85**
Depth to neutral axis	$c = a / \beta_1$ = **1.038** in
Strain in tensile reinforcement	$\varepsilon_t = 0.003 \times d / c - 0.003$ = **0.05643**
Minimum tensile strain(8.3.3.1)	$\varepsilon_{min} = \varepsilon_{ty} + 0.003$ = **0.00500**

PASS - Tensile strain exceeds minimum required

Nominal moment capacity	$M_n = A_{sx.bot.prov} \times f_y \times (d - a / 2)$ = **482.912** kip_ft
Flexural strength reduction factor	$\phi_f = \min(\max(0.65 + 0.25 \times (\varepsilon_t - \varepsilon_{ty}) / (0.003), 0.65), 0.9)$ = **0.900**
Design moment capacity	$\phi M_n = \phi_f \times M_n$ = **434.621** kip_ft
	$M_{u.x.max} / \phi M_n$ = **0.224**

PASS - Design moment capacity exceeds ultimate moment load

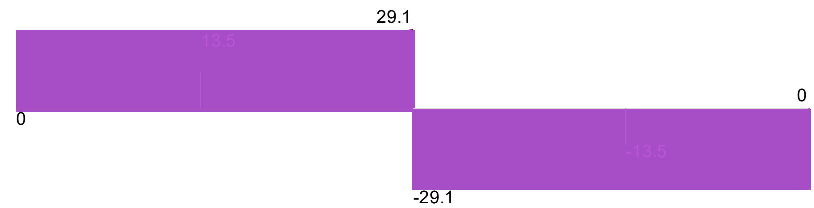
One-way shear design, x direction

Ultimate shear force	$V_{u.x}$ = **24.689** kips
Depth to reinforcement	$d_v = \min(h - c_{nom\_b} - \phi_{x.bot} / 2, h - c_{nom\_t} - \phi_{x.top} / 2)$ = **20.562** in
Size effect factor (22.5.5.1.3)	λ_s = **1**

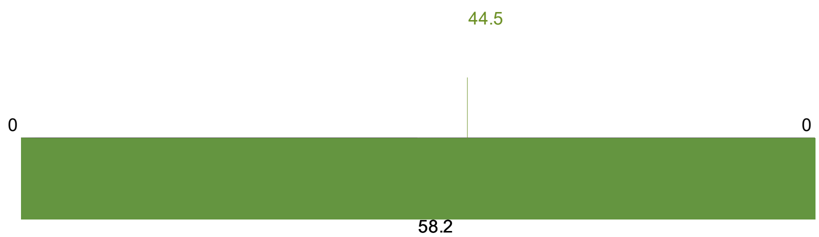
Ratio of longitudinal reinforcement	$\rho_w = \min(A_{sx.top.prov}, A_{sx.bot.prov}) / (L_y \times d_v) = \mathbf{0.00243}$
Shear strength reduction factor	$\phi_v = \mathbf{0.75}$
Nominal shear capacity (Eq. 22.5.5.1)	$V_n = \min(8 \times \lambda_s \times \lambda \times (\rho_w)^{1/3} \times \sqrt{(f'_c \times 1\text{ psi})} \times L_y \times d_v, 5 \times \lambda \times \sqrt{(f'_c \times 1\text{ psi})} \times L_y \times d_v) = \mathbf{134.307}$ kips
Design shear capacity	$\phi V_n = \phi_v \times V_n = \mathbf{100.73}$ kips
	$V_{u.x} / \phi V_n = \mathbf{0.245}$

PASS - Design shear capacity exceeds ultimate shear load

Shear diagram, y axis (kips)



Moment diagram, y axis (kip_ft)



Moment design, y direction, positive moment

Ultimate bending moment	$M_{u.y.max} = \mathbf{44.513}$ kip_ft
Tension reinforcement provided	13 No.7 bottom bars (11.4 in c/c)
Area of tension reinforcement provided	$A_{sy.bot.prov} = \mathbf{7.8}$ in^2
Minimum area of reinforcement (8.6.1.1)	$A_{s.min} = 0.0018 \times L_x \times h = \mathbf{6.221}$ in^2

PASS - Area of reinforcement provided exceeds minimum

Maximum spacing of reinforcement (8.7.2.2)	$s_{max} = \min(2 \times h, 18\text{ in}) = \mathbf{18}$ in

PASS - Maximum permissible reinforcement spacing exceeds actual spacing

Depth to tension reinforcement	$d = h - c_{nom\_b} - \phi_{x.bot} - \phi_{y.bot} / 2 = \mathbf{19.687}$ in
Depth of compression block	$a = A_{sy.bot.prov} \times f_y / (0.85 \times f'_c \times L_x) = \mathbf{0.956}$ in
Neutral axis factor	$\beta_1 = \mathbf{0.85}$
Depth to neutral axis	$c = a / \beta_1 = \mathbf{1.125}$ in
Strain in tensile reinforcement	$\varepsilon_t = 0.003 \times d / c - 0.003 = \mathbf{0.04952}$
Minimum tensile strain(8.3.3.1)	$\varepsilon_{min} = \varepsilon_{ty} + 0.003 = \mathbf{0.00500}$

PASS - Tensile strain exceeds minimum required

Nominal moment capacity	$M_n = A_{sy.bot.prov} \times f_y \times (d - a / 2) = \mathbf{749.173}$ kip_ft
Flexural strength reduction factor	$\phi_f = \min(\max(0.65 + 0.25 \times (\varepsilon_t - \varepsilon_{ty}) / (0.003), 0.65), 0.9) = \mathbf{0.900}$
Design moment capacity	$\phi M_n = \phi_f \times M_n = \mathbf{674.256}$ kip_ft
	$M_{u.y.max} / \phi M_n = \mathbf{0.066}$

PASS - Design moment capacity exceeds ultimate moment load

Footing geometry factor (13.3.3.3) — $\beta_f = L_x / L_y =$ **1.500**

Area of reinf. req. for uniform distribution (CRSI) — $A_{sreq} = (M_{u.y.max} / (\phi_f \times f_y \times (d - a / 2))) \times 2 \times \beta_f / (\beta_f + 1) =$ **0.618** in^2

PASS - Reinforcement can be distributed uniformly

One-way shear design, y direction

Ultimate shear force — $V_{u.y} =$ **13.513** kips

Depth to reinforcement — $d_v = \min(h - c_{nom\_b} - \phi_{x.bot} - \phi_{y.bot} / 2, h - c_{nom\_t} - \phi_{y.top} / 2) =$ **19.687** in

Size effect factor (22.5.5.1.3) — $\lambda_s =$ **1**

Ratio of longitudinal reinforcement — $\rho_w = \min(A_{sy.top.prov}, A_{sy.bot.prov}) / (L_x \times d_v) =$ **0.00275**

Shear strength reduction factor — $\phi_v =$ **0.75**

Nominal shear capacity (Eq. 22.5.5.1) — $V_n = \min(8 \times \lambda_s \times \lambda \times (\rho_w)^{1/3} \times \sqrt{(f'_c \times 1 \text{ psi})} \times L_x \times d_v, 5 \times \lambda \times \sqrt{(f'_c \times 1 \text{ psi})} \times L_x \times d_v) =$ **200.996** kips

Design shear capacity — $\phi V_n = \phi_v \times V_n =$ **150.747** kips

$V_{u.y} / \phi V_n =$ **0.090**

PASS - Design shear capacity exceeds ultimate shear load

Two-way shear design at column 1

Depth to reinforcement — $d_{v2} =$ **20.125** in

Shear perimeter length (22.6.4) — $l_{xp} =$ **32.125** in

Shear perimeter width (22.6.4) — $l_{yp} =$ **32.125** in

Shear perimeter (22.6.4) — $b_o = 2 \times (l_{x1} + d_{v2}) + 2 \times (l_{y1} + d_{v2}) =$ **128.500** in

Shear area — $A_p = l_{x,perim} \times l_{y,perim} =$ **1032.016** in^2

Surcharge loaded area — $A_{sur} = A_p - l_{x1} \times l_{y1} =$ **888.016** in^2

Ultimate bearing pressure at center of shear area — $q_{up.avg} =$ **1.110** ksf

Ultimate shear load — $F_{up} = \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil}) + \gamma_{Lr} \times F_{Lrz1} + \gamma_W \times F_{Wz1} + \gamma_D \times A_p \times F_{swt} + \gamma_D \times A_{sur} \times F_{soil} - q_{up.avg} \times A_p =$ **53.656** kips

Ultimate shear stress from vertical load — $v_{ug} = \max(F_{up} / (b_o \times d_{v2}), 0 \text{ psi}) =$ **20.748** psi

Column geometry factor (Table 22.6.5.2) — $\beta = l_{y1} / l_{x1} =$ **1.00**

Column location factor (22.6.5.3) — $\alpha_s =$ **40**

Size effect factor (22.5.5.1.3) — $\lambda_s =$ **1**

Concrete shear strength (22.6.5.2) — $v_{cpa} = (2 + 4 / \beta) \times \lambda_s \times \lambda \times \sqrt{(f'_c \times 1 \text{ psi})} =$ **379.473** psi

$v_{cpb} = (\alpha_s \times d_{v2} / b_o + 2) \times \lambda_s \times \lambda \times \sqrt{(f'_c \times 1 \text{ psi})} =$ **522.699** psi

$v_{cpc} = 4 \times \lambda_s \times \lambda \times \sqrt{(f'_c \times 1 \text{ psi})} =$ **252.982** psi

$v_{cp} = \min(v_{cpa}, v_{cpb}, v_{cpc}) =$ **252.982** psi

Shear strength reduction factor — $\phi_v =$ **0.75**

Nominal shear stress capacity (Eq. 22.6.1.2) — $v_n = v_{cp} =$ **252.982** psi

Design shear stress capacity (8.5.1.1(d)) — $\phi v_n = \phi_v \times v_n =$ **189.737** psi

$v_{ug} / \phi v_n =$ **0.109**

PASS - Design shear stress capacity exceeds ultimate shear stress load

Michael Baker INTERNATIONAL	Project Creech DRP Phase 2				Job Ref.	
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