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

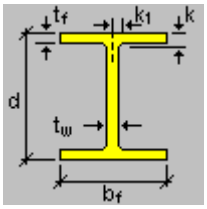
AISC 360-2022 LRFD (Hot-rolled)

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

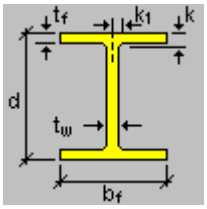
Intermediate results	Unit	Value	Reference
Interaction of flexure and axial force:	--	0.39	Eq.H1-1b
Available flexural strength about strong axis (M_{c33})	[Kip*ft]	791.25	Cl.H1.1
Available flexural strength about weak axis (M_{c22})	[Kip*ft]	207.38	Cl.H1.1
Available axial strength (P_c)	[Kip]	1282.50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

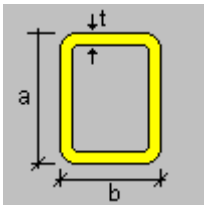
Intermediate results	Unit	Value	Reference
Interaction of flexure and axial force:	--	0.34	Eq.H1-1b
Available flexural strength about strong axis (M_{c33})	[Kip*ft]	791.25	Cl.H1.1
Available flexural strength about weak axis (M_{c22})	[Kip*ft]	207.38	Cl.H1.1
Available axial strength (P_c)	[Kip]	1282.50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

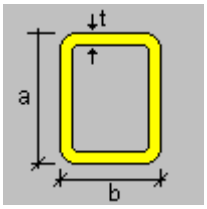
Intermediate results	Unit	Value	Reference
Interaction of flexure and axial force:	--	0.13	Eq.H1-1b
Available flexural strength about strong axis (M_{c33})	[Kip*ft]	476.25	Cl.H1.1
Available flexural strength about weak axis (M_{c22})	[Kip*ft]	476.25	Cl.H1.1
Available axial strength (P_c)	[Kip]	1270.47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