PRCNC20251558

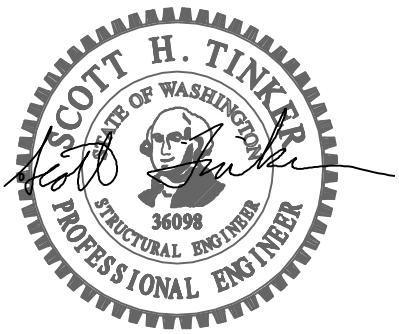
QUANTUM
CONSULTING ENGINEERS

November 24, 2025

STRUCTURAL CALCULATIONS
(Permit Submittal)

1015 TRASH ENCLOSURE
1015 39th Ave SE
Puyallup, WA 98374

Quantum Job Number: 19305.04



Prepared for:
BENAROYA COMPANIES
9675 SE 36th Street
Ste 115
Mercer Island, WA 98040

Calculations required to be provided by the Permittee on site for all Inspections

Prepared by:
QUANTUM CONSULTING ENGINEERS
1511 Third Avenue, Suite 323
Seattle, WA 98101
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City of Puyallup
Building
REVIEWED FOR COMPLIANCE
SKinnear
12/17/2025
8:54:40 AM
CITY OF PUYALLUP
STATE OF WASHINGTON

Structural Design Criteria

Building Code: 2021 International Building Code
Building Department: City of Puyallup

Seismic Criteria

S_s:	1.26	I_e:	1.00
S_1:	0.43	Seismic Soil Site Class:	C
S_{ds}:	1.01	Seismic Design Category:	D
S_{d1}:	0.43	Cs:	0.40
R:	2.50	Steel Special Cantilever Column System	

Wind Criteria

Wind Speed:	98
Risk Category:	II
Wind Exposure:	B
Kzt:	1

Geotechnical Criteria

Allowable Bearing Pressure	5000 PSF
Frost Depth	18” min.
Soils Consultant	Geoengineers, Inc.
Soils Report Number	File No 4565-064-09
Soils Report Date	October 14, 2024
Active Soil Pressure (Restrained/Unrestrained)	55 PCF / 35 PCF
Seismic Surcharge Pressure	8H PSF
Passive Soil Pressure	300 PCF
Coefficient of Friction	0.4

Materials Criteria

Concrete (28 Day Strength):

Foundation/Slab on Grade	F'c= 2,500 PSI

Reinforcing Steel:

Grade 60	Fy= 60,000 PSI

Structural Steel:

Wide-Flange Sections: A-992	Fy= 50,000 PSI
Miscellaneous Sections: A-36	Fy= 36,000 PSI
Tube Sections: A-500	Fy= 46,000 PSI
Pipe Sections: A-53	Fy= 35,000 PSI
Welding	Fy= 70,000 PSI

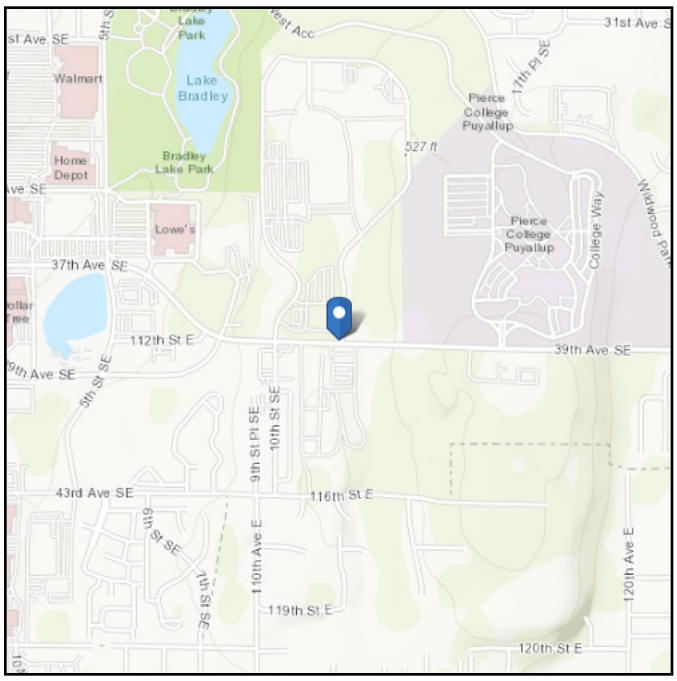
Light Gauge Steel:

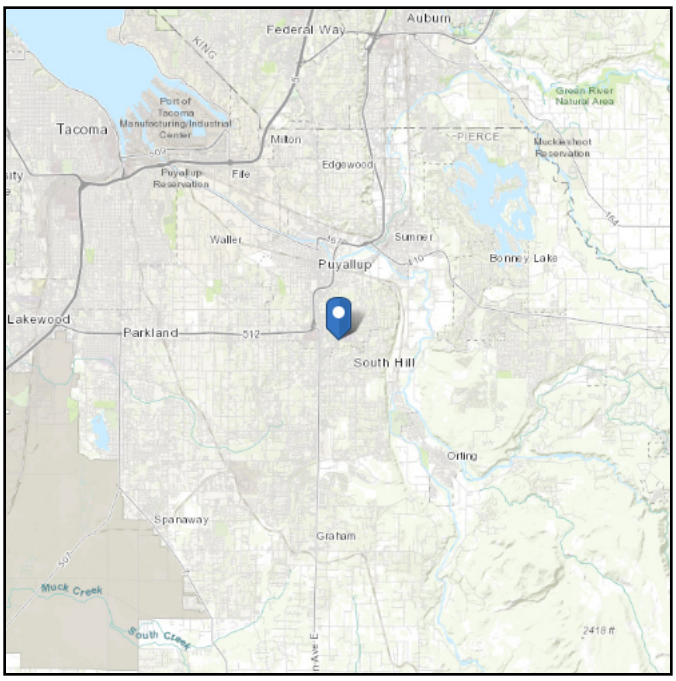
43 AND 33 MIL.: ASTM A-653 SS GRADE 33	Fy= 33,000 PSI
118, 97, 68 AND 54 MIL.: ASTM A-653 SS GRADE 50	Fy= 50,000 PSI
WELDING	Fy= 60,000 PSI

ASCE Hazards Report

Address:
1015 39th Ave SE
Puyallup, Washington
98374

Standard:	ASCE/SEI 7-16	**Latitude:**	47.154821
Risk Category:	II	**Longitude:**	-122.279437
Soil Class:	C - Very Dense Soil and Soft Rock	**Elevation:**	504.17578801354597 ft (NAVD 88)





Wind

Results:

Wind Speed	98 Vmph
10-year MRI	67 Vmph
25-year MRI	73 Vmph
50-year MRI	78 Vmph
100-year MRI	83 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Mon Nov 24 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 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

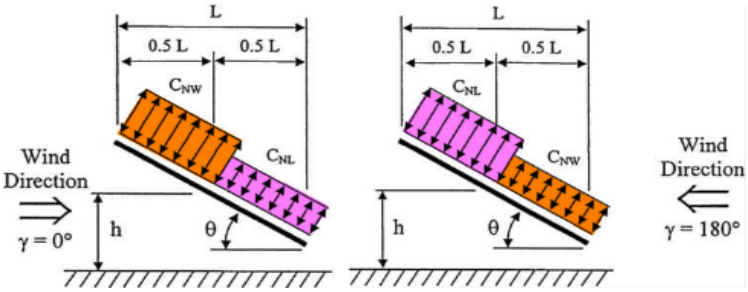
Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

Open Building Wind Load Monoslope Roof

Per IBC 2021 & ASCE 7-16

Wind Load Criteria:

Risk Category	II	
Wind Speed	V = 98 mph	*ASCE 7-16*
Exposure Coe.	Kz = 0.85	*Table 26.10-1*
Direction Coe.	Kd = 0.85	*Table 26.6-1*
Topo Coe.	Kzt = 1.00	*Sec. 26.8.2*
V_Pressure	qz = 17.76 psf	*EQ 26.10-1*
Gust Factor	G = 0.85	*Sec 26.11*
Roof Slope	7.13 °	



Main Wind Force Resisting System: Chap 27 Part 1 Procedure:

Figure 27.3-4 & 7

	Wind Direction = 0° (Windward)								Wind Direction 90°, 270°	
	Main Roof				Roof Overhang					
Load Case	**Cnw**	WL	**Cnl**	WL	**Cnw**	WL	**Cnl**	WL	**Cn**	WL
A	-0.6	**-9.1 psf**	-1	**-15.1 psf**	-1.4	**-21.1 psf**	-1.8	**-27.2 psf**	-0.8	**-12.1 psf**
B	-1.4	**-21.1 psf**	0.0	**0.0 psf**	-2.2	**-33.2 psf**	-0.8	**-12.1 psf**	0.8	**12.1 psf**

	Wind Direction = 180°			
Load Case	**Cnw**	WL	**Cnl**	WL
A	0.9	**13.6 psf**	1.5	**22.6 psf**
B	1.6	**24.2 psf**	0.3	**4.5 psf**

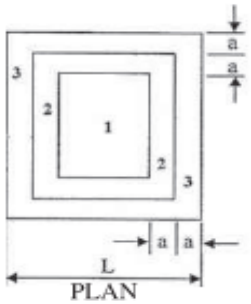
Note: Separate roof overhang wind load is only required with wind uplift case.
Negative Load Indicates Uplift

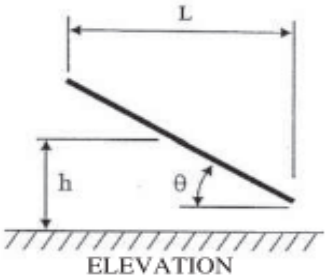
Components and Cladding: Chap 30 Part 5 Procedure:

Wind Area =	60.0 sqft
a =	3.0 ft

Wind Area > 4a^2

Zone	3
Pressure Coe	Cn = 1.60
Pressure Coe	-Cn = -1.40
Pressure (+)	**24.2 psf**
Pressure (-)	**-21.1 psf**





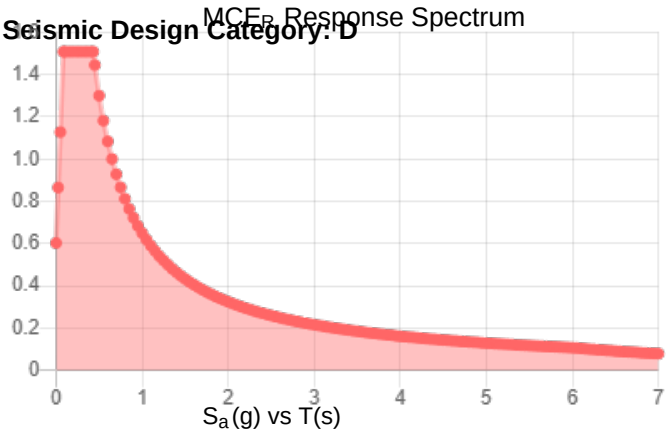
Seismic

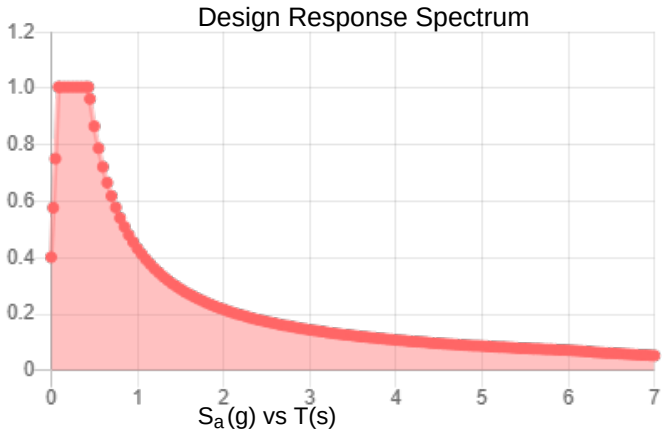
Site Soil Class: C - Very Dense Soil and Soft Rock

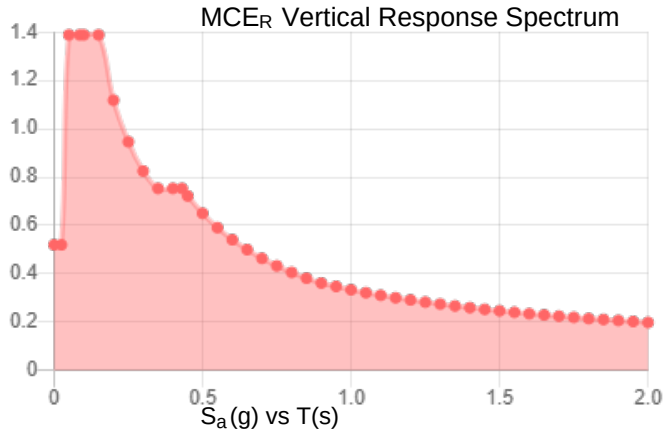
Results:

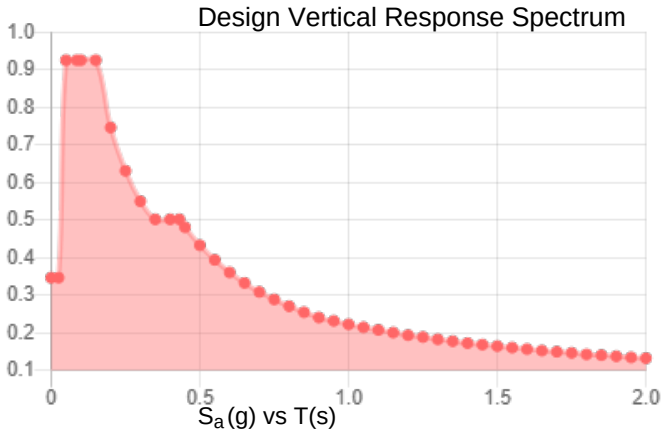
S_S :	1.256	S_{D1} :	0.433
S_1 :	0.433	T_L :	6
F_a :	1.2	PGA :	0.5
F_v :	1.5	PGA_M :	0.6
S_{MS} :	1.507	F_{PGA} :	1.2
S_{M1} :	0.65	I_e :	1
S_{DS} :	1.005	C_v :	1.151

Seismic Design Category: D









Data Accessed: Mon Nov 24 2025

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

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Seismic Base Shear for the Equivalent Lateral Force Procedure

Per IBC 2021 & ASCE 7-16

Structure: **South Hill Trash Enclosure**
Address: **1015 Bldg East Parking Lot**
Latitude: Longitude:

Structure Classification

Risk Category : **II** per ASCE Table 1.5-1

Seismic Force-Resisting System: **Steel Special Cantilever Column System**

R:	**2 1/2**	per ASCE Table 12.2-1
W_o:	**1 1/4**	per ASCE Table 12.2-1
C_d:	**2 1/2**	per ASCE Table 12.2-1
h_n (ft):	**12.00**	height above the base to the highest level of the structure

Site Ground Motion

Reg. Structure/5 Stories Max: **No** Per ASCE 12.8.1.3

S_1 (g-sec): **0.43** S_S (g-sec): **1.26**

Site Class: **C** **Per Geotechnical Report** per ASCE 11.4.3

F_v **1.50** F_a **1.20**

S_{M1} (g-sec): **0.65** S_{MS} (g-sec): **1.51** per ASCE 11.4.4

S_{D1} (g-sec): **0.43** S_{DS} (g-sec): **1.01** per ASCE 11.4.5

SDC: **D** per ASCE 11.6

I_E: **1.00** per ASCE Table 1.5-2

Fundamental Period per ASCE 12.8.2

Period Method: **Approximate Fundamental Period**

Structure Type: **All Other Structural Systems**

T_L (sec):	**6.00**	ASCE Figures 22-14 through 22-17
T_s:	0.43	
Ta (sec):	0.13	Ct * hnx per ASCE Eq. 12.8-7
T_{use} (sec):	**0.13**	<= TL

Equivalent Lateral Force Procedure Design Base Shear per ASCE 12.8

C_s:	0.40	$= S_{DS} / (R/I_E)$ per ASCE Eq. 12.8-2
$C_{s\text{-}max}$:	1.33	$= S_{D1} / (T_a * R/I_E)$ for T <= T_L per ASCE Eq. 12.8-3
$C_{s\text{-}max}$:	--	$= S_{D1} * T_L / (T_a^2 * R/I_E)$ for T > T_L per ASCE Eq. 12.8-4
$C_{s\text{-}min}$:	0.04	per ASCE Eq. 12.8-5
$C_{s\text{-}min}$:	--	$= 0.5S_1 / (R/I_E)$ for S_1 => 0.6g per ASCE Eq. 12.8-6
$C_{s\text{-}use}$:	0.40	

V : 0.403 W **$= C_{S\text{-}use}$ * W per ASCE Eq. 12.8-1**

Vert. Distribution of Seismic Forces for the Equiv. Lateral Force Procedure

Per IBC 2021 & ASCE 7-16

Structure: **South Hill Trash Enclosure**

Seismic Parameters

I_E:	1.00	per ASCE Table 1.5-2
S_{DS} (g-sec):	1.01	per ASCE 11.4.4
Period (Sec):	0.13	per ASCE 12.8.2.1
k:	1.00	per ASCE 12.8.3

Vertical Distribution of Seismic Forces per ASCE 12.8.3

$F_x = C_{vx}V$ per ASCE Eq. 12.8-11

$C_{vx} = (w_x h_x^k)/(\Sigma w_i h_i^k)$ per ASCE Eq. 12.8-12

Level	h_x (ft)	w_x (k)	% of W_{total}	$w_x * h_x^k$	C_{vx} (%)	F_x (k)	V_x (k)
Roof	10.25	11.20	100.0%	114.8	100.0%	4.52	4.52

Total WT (k): 11.20 Sum: 115

$C_{s\text{-}use}$: 0.403

V (k): 4.52 per ASCE 12.8.1

Vertical Distribution of Seismic Diaphragm Forces per ASCE 12.10.1.1

$F_{px} = (SF_i/Sw_i) * w_{px}$ per ASCE Eq 12.10-1

$F_{px\text{-}max} = 0.4*S_{DS}*I_E*w_{px}$ per per ASCE 12.10.1.1

$F_{px\text{-}min} = 0.2*S_{DS}*I_E*w_{px}$ per per ASCE 12.10.1.1

Level	w_{px} (k)	Σw_i (k)	F_x (k)	ΣF_i (k)	F_{px} (k)	Notes	Diaphragm/Story Force Ratio
Roof	11.20	11.20	4.52	4.52	4.52		1.000

Trash Enclosure Seismic Loads

IBC 2021, ASCE 7-16

Number of Column 6 (1/2 at Front, 1/2 at Rear)
Earthquake Force 4.52 k
Overstrength Factor 1.25

			EQ Loads			Overstrength	
Col.	Location	Height	R	V	M	ΩV	ΩM
1	Front	11.67 ft	0.63	0.47 k	5.524 k-ft	0.59 k	6.905 k-ft
2	Front	11.67 ft	0.63	0.47 k	5.524 k-ft	0.59 k	6.905 k-ft
3	Front	11.67 ft	0.63	0.47 k	5.524 k-ft	0.59 k	6.905 k-ft
4	Rear	9.00 ft	1.37	1.03 k	9.287 k-ft	1.29 k	11.61 k-ft
5	Rear	9.00 ft	1.37	1.03 k	9.287 k-ft	1.29 k	11.61 k-ft
6	Rear	9.00 ft	1.37	1.03 k	9.287 k-ft	1.29 k	11.61 k-ft
		Total =	6.00	4.52 k		5.64 k	

Steel Column

Project File: Trash Enclosure.ec6

DESCRIPTION: Cantilever Column - 9'-0"

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS5x5x1/4**

Analysis Method :	Allowable Strength
Steel Stress Grade	
Fy : Steel Yield	50.0 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height	9.0 ft
Top & Bottom Fixity	Top Free, Bottom Fixed
Brace condition :	

Unbraced Length for buckling ABOUT X-X Axis = 9.0 ft, K = 2.1
Unbraced Length for buckling ABOUT Y-Y Axis = 9.0 ft, K = 2.1

Applied Loads

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

Column self weight included : 140.580 lbs * Dead Load Factor
AXIAL LOADS . . .
Roof: Axial Load at 9.0 ft, D = 2.754, S = 4.050 k
BENDING LOADS . . .
Lat. Point Load at 9.0 ft creating Mx-x, E = 1.030 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = 0.3771 : 1

Load Combination	+1.141D+0.70E	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Pa : Axial	3.304	k
Pn / Omega : Allowabl	46.803	k
Ma-x : Applied	-6.489	k-ft
Mn-x / Omega : Allowable	18.987	k-ft
Ma-y : Applied	0.0	k-ft
Mn-y / Omega : Allowable	18.987	k-ft

PASS Maximum Shear Stress Rati 0.02003 : 1

Load Combination	+1.141D+0.70E	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Va : Applied	0.7210	k
Vn / Omega : Allowable	36.005	k

Maximum Load Reactions . .

Top along X-X	k
Bottom along X-X	k
Top along Y-Y	k
Bottom along Y-Y	k

Maximum Load Deflections . . .

Along Y-Y in at ft above base
for load combination :

Along X-X in at ft above base
for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Extreme Reactions

Item	Extreme Value	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance

Steel Section Properties : HSS5x5x1/4

Steel Section Properties : HSS5x5x1/4

Steel Column

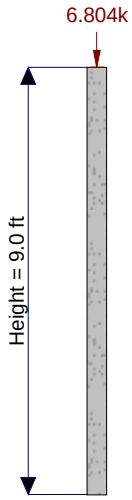
Project File: Trash Enclosure.ec6

DESCRIPTION: Cantilever Column - 9'-0"

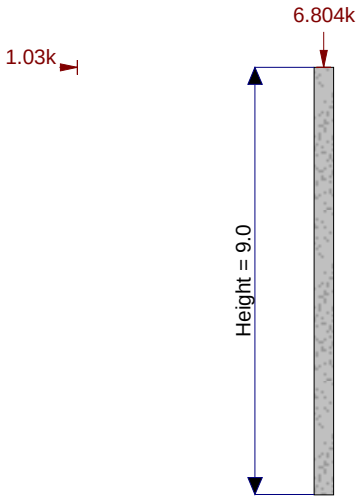
Depth	=	5.000	in	I xx	=	16.00	in^4	J	=	25.800 in^4
Design Thick	=	0.233	in	S xx	=	6.41	in^3			
Width	=	5.000	in	R xx	=	1.930	in			
Wall Thick	=	0.250	in	Zx	=	7.610	in^3			
Area	=	4.300	in^2	I yy	=	16.000	in^4	C	=	10.500 in^3
Weight	=	15.620	plf	S yy	=	6.410	in^3			
				R yy	=	1.930	in			
Ycg	=	0.000	in							

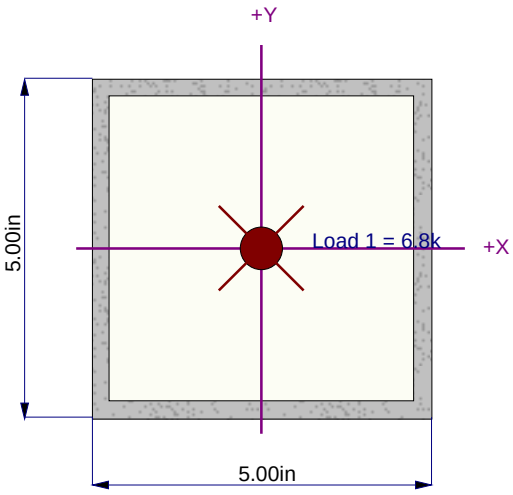
Sketches

My Loads - Looking along Y-Y Axis



My Loads - Looking along X-X Axis





Steel Column

Project File: Trash Enclosure.ec6

DESCRIPTION: Cantilever Column - 11'-8"

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS5x5x1/4**

Analysis Method :	Allowable Strength
Steel Stress Grade	
Fy : Steel Yield	50.0 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height	11.670 ft
Top & Bottom Fixity	Top Free, Bottom Fixed
Brace condition :	

Unbraced Length for buckling ABOUT X-X Axis = 11.670 ft, K = 2.1
Unbraced Length for buckling ABOUT Y-Y Axis = 11.670 ft, K = 2.1

Applied Loads

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

Column self weight included : 182.285 lbs * Dead Load Factor
AXIAL LOADS . . .
Roof: Axial Load at 11.670 ft, D = 2.754, S = 4.050 k
BENDING LOADS . . .
Lat. Point Load at 9.0 ft creating Mx-x, E = 0.470 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = 0.3298 : 1

Load Combination	+1.106D+0.750S+0.5250E	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Pa : Axial	6.285	k
Pn / Omega : Allowabl	27.837	k
Ma-x : Applied	-2.221	k-ft
Mn-x / Omega : Allowable	18.987	k-ft
Ma-y : Applied	0.0	k-ft
Mn-y / Omega : Allowable	18.987	k-ft

PASS Maximum Shear Stress Rati 0.009138 : 1

Load Combination	+1.141D+0.70E	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Va : Applied	0.3290	k
Vn / Omega : Allowable	36.005	k

Maximum Load Reactions . .

Top along X-X	k
Bottom along X-X	k
Top along Y-Y	k
Bottom along Y-Y	k

Maximum Load Deflections . . .

Along Y-Y in at ft above base
for load combination :

Along X-X in at ft above base
for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Extreme Reactions

Item	Extreme Value	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance

Steel Section Properties : HSS5x5x1/4

Steel Section Properties : HSS5x5x1/4

Steel Column

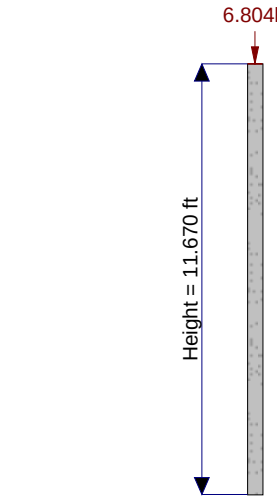
Project File: Trash Enclosure.ec6

DESCRIPTION: Cantilever Column - 11'-8"

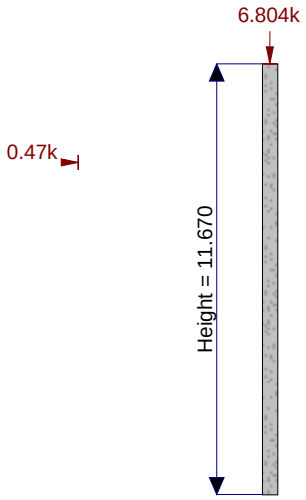
Depth	=	5.000 in	I xx	=	16.00 in^4	J	=	25.800 in^4
Design Thick	=	0.233 in	S xx	=	6.41 in^3			
Width	=	5.000 in	R xx	=	1.930 in			
Wall Thick	=	0.250 in	Zx	=	7.610 in^3			
Area	=	4.300 in^2	I yy	=	16.000 in^4	C	=	10.500 in^3
Weight	=	15.620 plf	S yy	=	6.410 in^3			
			R yy	=	1.930 in			
Ycg	=	0.000 in						

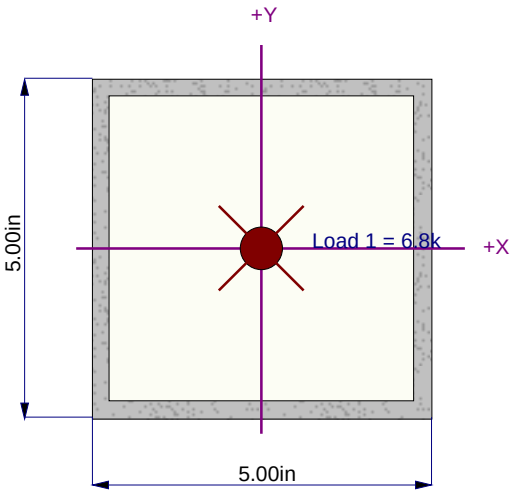
Sketches

My Loads - Looking along Y-Y Axis



My Loads - Looking along X-X Axis





SIMPSON Strong-Tie

Anchor Designer™ for Concrete Software
Version 3.4.2506.1

Company:	QCE	Date:	11/24/2025
Engineer:	TVM	Page:	1
Project:	1015 Trash Enclosure		
Address:			
Phone:			
E-mail:			

1.Project information

Project description: Trash Encloure Base Plate

Location:
Design name: EQ 100%/30%

Comment:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

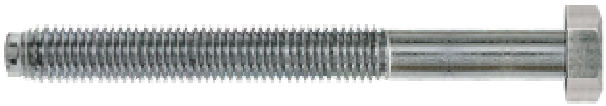
Anchor Information:
Anchor type: Cast-in-place
Material: F1554 Grade 36
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 4.125
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 5.63
C_{min} (inch): 1.22
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 18.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: Yes
Ignore concrete breakout in shear: Yes
Ignore 6do requirement: Yes
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 12.00 x 12.00 x 0.96
Yield stress: 36000 psi

Profile type/size: 5X5X1/4

Recommended Anchor
Anchor Name: Heavy Hex Bolt - 3/4"Ø Heavy Hex Bolt, F1554 Gr. 36



SIMPSON Strong-Tie

Anchor Designer™ for Concrete Software
Version 3.4.2506.1

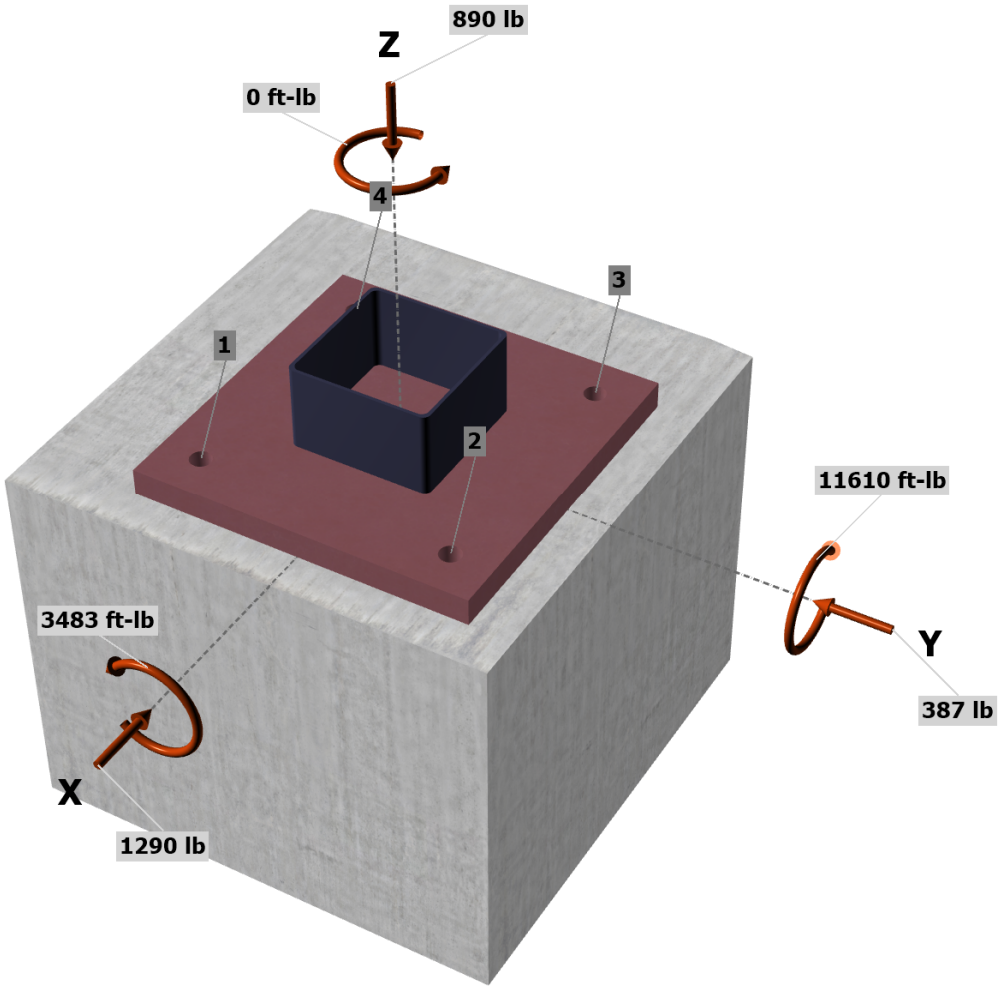
Company:	QCE	Date:	11/24/2025
Engineer:	TVM	Page:	2
Project:	1015 Trash Enclosure		
Address:			
Phone:			
E-mail:			

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.10.5.3 (d) is satisfied
Ductility section for shear: 17.10.6.3 (c) is satisfied
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]:	-890
V_{uax} [lb]:	-1290
V_{uay} [lb]:	-387
M_{ux} [ft-lb]:	3483
M_{uy} [ft-lb]:	-11610
M_{uz} [ft-lb]:	0

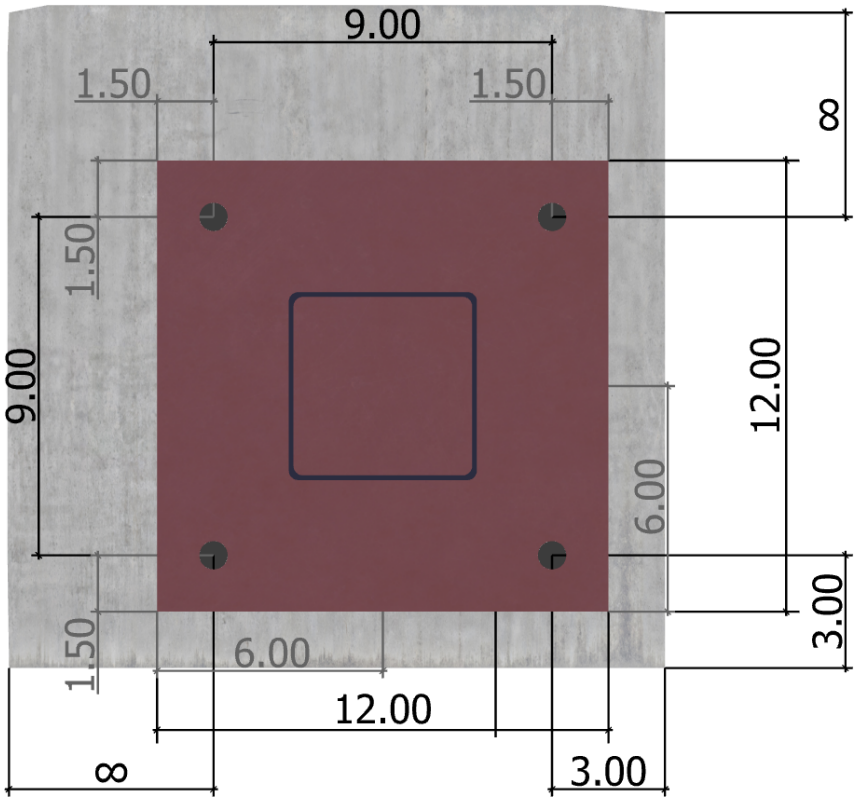
<Figure 1>



SIMPSON Strong-Tie Anchor Designer™ for Concrete Software
Version 3.4.2506.1

Company:	QCE	Date:	11/24/2025
Engineer:	TVM	Page:	3
Project:	1015 Trash Enclosure		
Address:			
Phone:			
E-mail:			

<Figure 2>

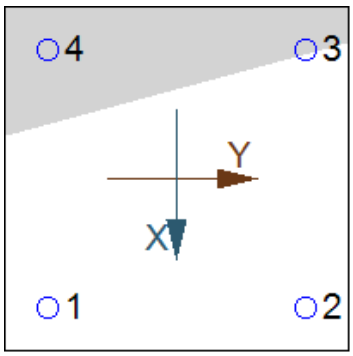


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	6057.3	-322.5	-96.7	336.7
2	8372.6	-322.5	-96.7	336.7
3	0.0	-322.5	-96.8	336.7
4	0.0	-322.5	-96.8	336.7
Sum	14429.9	-1290.0	-387.0	1346.8

Maximum concrete compression strain (‰): 0.29
Maximum concrete compression stress (psi): 1256
Resultant tension force (lb): 14430
Resultant compression force (lb): 15320
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.72
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



SIMPSON Strong-Tie

Anchor Designer™ for Concrete Software
Version 3.4.2506.1

Company:	QCE	Date:	11/24/2025
Engineer:	TVM	Page:	4
Project:	1015 Trash Enclosure		
Address:			
Phone:			
E-mail:			

4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
19370	0.75	14528

5. Pullout Strength of Anchor in Tension (Sec. 17.6.3)

$0.75\phi N_{pn} = 0.75\phi\Psi_{c,P}N_p = 0.75\phi\Psi_{c,P}8A_{brg}f'_c$ (Sec. 17.5.1.2, Eq. 17.6.3.1 & 17.6.3.2.2a)

$\Psi_{c,P}$	A_{brg} (in^2)	f'_c (psi)	ϕ	$0.75\phi N_{pn}$ (lb)
1.0	0.91	2500	0.70	9566

6. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
11625	1.0	0.65	7556

7. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi k_{cp}N_{cbg} = \phi k_{cp}(A_{Nc}/A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	330.79	153.14	1.000	0.845	1.000	1.000	10053	0.70	25703

8. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, øN_n (lb)	Ratio	Status
Steel	8373	14528	0.58	Pass
Pullout	**8373**	**9566**	**0.88**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	337	7556	0.04	Pass
Pryout	**1347**	**25703**	**0.05**	**Pass (Governs)**

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Utilization Ratio	Permissible	Status
Sec. 17.8.3	0.88	0.05	77.3%	1.0	Pass

3/4"Ø Heavy Hex Bolt, F1554 Gr. 36 with hef = 4.125 inch meets the selected design criteria.

SIMPSON Strong-Tie

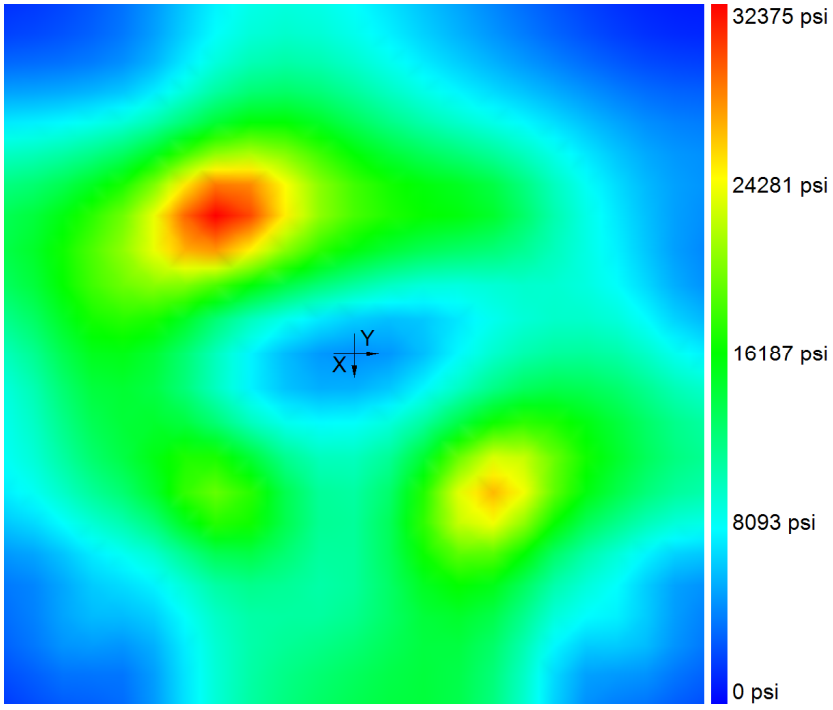
Anchor Designer™ for Concrete Software
Version 3.4.2506.1

Company:	QCE	Date:	11/24/2025
Engineer:	TVM	Page:	5
Project:	1015 Trash Enclosure		
Address:			
Phone:			
E-mail:			

Base Plate Thickness

Steel	**36000 psi**
Maximum stress	**32375 psi**
Calculated plate thickness	**0.960 inch**

Stress distribution



For ACI and CSA design methods, maximum base plate stress is limited to 0.9 times yield stress.
For ETAG and EN-1992-4 design method, maximum base plate stress is limited to yield stress divide by 1.5.
Plate stress is derived using Von Mises theory.

$$\sigma_{xx} = \frac{F_{xx}}{t} + \frac{6M_{xx}}{t^2} \text{ (@ bottom) or } \sigma_{xx} = \frac{F_{xx}}{t} - \frac{6M_{xx}}{t^2} \text{ (@ top)}$$

$$\sigma_{yy} = \frac{F_{yy}}{t} + \frac{6M_{yy}}{t^2} \text{ (@bottom) or } \sigma_{yy} = \frac{F_{yy}}{t} - \frac{6M_{yy}}{t^2} \text{ (@ top)}$$

$$\sigma_{xy} = \frac{F_{xy}}{t} + \frac{6M_{xy}}{t^2} \text{ (@bottom) or } \sigma_{xy} = \frac{F_{xy}}{t} - \frac{6M_{xy}}{t^2} \text{ (@ top)}$$

$$\sigma_{xz} = \frac{V_x}{t}$$

$$\sigma_{yz} = \frac{V_y}{t}$$

$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}$ as follows:

$$S_1 = \frac{\sigma_{xx} + \sigma_{yy}}{2} + \sqrt{(\frac{\sigma_{xx} - \sigma_{yy}}{2})^2 + \sigma_{xy}^2}$$

$$S_2 = \frac{\sigma_{xx} + \sigma_{yy}}{2} - \sqrt{(\frac{\sigma_{xx} - \sigma_{yy}}{2})^2 + \sigma_{xy}^2}$$

$$S_3 = 0$$

$$\sigma_{Von\,Mises} = \sqrt{\frac{(S_1 - S_2)^2 + (S_1 - S_3)^2 + (S_2 - S_3)^2}{2}}$$

9. Warnings

- Minimum spacing and edge distance requirement of 6da per ACI 318 Table 17.9.2(a) for torqued cast-in-place anchor is waived per designer option.\n
- Concrete breakout strength in tension has not been evaluated against applied tension load(s) per designer option. Refer to ACI 318 Section 17.5.2.1 for conditions where calculations of the concrete breakout strength may not be required.

- Concrete breakout strength in shear has not been evaluated against applied shear load(s) per designer option. Refer to ACI 318 Section 17.5.2.1 for conditions where calculations of the concrete breakout strength may not be required.

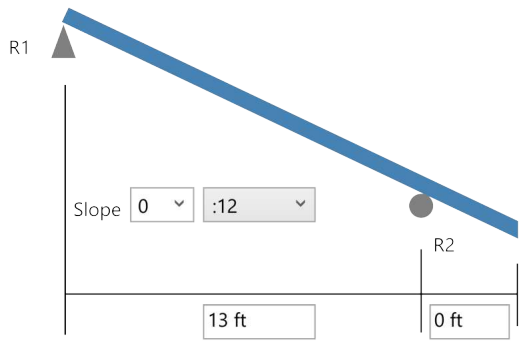
- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.

- Per designer input, ductility requirements for shear have been determined to be satisfied – designer to verify.

- Designer must exercise own judgement to determine if this design is suitable.

Project Name: Roof Framing
Model: Rafter – Wind Down
Code: AISI S100-16w/S2-20

Date: 11/24/2025
Simpson Strong-Tie® CFS Designer™ 5.2.8.0



Section : 600S162-54 (50 ksi) @ 24" o.c. Single C Stud (punched)
Maxo = 2313.4(ft-lb) **Va =** 2822.9 **I =** 2.860 in^4

Bracing, Interconnection and Distortional Buckling Parameters

	Span	Overhang
Flexural Bracing	Full	None
Axial Bracing	NA	None
Distortional Buckling, K-phi	5000 lb-	5000 lb-
Distortional Buckling Bracing, Lm	48 in	48 in

Load Cases

	Span (psf)	Overhang (psf)
Dead Load	14	NA
Live Load	0.01	NA
Snow Load	25	NA
Inward Wind Load	24.2	NA
Outward Wind Load	-21.1	NA

Load Combinations

LC Number	Dead	Live	Snow	Inward Wind	Outward Wind
1	1	1	0	0	0
2	1	0	1	0	0
3	1	0	0	1	0
4	1	0.75	0	0.75	0
5	1	0	0.75	0.75	0
6	0.6	0	0	0	1

Reactions

	Vertical				Horizontal			
	Max Rxn (lb)	Load Comb.	Min Rxn (lb)	Load Comb.	Max Rxn (lb)	Load Comb.	Min Rxn (lb)	Load Comb.
R1	661.70	5	-165.10	6	0.00	1	0.00	1
R2	661.70	5	-165.10	6	0.00	1	0.00	1

Rafter Flexural and Deflection

Mmax (ft-lb)	Ma (ft-lb)	Mmax/ Ma	Load Comb.	Span Defl	Load Comb.	Overhang Defl	Load Comb.
2151	2313	0.93	5	L/201	5	L/201	5

Rafter Bending and Web Crippling

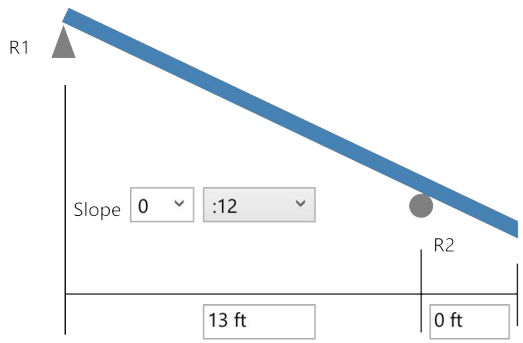
Support	Load (lb)	Load Comb.	Bearing (in)	Pa (lb)	Pn (lb)	Max Intr.	Load Comb.	Stiffeners Req'd
R1	661.7	5	1.00	598.9	1048.1	0.57	5	YES
R2	661.7	5	3.50	841.0	1471.7	0.41	5	NO

Rafter Bending and Shear

Support	Vmax (lb)	Load Comb.	Va Factor	V/Va	M/Ma	Intr. Unstiffen	Load Comb.	Intr. Stiffen	Load Comb.
R1	662	5	1.000	0.23	0.00	0.23	5	N/A	N/A
R2	662	5	0.690	0.34	0.00	0.34	5	N/A	N/A

Project Name: Roof Framing
Model: Rafter – Wind Up
Code: AISI S100-16w/S2-20

Date: 11/24/2025
Simpson Strong-Tie® CFS Designer™ 5.2.8.0



Section : 600S162-54 (50 ksi) @ 24" o.c. Single C Stud (punched)
Maxo = 2313.4(ft-lb) **Va =** 2822.9 **I =** 2.860 in^4

Bracing, Interconnection and Distortional Buckling Parameters

	Span	Overhang
Flexural Bracing	Mid-Pt	None
Axial Bracing	NA	None
Distortional Buckling, K-phi	0 lb-in/in	0 lb-in/in
Distortional Buckling Bracing, Lm	Mid-Pt	Mid-Pt

Load Cases

	Span (psf)	Overhang (psf)
Dead Load	14	NA
Live Load	0.01	NA
Snow Load	0	NA
Inward Wind Load	0	NA
Outward Wind Load	-21.1	NA

Load Combinations

LC Number	Dead	Live	Snow	Inward Wind	Outward Wind
1	1	1	0	0	0
2	1	0	1	0	0
3	1	0	0	1	0
4	1	0.75	0	0.75	0
5	1	0	0.75	0.75	0
6	0.6	0	0	0	1

Reactions

	Vertical				Horizontal			
	Max Rxn (lb)	Load Comb.	Min Rxn (lb)	Load Comb.	Max Rxn (lb)	Load Comb.	Min Rxn (lb)	Load Comb.
R1	182.13	1	-165.10	6	0.00	1	0.00	1
R2	182.13	1	-165.10	6	0.00	1	0.00	1

Rafter Flexural and Deflection

Mmax (ft-lb)	Ma (ft-lb)	Mmax/ Ma	Load Comb.	Span Defl	Load Comb.	Overhang Defl	Load Comb.
592	1552	0.38	1	L/731	1	L/731	1

Rafter Bending and Web Crippling

Support	Load (lb)	Load Comb.	Bearing (in)	Pa (lb)	Pn (lb)	Max Intr.	Load Comb.	Stiffeners Req'd
R1	182.1	1	1.00	598.9	1048.1	0.16	1	NO
R2	182.1	1	3.50	841.0	1471.7	0.11	1	NO

Rafter Bending and Shear

Support	Vmax (lb)	Load Comb.	Va Factor	V/Va	M/Ma	Intr. Unstiffen	Load Comb.	Intr. Stiffen	Load Comb.
R1	182	1	1.000	0.06	0.00	0.06	1	N/A	N/A
R2	182	1	0.690	0.09	0.00	0.09	1	N/A	N/A

Steel Beam

Project File: Trash Enclosure.ec6

DESCRIPTION: Center Beam - Wind Down

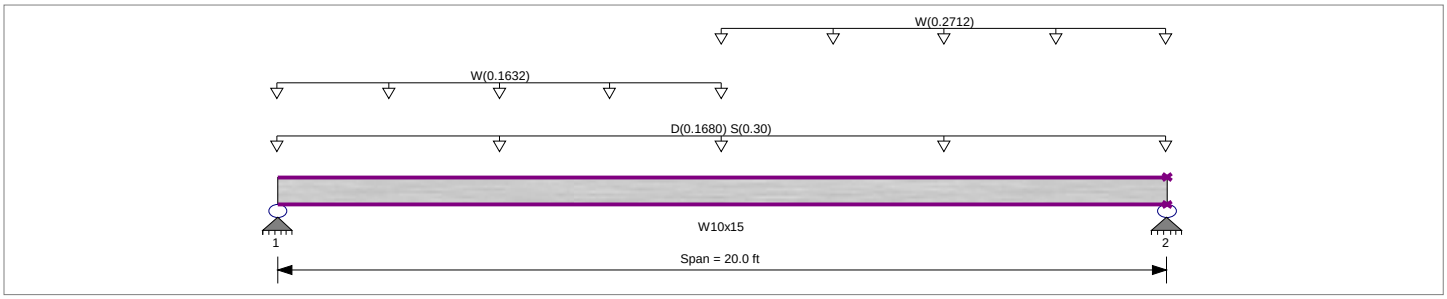
Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0140, S = 0.0250 ksf, Tributary Width = 12.0 ft, (Roof)
Uniform Load : W = 0.01360 ksf, Extent = 0.0 -->> 10.0 ft, Tributary Width = 12.0 ft, (Wind - Cnw)
Uniform Load : W = 0.02260 ksf, Extent = 10.0 -->> 20.0 ft, Tributary Width = 12.0 ft, (Wind - Cnl)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.634 : 1	Maximum Shear Stress Ratio =	0.113 : 1
Section used for this span	W10x15	Section used for this span	W10x15
Ma : Applied	25.301 k-ft	Va : Applied	5.179 k
Mn / Omega : Allowable	39.920 k-ft	Vn/Omega : Allowable	45.954 k
Load Combination	+D+0.750S+0.450W	Load Combination	+D+0.750S+0.450W
		Location of maximum on span	20.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.542 in	Ratio =	442	>=240.	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<240.0	n/a
Max Downward Total Deflection	0.915 in	Ratio =	262	>=180	Span: 1 : +D+0.750S+0.450W
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
D Only												
Dsgn. L = 20.00 ft	1	0.229	0.040	9.15		9.15	66.67	39.92	1.00	1.00	1.83	68.93 45.95
+D+S												
Dsgn. L = 20.00 ft	1	0.605	0.105	24.15		24.15	66.67	39.92	1.00	1.00	4.83	68.93 45.95
+D+0.750S												
Dsgn. L = 20.00 ft	1	0.511	0.089	20.40		20.40	66.67	39.92	1.00	1.00	4.08	68.93 45.95
+D+0.60W												
Dsgn. L = 20.00 ft	1	0.393	0.072	15.70		15.70	66.67	39.92	1.00	1.00	3.30	68.93 45.95
+D+0.450W												
Dsgn. L = 20.00 ft	1	0.352	0.064	14.06		14.06	66.67	39.92	1.00	1.00	2.93	68.93 45.95
+D+0.750S+0.450W												
Dsgn. L = 20.00 ft	1	0.634	0.113	25.30		25.30	66.67	39.92	1.00	1.00	5.18	68.93 45.95
+0.60D+0.60W												
Dsgn. L = 20.00 ft	1	0.302	0.056	12.05		12.05	66.67	39.92	1.00	1.00	2.56	68.93 45.95
+0.60D												
Dsgn. L = 20.00 ft	1	0.138	0.024	5.49		5.49	66.67	39.92	1.00	1.00	1.10	68.93 45.95

Steel Beam

Project File: Trash Enclosure.ec6

DESCRIPTION: Center Beam - Wind Down

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+0.750S+0.450W	0.9154	10.057		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	4.936	5.179
Max Upward from Load Combinations	4.936	5.179
Max Upward from Load Cases	3.000	3.000
D Only	1.830	1.830
+D+S	4.830	4.830
+D+0.750S	4.080	4.080
+D+0.60W	2.971	3.295
+D+0.450W	2.686	2.929
+D+0.750S+0.450W	4.936	5.179
+0.60D+0.60W	2.239	2.563
+0.60D	1.098	1.098
S Only	3.000	3.000
W Only	1.902	2.442

Steel Beam

Project File: Trash Enclosure.ec6

DESCRIPTION: Center Beam - Wind Up

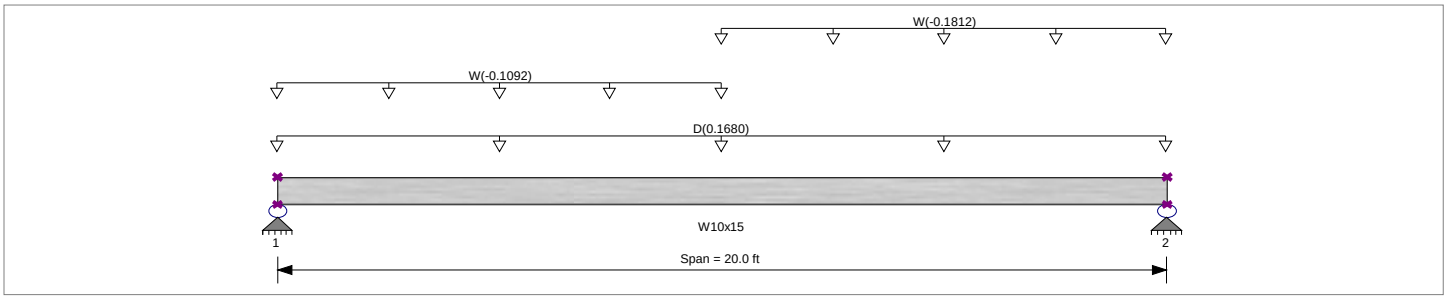
Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0140 ksf, Tributary Width = 12.0 ft, (Roof)
Uniform Load : W = -0.00910 ksf, Extent = 0.0 -->> 10.0 ft, Tributary Width = 12.0 ft, (Wind - Cnw)
Uniform Load : W = -0.01510 ksf, Extent = 10.0 -->> 20.0 ft, Tributary Width = 12.0 ft, (Wind - Cnl)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.140 : 1	Maximum Shear Stress Ratio =	0.007 : 1
Section used for this span	W10x15	Section used for this span	W10x15
Ma : Applied	1.266 k-ft	Va : Applied	0.3348 k
Mn / Omega : Allowable	9.052 k-ft	Vn/Omega : Allowable	45.954 k
Load Combination	+0.60D+0.60W	Load Combination	+0.60D+0.60W
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0 in	Ratio =	0 <240.0	n/a
Max Upward Transient Deflection	-0.263 in	Ratio =	912 >=240.	Span: 1 : W Only
Max Downward Total Deflection	0.331 in	Ratio =	725 >=180	Span: 1 : D Only
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
+0.60D+0.60W													
Dsgn. L = 20.00 ft	1	0.140	0.007	1.27		1.27	15.12	9.05	1.24	1.00	0.33	68.93	45.95

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	D Only	0.3312	10.057		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.830	1.830
Max Upward from Load Combinations	1.258	1.098
Max Upward from Load Cases	1.830	1.830
Max Downward from all Load Conditions (Resisting Uplift)	-1.272	-1.632
Max Downward from Load Cases (Resisting Uplift)	-1.272	-1.632
D Only	1.830	1.830
+D+0.60W	1.067	0.851
+D+0.450W	1.258	1.096
+0.60D+0.60W	0.335	0.119
+0.60D	1.098	1.098

Steel Beam

DESCRIPTION: Center Beam - Wind Up

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
W Only	-1.272	-1.632

Steel Column

Project File: Trash Enclosure.ec6

DESCRIPTION: W6 Drag

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **W6x12**

Analysis Method :	Allowable Strength
Steel Stress Grade	
Fy : Steel Yield	50 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height	13 ft
Top & Bottom Fixity	Top & Bottom Pinned
Brace condition :	

Unbraced Length for buckling ABOUT X-X Axis = 13 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 13 ft, K = 1.0

Applied Loads

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

Column self weight included : 156.0 lbs * Dead Load Factor
AXIAL LOADS . . .
Overstrength Drag Force: Axial Load at 13.0 ft, E = 1.940 k
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, D = 0.0280, S = 0.050 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = 0.1514 : 1

Load Combination	+1.106D+0.750S+0.5250E	
Location of max.above base	6.456	ft
At maximum location values are . . .		
Pa : Axial	1.191	k
Pn / Omega : Allowabl	18.478	k
Ma-x : Applied	1.446	k-ft
Mn-x / Omega : Allowable	12.133	k-ft
Ma-y : Applied	0.0	k-ft
Mn-y / Omega : Allowable	5.788	k-ft

PASS Maximum Shear Stress Rati 0.01828 : 1

Load Combination	+D+S	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Va : Applied	0.5070	k
Vn / Omega : Allowable	27.738	k

Maximum Load Reactions . .

Top along X-X	k
Bottom along X-X	k
Top along Y-Y	k
Bottom along Y-Y	k

Maximum Load Deflections . . .

Along Y-Y in at ft above base
for load combination :

Along X-X in at ft above base
for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Extreme Reactions

Item	Extreme Value	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance

Steel Section Properties : W6x12

Steel Section Properties : W6x12

Steel Column

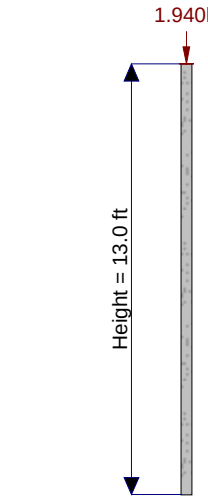
Project File: Trash Enclosure.ec6

DESCRIPTION: W6 Drag

Depth	=	6.030	in	I xx	=	22.10	in^4	J	=	0.090	in^4
Web Thick	=	0.230	in	S xx	=	7.31	in^3	Cw	=	24.70	in^6
Flange Width	=	4.000	in	R xx	=	2.490	in				
Flange Thick	=	0.280	in	Zx	=	8.300	in^3				
Area	=	3.550	in^2	I yy	=	2.990	in^4				
Weight	=	12.000	plf	S yy	=	1.500	in^3	Wno	=	5.750	in^2
Kdesign	=	0.530	in	R yy	=	0.918	in	Sw	=	1.610	in^4
K1	=	0.563	in	Zy	=	2.320	in^3	Qf	=	1.520	in^3
rts	=	1.080	in					Qw	=	4.080	in^3
Ycg	=	0.000	in								

Sketches

My Loads - Looking along Y-Y Axis



My Loads - Looking along X-X Axis