



harris & sloan

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Structural &
Mechanical
Engineers

Cota Vera Swim Club for Homefed Corporation

to be constructed in Chula Vista, CA

Structural Calculations per 2022 CBC for Trellis & Trash Enclosure

Harris & Sloan Job # HS22244



Initial Submittal Date: 1/13/2023



Seismic Design Per IBC Section 1613 & ASCE 7 Chapters 11 & 12

Site Information		Short Period Response		1-Second Period Response	
S _s	0.754 IBC Sect. 1613.3.1	F _a	1.200 CBC 1613.2.3	F _v	1.500 CBC 1613.2.3
S ₁	0.275 IBC Sect. 1613.1.1	S _{MS} = F _a S _s	0.905 CBC Eqn. 16-36	S _{M1} = F _v S ₁	0.413 CBC Eqn. 16-37
Site Class	C	S _{DS} = (2/3) S _{MS}	0.603 CBC Eqn. 16-38	S _{D1} = (2/3) S _{M1}	0.275 CBC Eqn. 16-39

Seismic Loads: ASCE 7 Chapter 15 (Non-Building Structures)

Principal Code Equations

ASCE Eqn. 12.8-1	ASCE Eqn. 12.8-2	ASCE Eqn. 12.8-3	ASCE Eqn. 12.8-5	ASCE Eqn. 12.8-6
$V = C_s W$	$C_s = \frac{S_{DS}}{\left(\frac{R}{I_e}\right)}$	$C_s = \frac{S_{D1}}{T \left(\frac{R}{I_e}\right)}$	$C_s = 0.044 S_{DS} I_e \geq 0.01$	$C_s = 0.5 S_1 / (R I_e)$
ASCE Eqn. 15.4-1	ASCE Eqn. 15.4-2	ASCE Eqn. 15.4-6	$T = 2\pi \sqrt{\frac{\sum_{i=1}^n f_i \delta_i^2}{g \sum_{i=1}^n f_i \delta_i}}$	
$C_s = 0.044 S_{DS} I_e$	$C_s = 0.8 S_1 / (R I_e)$			

Seismic Forces on Non-Building Structures

Seismic loads on non-building structures are determined per ASCE 7 chapter 15. Site info, short and 1-second period responses, and response coefficient max/mins are the same as determined previously except where ch. 15 values govern. Calculations are for for 1-story structures only, no vertical load distribution calculations req'd.

Seismic Forces on Non-Building Structures											
Structure Description	Reference	Risk Cat.	Importance	SDC	Sim to Bldg	Weight (W)	R	Elast Defl	T	Cs	0.7 V
Trellis (LOAD TO WORST-CASE COLUMN)		II	1.00	D	No	2310 lb	1.50	0.20	0.50	0.402	650 lb
Trash Enclosure Trellis		II	1.00	D	No	1496 lb	1.50	0.20	0.50	0.402	421 lb
Trash Enclosure Wall		II	1.00	D	No	750 plf	2.00	0.20	0.50	0.302	158 lb
6' Concrete Wall		II	1.00	D	No	900 lb	2.00	0.20	0.50	0.302	190 lb



Wind Design

Site Information (Wind)

Exposure Category	C (ASCE 7 26.7.3)	Hill Type	None
Directionality Factor (K_d)	0.85 (ASCE 7 Table 26.6-1)	Hill Height, (H)	NA ft
Gust Factor (G)	0.85 (ASCE 7 26.9.1)	Hill Length, (L_h)	NA ft
		Distance to Peak, (x)	NA ft

Wind Design Per IBC/ASCE 7 Chapters 26, 27, & 30

Principal Code Equations

ASCE 7 - Fig 26.8-1	$K_2 = (1 - \frac{ x }{\mu L_h})$	ASCE Eqn. 29.3-1	ASCE Eqn. 29.5-1
Equations	$K_{zt} = (1 + K_1 K_2 K_3)^2$	$q_z = 0.00256 K_z K_{zt} K_d V^2$ (lb/ft ²)	$F = q_z G C_f A_f$ (lb) (N)
	$K_3 = e^{-\gamma z/L_h}$	ASCE Eqn. 29.4-1	
		$F = q_h G C_f A_f$ (lb) (N)	

Wind Forces on Non-Building Structures

Wind Forces on Solid, Free-Standing Walls & Signs (ASCE 7, Ch.29.4) and Other Structures (ASCE 7, Ch.29.5)											
Structure Description	Reference	Risk Cat.	BWS (V)	Height	kz	kzt	0.6 qz	Cf	0.6 P	As	0.6 F
Trellis (LOAD TO WORST)		II	96 mph	20.50 ft	0.91	1.00	10.9 psf	1.46	13.5 psf	132.14 sf	1789 lb
Trash Enclosure Trellis		II	96 mph	10.67 ft	0.85	1.00	10.2 psf	1.46	12.7 psf	15.45 sf	196 lb
Trash Enclosure Wall		II	96 mph	6.00 ft	0.85	1.00	10.2 psf	1.40	12.2 psf	6.00 sf	73 lb
6' Concrete Wall		II	96 mph	6.00 ft	0.85	1.00	10.2 psf	1.37	11.9 psf	6.00 sf	71 lb



Wind & Seismic Design

Forces on Non-Building Structures							
Structure Description	Reference	Strength-level			Service-level		
		V	F	Governs	0.7 V	0.6 F	Governs
Trellis (LOAD TO WORST)	0	929 lb	2981 lb	WIND	650 lb	1789 lb	WIND
Trash Enclosure Trellis	0	602 lb	327 lb	SEISMIC	421 lb	196 lb	SEISMIC
Trash Enclosure Wall	0	226 lb	122 lb	SEISMIC	158 lb	73 lb	SEISMIC
6' Concrete Wall	0	271 lb	119 lb	SEISMIC	190 lb	71 lb	SEISMIC



Foundation Calculations

Soils Engineer & Report

Advanced Geotechnical Solutions, Inc.
485 Corporate Drive, Suite B
Escondido, CA 92029

Report #: 2202-04-B-2
Date: 04/08/2022

Foundation Design Information

General Foundation Design Parameters

Allowable Soil Pressure	2000 psf
Min Footing Depth	24 in
Passive Pressure	250 pcf
1/3 Increase for Short-Term Loads?	Yes
Friction Factor	0.35
OK to Combine Friction & Passive?	Yes
% Friction usable	50% %
% Passive usable	100% %
Height of Soil Over Toe to Neglect	12 in

Retaining Wall & Pier Footing Design Parameters

Passive pressure over 2x pier dia.?	Yes
Active Pressure	38 pcf

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Wood Column

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ecb

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 10x10 Squash Post

Code References

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

General Information

Analysis Method	Allowable Stress Design			Wood Section Name	10x10
End Fixities	Top Pinned, Bottom Fixed			Wood Grading/Manuf.	Graded Lumber
Overall Column Height	10 ft			Wood Member Type	Sawn
<i>(Used for non-slender calculations)</i>					
Wood Species	Douglas Fir-Larch			Exact Width	9.50 in
Wood Grade	No.1			Exact Depth	9.50 in
Fb +	1,000.0 psi	Fv	180.0 psi	Area	90.250 in ²
Fb -	1,000.0 psi	Ft	675.0 psi	Ix	678.76 in ⁴
Fc - Prll	1,500.0 psi	Density	31.210 pcf	Iy	678.76 in ⁴
Fc - Perp	625.0 psi	Incising Factors :			
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial	for Bending	0.80
	Basic	1,700.0	1,700.0	for Elastic Modulus	0.95
	Minimum	620.0	620.0		
			1,700.0 ksi		
				Brace condition for deflection (buckling) along columns :	
				X-X (width) axis :	Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, k
				Y-Y (depth) axis :	Unbraced Length for buckling ABOUT X-X Axis = 10 ft, k

Applied Loads

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

Column self weight included : 195.604 lbs * Dead Load Factor

AXIAL LOADS . . .

3-Pt Beam Above: Axial Load at 10.0 ft, D = 1.268, Lr = 1.208 k

BENDING LOADS . . .

Wind: Lat. Point Load at 10.0 ft creating Mx-x, W = 1.789 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.04683 : 1	Maximum SERVICE Lateral Load Reactions . .	
Load Combination	+D+Lr	Top along Y-Y	1.789 k
Governing NDS Formula	Comp Only, fc/Fc'	Bottom along Y-Y	0.0 k
Location of max.above base	0.0 ft	Top along X-X	0.0 k
At maximum location values are .		Bottom along X-X	0.0 k
Applied Axial	2.672 k	Maximum SERVICE Load Lateral Deflections . . .	
Applied Mx	0.0 k-ft	Along Y-Y	0.0 in at 0.0 ft above base
Applied My	0.0 k-ft	for load combination :	n/a
Fc : Allowable	632.18 psi	Along X-X	0.0 in at 0.0 ft above base
		for load combination :	n/a
PASS Maximum Shear Stress Ratio =	0.1291 : 1	Other Factors used to calculate allowable stresses . . .	
Load Combination	+D+W	Bending	Compression
Location of max.above base	10.0 ft	Tension	
Applied Design Shear	29.734 psi		
Allowable Shear	230.40 psi		

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.542	0.02769	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+Lr	1.250	0.421	0.04683	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+0.750Lr	1.250	0.421	0.04153	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+W	1.600	0.342	0.02472	PASS	0.0 ft	0.1291	PASS	10.0 ft
+D-W	1.600	0.342	0.02472	PASS	0.0 ft	0.1291	PASS	10.0 ft
+D+0.750Lr+0.750W	1.600	0.342	0.04002	PASS	0.0 ft	0.09679	PASS	10.0 ft
+D+0.750Lr-0.750W	1.600	0.342	0.04002	PASS	0.0 ft	0.09679	PASS	10.0 ft
+D+0.750W	1.600	0.342	0.02472	PASS	0.0 ft	0.09679	PASS	10.0 ft
+D-0.750W	1.600	0.342	0.02472	PASS	0.0 ft	0.09679	PASS	10.0 ft

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Wood Column

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 10x10 Squash Post

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+0.60D+W	1.600	0.342	0.01483	PASS	0.0 ft	0.1291	PASS	10.0 ft
+0.60D-W	1.600	0.342	0.01483	PASS	0.0 ft	0.1291	PASS	10.0 ft
+0.60D	1.600	0.342	0.01483	PASS	0.0 ft	0.0	PASS	10.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top
D Only						1.464				
+D+Lr						2.672				
+D+0.750Lr						2.370				
+D+W				1.789		1.464				
+D+0.750Lr+0.750W				1.342		2.370				
+D+0.750W				1.342		1.464				
+0.60D+W				1.789		0.878				
+0.60D						0.878				
Lr Only						1.208				
W Only				1.789						

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Max. Y-Y Deflection	
	Distance	Distance	Distance	Distance
D Only	0.0000 in	0.000ft	0.000 in	0.000ft
+D+Lr	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750Lr	0.0000 in	0.000ft	0.000 in	0.000ft
+D+W	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750Lr+0.750W	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750W	0.0000 in	0.000ft	0.000 in	0.000ft
+0.60D+W	0.0000 in	0.000ft	0.000 in	0.000ft
+0.60D	0.0000 in	0.000ft	0.000 in	0.000ft
Lr Only	0.0000 in	0.000ft	0.000 in	0.000ft
W Only	0.0000 in	0.000ft	0.000 in	0.000ft

Wood Column

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

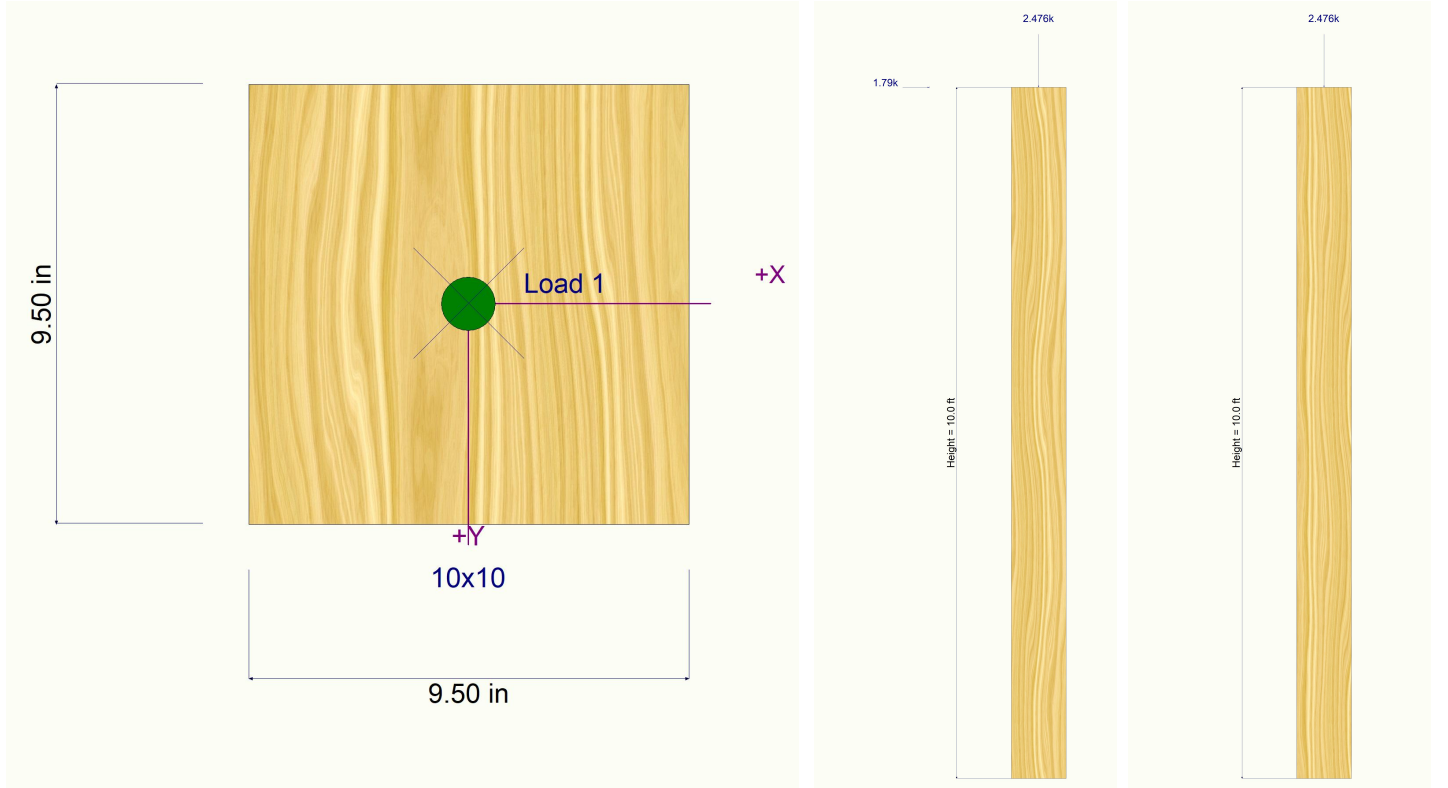
LIC# : KW-06014152, Build:20.22.10.25

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DESCRIPTION: 10x10 Squash Post

Sketches



Project Title:
 Engineer:
 Project ID:
 Project Descr:

Wood Column

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ecb

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 12x12 Worst-Case Post

Code References

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

General Information

Analysis Method	Allowable Stress Design			Wood Section Name	12x12
End Fixities	Top Free, Bottom Fixed			Wood Grading/Manuf.	Graded Lumber
Overall Column Height	10 ft			Wood Member Type	Sawn
<i>(Used for non-slender calculations)</i>					
Wood Species	Douglas Fir-Larch			Exact Width	11.50 in
Wood Grade	No.1			Exact Depth	11.50 in
Fb +	1,000.0 psi	Fv	180.0 psi	Area	132.250 in ²
Fb -	1,000.0 psi	Ft	675.0 psi	Ix	1,457.51 in ⁴
Fc - Prll	1,500.0 psi	Density	31.210 pcf	Iy	1,457.51 in ⁴
Fc - Perp	625.0 psi			Incising Factors :	
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial	for Bending	0.80
	Basic	1,700.0	1,700.0	for Elastic Modulus	0.95
	Minimum	620.0	620.0		
				Allow Stress Modification Factors	
				Cf or Cv for Bending	1.0
				Cf or Cv for Compression	1.0
				Cf or Cv for Tension	1.0
				Cm : Wet Use Factor	1.0
				Ct : Temperature Fact	1.0
				Cfu : Flat Use Factor	1.0
				Kf : Built-up columns	1.0 <i>NDS 15.3.2</i>
				Use Cr : Repetitive ?	No
Brace condition for deflection (buckling) along columns :					
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, k					
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 10 ft, k					

Applied Loads

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

Column self weight included : 286.634 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 10.0 ft, D = 2.310 k

BENDING LOADS . . .

Lat. Point Load at 10.0 ft creating Mx-x, W = 1.789 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.6746 : 1	Maximum SERVICE Lateral Load Reactions . .	
Load Combination	+D+W	Top along Y-Y	1.789 k
Governing NDS Formula Comp + Mxx, NDS Eq. 3.9-3		Bottom along Y-Y	1.789 k
Location of max.above base	0.0 ft	Top along X-X	0.0 k
At maximum location values are .		Bottom along X-X	0.0 k
Applied Axial	2.597 k	Maximum SERVICE Load Lateral Deflections . . .	
Applied Mx	-17.890 k-ft	Along Y-Y	0.4356 in at 10.0 ft above base
Applied My	0.0 k-ft	for load combination : +D+W	
Fc : Allowable	901.67 psi	Along X-X	0.0 in at 0.0 ft above base
		for load combination : n/a	
PASS Maximum Shear Stress Ratio =	0.08807 : 1	Other Factors used to calculate allowable stresses . . .	
Load Combination	+D+W	<u>Bending</u>	<u>Compression</u>
Location of max.above base	9.933 ft	<u>Tension</u>	
Applied Design Shear	20.291 psi		
Allowable Shear	230.40 psi		

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.685	0.02654	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+W	1.600	0.470	0.6746	PASS	0.0 ft	0.08807	PASS	9.933 ft
+D-W	1.600	0.470	0.6746	PASS	0.0 ft	0.08807	PASS	9.933 ft
+D+0.750W	1.600	0.470	0.5061	PASS	0.0 ft	0.06605	PASS	9.933 ft
+D-0.750W	1.600	0.470	0.5061	PASS	0.0 ft	0.06605	PASS	9.933 ft
+0.60D+W	1.600	0.470	0.6693	PASS	0.0 ft	0.08807	PASS	9.933 ft
+0.60D-W	1.600	0.470	0.6693	PASS	0.0 ft	0.08807	PASS	9.933 ft
+0.60D	1.600	0.470	0.01307	PASS	0.0 ft	0.0	PASS	10.0 ft

Wood Column

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 12x12 Worst-Case Post

Maximum Reactions

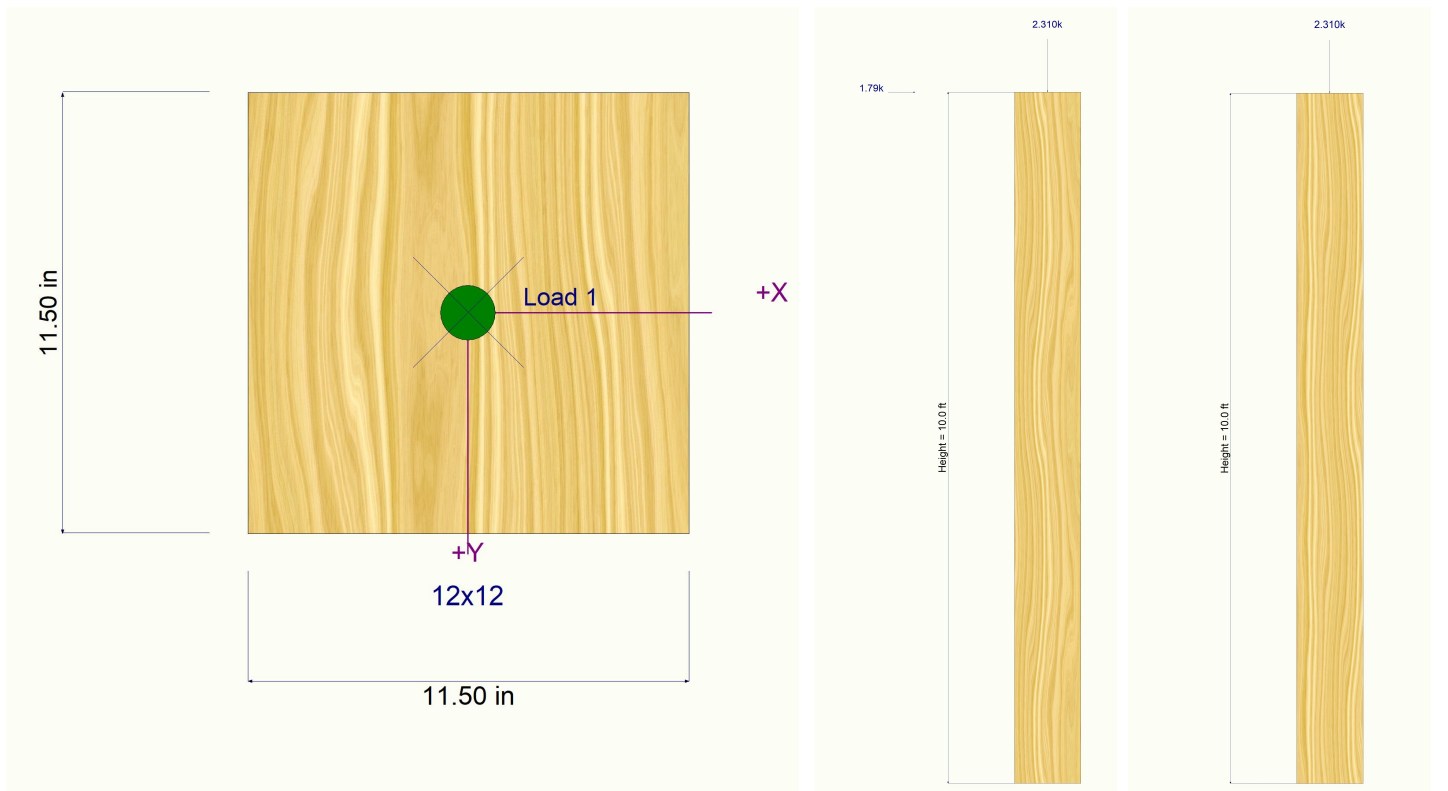
Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top
D Only					1.789	2.597				
+D+W				1.789	1.789	2.597			17.890	
+D+0.750W				1.342	1.789	2.597			13.418	
+0.60D+W				1.789	1.789	1.558			17.890	
+0.60D					1.789	1.558				
W Only				1.789	1.789				17.890	

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000ft	0.000 in	0.000ft
+D+W	0.0000 in	0.000ft	0.436 in	10.000ft
+D+0.750W	0.0000 in	0.000ft	0.327 in	10.000ft
+0.60D+W	0.0000 in	0.000ft	0.436 in	10.000ft
+0.60D	0.0000 in	0.000ft	0.000 in	0.000ft
W Only	0.0000 in	0.000ft	0.431 in	9.933ft

Sketches



Wood Beam

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

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DESCRIPTION: 10x12 F-B Beam (4-PT)

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

Load Combination Set : HSNonBeams

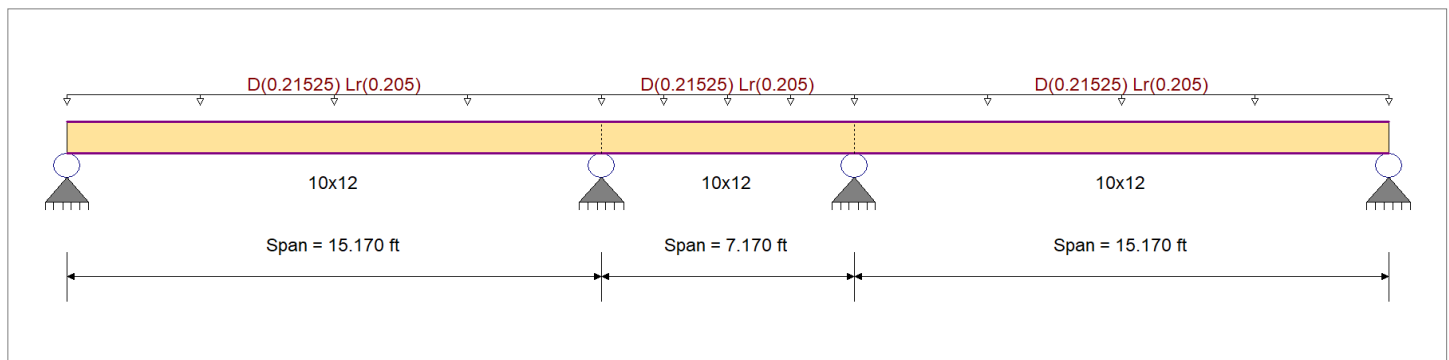
Material Properties

Analysis Method : Allowable Stress Design
 Load Combination : HSNonBeams

Wood Species : Douglas Fir-Larch
 Wood Grade : No.1

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	1,000.0 psi	E : Modulus of Elasticity	
Fb -	1,000.0 psi	Ebend- xx	1,700.0ksi
Fc - Prll	1,500.0 psi	Eminbend - xx	620.0ksi
Fc - Perp	625.0 psi		
Fv	180.0 psi		
Ft	675.0 psi	Density	31.210pcf



Applied Loads

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

Beam self weight NOT internally calculated and added

Load for Span Number 1

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Tributary Width = 10.250 ft

Load for Span Number 2

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Tributary Width = 10.250 ft

Load for Span Number 3

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Tributary Width = 10.250 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.487 : 1	Maximum Shear Stress Ratio	=	0.254 : 1
Section used for this span		10x12	Section used for this span		10x12
fb: Actual	=	486.82psi	fv: Actual	=	45.70 psi
F'b	=	1,000.00psi	F'v	=	180.00 psi
Load Combination		+D+Lr	Load Combination		+D+Lr
Location of maximum on span	=	6.374ft	Location of maximum on span	=	14.278 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection		0.079 in Ratio = 2314 >=360	Span: 3 : Lr Only		
Max Upward Transient Deflection		-0.016 in Ratio = 5445 >=360	Span: 2 : Lr Only		
Max Downward Total Deflection		0.161 in Ratio = 1129 >=240	Span: 3 : +D+Lr		
Max Upward Total Deflection		-0.032 in Ratio = 2656 >=240	Span: 2 : +D+Lr		

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values				
			M	V	CD	CM	C _t	CL _x	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v	
D Only																			
	Length = 15.170 ft	1	0.346	0.181	0.90	1.00	1.00	1.00	1.000	1.00	0.80	1.00	4.35	249.3	720.0	0.0	1.70	23.4	129.6
	Length = 7.170 ft	2	0.319	0.181	0.90	1.00	1.00	1.00	1.000	1.00	0.80	1.00	4.01	229.6	720.0	0.0	1.70	23.4	129.6
	Length = 15.170 ft	3	0.346	0.181	0.90	1.00	1.00	1.00	1.000	1.00	0.80	1.00	4.35	249.3	720.0	0.0	1.70	23.4	129.6
+D+Lr																			
	Length = 15.170 ft	1	0.487	0.254	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	8.49	486.8	1,000.0	0.0	3.33	45.7	180.0

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Wood Beam

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

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DESCRIPTION: 10x12 F-B Beam (4-PT)

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values			
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F ^b	V	f _v	F ^v
	Length = 7.170 ft	2	0.448	0.254	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	7.82	448.2	1,000.0	3.33	45.7	180.0
	Length = 15.170 ft	3	0.487	0.254	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	8.49	486.8	1,000.0	3.33	45.7	180.0
+D+0.750Lr															0.0	0.00	0.0	0.0
	Length = 15.170 ft	1	0.427	0.223	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	7.46	427.4	1,000.0	2.92	40.1	180.0
	Length = 7.170 ft	2	0.394	0.223	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	6.87	393.5	1,000.0	2.92	40.1	180.0
	Length = 15.170 ft	3	0.427	0.223	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	7.46	427.4	1,000.0	2.92	40.1	180.0
+0.60D															0.0	0.00	0.0	0.0
	Length = 15.170 ft	1	0.117	0.061	1.60	1.00	1.00	1.00	1.000	1.00	0.80	1.00	2.61	149.6	1,280.0	1.02	14.0	230.4
	Length = 7.170 ft	2	0.108	0.061	1.60	1.00	1.00	1.00	1.000	1.00	0.80	1.00	2.40	137.7	1,280.0	1.02	14.0	230.4
	Length = 15.170 ft	3	0.117	0.061	1.60	1.00	1.00	1.00	1.000	1.00	0.80	1.00	2.61	149.6	1,280.0	1.02	14.0	230.4

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+Lr	1	0.1612	7.011		0.0000	0.000
	2	0.0000	7.011	+D+Lr	-0.0324	3.615
+D+Lr	3	0.1601	8.286		0.0000	3.615

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Max Upward from all Load Conditions	2.672	5.210	5.210	2.672
Max Upward from Load Combinations	2.672	5.210	5.210	2.672
Max Upward from Load Cases	1.369	2.668	2.668	1.369
D Only	1.369	2.668	2.668	1.369
+D+Lr	2.672	5.210	5.210	2.672
+D+0.750Lr	2.346	4.574	4.574	2.346
+0.60D	0.821	1.601	1.601	0.821
Lr Only	1.303	2.541	2.541	1.303

Wood Beam

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ecb

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 10x14 F-B Beam (4-PT)

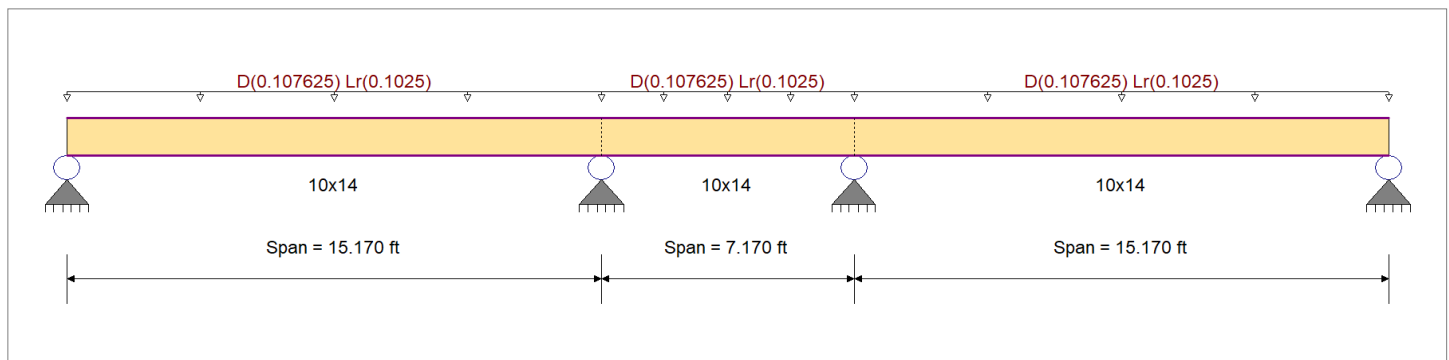
CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

Load Combination Set : HSNonBeams

Material Properties

Analysis Method : Allowable Stress Design	Fb +	1,000.0 psi	E : Modulus of Elasticity
Load Combination : HSNonBeams	Fb -	1,000.0 psi	Ebend- xx
	Fc - Prll	1,500.0 psi	Eminbend - xx
Wood Species : Douglas Fir-Larch	Fc - Perp	625.0 psi	
Wood Grade : No.1	Fv	180.0 psi	
	Ft	675.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			31.210pcf



Applied Loads

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

Beam self weight NOT internally calculated and added

Load for Span Number 1

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Tributary Width = 5.125 ft

Load for Span Number 2

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Tributary Width = 5.125 ft

Load for Span Number 3

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Tributary Width = 5.125 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.179	1	Maximum Shear Stress Ratio	=	0.106	: 1
Section used for this span		10x14		Section used for this span		10x14	
fb: Actual	=	176.63psi		fv: Actual	=	19.15 psi	
F'b	=	987.00psi		F'v	=	180.00 psi	
Load Combination		+D+Lr		Load Combination		+D+Lr	
Location of maximum on span	=	8.796ft		Location of maximum on span	=	14.150ft	
Span # where maximum occurs	=	Span # 3		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		0.024 in	Ratio =	7488	>=	360	Span: 3 : Lr Only
Max Upward Transient Deflection		-0.005 in	Ratio =	17619	>=	360	Span: 2 : Lr Only
Max Downward Total Deflection		0.050 in	Ratio =	3653	>=	240	Span: 3 : +D+Lr
Max Upward Total Deflection		-0.010 in	Ratio =	8594	>=	240	Span: 2 : +D+Lr

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values				
			M	V	CD	CM	C _t	CL _x	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v	
D Only																			
	Length = 15.170 ft	1	0.127	0.076	0.90	1.00	1.00	1.00	0.987	1.00	0.80	1.00	2.18	90.5	710.6	0.84	9.8	129.6	0.0
	Length = 7.170 ft	2	0.117	0.076	0.90	1.00	1.00	1.00	0.987	1.00	0.80	1.00	2.00	83.3	710.6	0.84	9.8	129.6	0.0
	Length = 15.170 ft	3	0.127	0.076	0.90	1.00	1.00	1.00	0.987	1.00	0.80	1.00	2.18	90.5	710.6	0.84	9.8	129.6	0.0
+D+Lr																			
	Length = 15.170 ft	1	0.179	0.106	1.25	1.00	1.00	1.00	0.987	1.00	0.80	1.00	4.25	176.6	987.0	1.64	19.1	180.0	0.0

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Wood Beam

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 10x14 F-B Beam (4-PT)

Maximum Forces & Stresses for Load Combinations

Load Combination	Max Stress Ratios											Moment Values			Shear Values		
	Segment Length	Span #	M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv
Length = 7.170 ft	2	0.165	0.106	1.25	1.00	1.00	1.00	0.987	1.00	0.80	1.00	3.91	162.6	987.0	1.64	19.1	180.0
Length = 15.170 ft	3	0.179	0.106	1.25	1.00	1.00	1.00	0.987	1.00	0.80	1.00	4.25	176.6	987.0	1.64	19.1	180.0
+D+0.750Lr						1.00	1.00	1.00	0.987	1.00	0.80			0.0	0.00	0.0	0.0
Length = 15.170 ft	1	0.157	0.093	1.25	1.00	1.00	1.00	0.987	1.00	0.80	1.00	3.73	155.1	987.0	1.44	16.8	180.0
Length = 7.170 ft	2	0.145	0.093	1.25	1.00	1.00	1.00	0.987	1.00	0.80	1.00	3.43	142.8	987.0	1.44	16.8	180.0
Length = 15.170 ft	3	0.157	0.093	1.25	1.00	1.00	1.00	0.987	1.00	0.80	1.00	3.73	155.1	987.0	1.44	16.8	180.0
+0.60D						1.00	1.00	1.00	0.987	1.00	0.80			0.0	0.00	0.0	0.0
Length = 15.170 ft	1	0.043	0.026	1.60	1.00	1.00	1.00	0.987	1.00	0.80	1.00	1.31	54.3	1,263.4	0.50	5.9	230.4
Length = 7.170 ft	2	0.040	0.026	1.60	1.00	1.00	1.00	0.987	1.00	0.80	1.00	1.20	50.0	1,263.4	0.50	5.9	230.4
Length = 15.170 ft	3	0.043	0.026	1.60	1.00	1.00	1.00	0.987	1.00	0.80	1.00	1.31	54.3	1,263.4	0.50	5.9	230.4

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+Lr	1	0.0498	7.011		0.0000	0.000
	2	0.0000	7.011	+D+Lr	-0.0100	3.615
+D+Lr	3	0.0495	8.286		0.0000	3.615

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Max Upward from all Load Conditions	1.336	2.605	2.605	1.336
Max Upward from Load Combinations	1.336	2.605	2.605	1.336
Max Upward from Load Cases	0.684	1.334	1.334	0.684
D Only	0.684	1.334	1.334	0.684
+D+Lr	1.336	2.605	2.605	1.336
+D+0.750Lr	1.173	2.287	2.287	1.173
+0.60D	0.411	0.801	0.801	0.411
Lr Only	0.652	1.271	1.271	0.652

Wood Beam

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 10x10 Typical Rafter

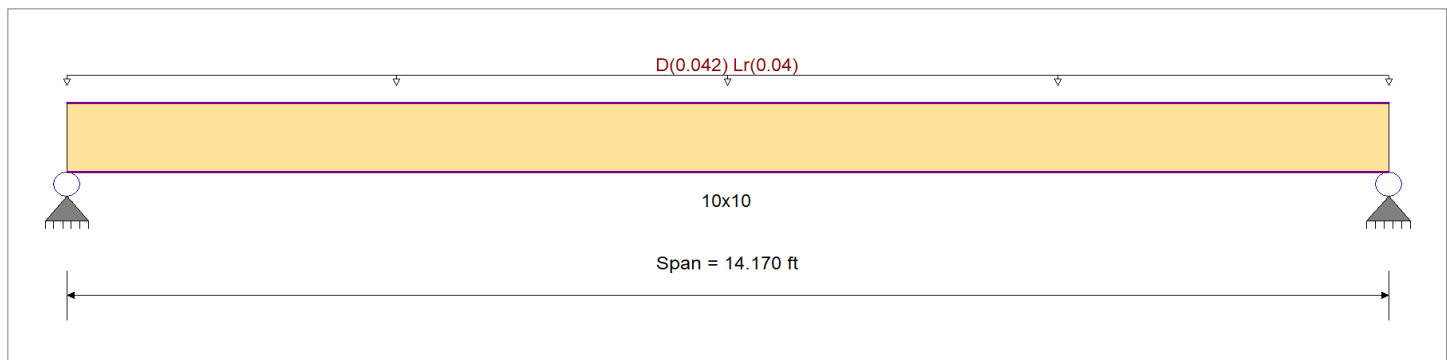
CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

Load Combination Set : HSNonBeams

Material Properties

Analysis Method : Allowable Stress Design	Fb +	1,000.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : HSNonBeams	Fb -	1,000.0 psi	Ebend- xx	1,700.0ksi
	Fc - Prll	1,500.0 psi	Eminbend - xx	620.0ksi
Wood Species : Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade : No.1	Fv	180.0 psi		
	Ft	675.0 psi	Density	31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight NOT internally calculated and added

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.173 < 1	Maximum Shear Stress Ratio	=	0.048 < 1
Section used for this span		10x10	Section used for this span		10x10
fb: Actual	=	172.83psi	fv: Actual	=	8.60 psi
F'b	=	1,000.00psi	F'v	=	180.00 psi
Load Combination		+D+Lr	Load Combination		+D+Lr
Location of maximum on span	=	7.085ft	Location of maximum on span	=	13.394 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection	0.033 in	Ratio = 5107	>=360	Span: 1 : Lr Only	
Max Upward Transient Deflection	0 in	Ratio = 0	<360	n/a	
Max Downward Total Deflection	0.068 in	Ratio = 2491	>=240	Span: 1 : +D+Lr	
Max Upward Total Deflection	0 in	Ratio = 0	<240	n/a	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values			
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v	
D Only																0.0	0.00	0.0	0.0
Length = 14.170 ft	1		0.123	0.034	0.90	1.00	1.00	1.00	1.000	1.00	0.80	1.00	1.05	88.5	720.0	0.26	4.4	129.6	
+D+Lr															0.0	0.00	0.0	0.0	
Length = 14.170 ft	1		0.173	0.048	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	2.06	172.8	1,000.0	0.52	8.6	180.0	
+D+0.750Lr															0.0	0.00	0.0	0.0	
Length = 14.170 ft	1		0.152	0.042	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	1.81	151.8	1,000.0	0.45	7.6	180.0	
+0.60D															0.0	0.00	0.0	0.0	
Length = 14.170 ft	1		0.041	0.011	1.60	1.00	1.00	1.00	1.000	1.00	0.80	1.00	0.63	53.1	1,280.0	0.16	2.6	230.4	

Pole Footing Embedded in Soil

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

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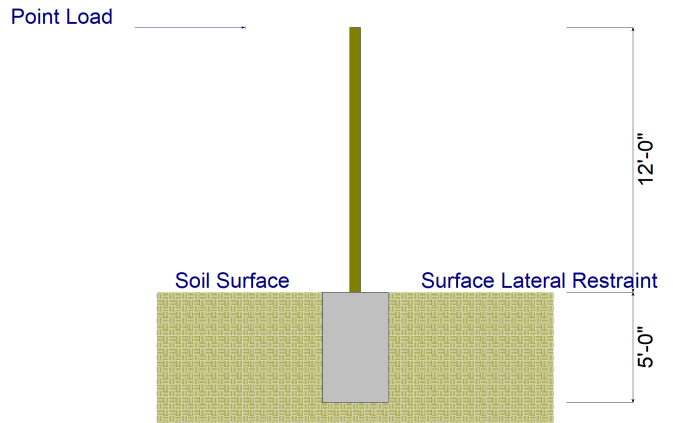
DESCRIPTION: Worst-Case Post Footing

Code References

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

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	36.0 in
Calculate Min. Depth for Allowable Pressures	
Lateral Restraint at Ground Surface	
Allow Passive	250.0 pcf
Max Passive	2,000.0 pcf



Controlling Values

Governing Load Combination	D+W
Lateral Load	1.789 k
Moment	21.468 k-ft
Restraint @ Ground Surface	
Pressure at Depth	
Actual	1,216.52 psf
Allowable	1,250.0 psf
Surface Restraint Force	10,912.9 lbs

Minimum Required Depth	5.0 ft
-------------------------------	---------------

Footing Base Area	7.069 ft ²
Maximum Soil Pressure	0.3674 ksf

Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (k)	Applied Moment (kft)	Vertical Load (k)
D : Dead Load	k	0.0 k-ft	2.597 k
Lr : Roof Live	k	k-ft	k
L : Live	k	k-ft	k
S : Snow	k	k-ft	k
W : Wind	1.789 k	k-ft	k
E : Earthquake	k	k-ft	k
H : Lateral Earth	k	k-ft	k
Load distance above ground surface	12.0 ft		
	TOP of Load above ground surface	ft	
	BOTTOM of Load above ground surface	ft	

Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at Depth		Soil Increase Factor
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)	
D Only	0.000	0.000	0.13	0.0	31.3	1.000
+D+W	1.789	21.468	5.00	1,216.5	1,250.0	1.000
+D-W	1.789	21.468	5.00	1,216.5	1,250.0	1.000
+D+0.750W	1.342	16.101	4.63	1,066.3	1,156.3	1.000
+D-0.750W	1.342	16.101	4.63	1,066.3	1,156.3	1.000
+0.60D+W	1.789	21.468	5.00	1,216.5	1,250.0	1.000
+0.60D-W	1.789	21.468	5.00	1,216.5	1,250.0	1.000
+0.60D	0.000	0.000	0.13	0.0	31.3	1.000

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Trash Enclosure CMU Wall

Code Reference

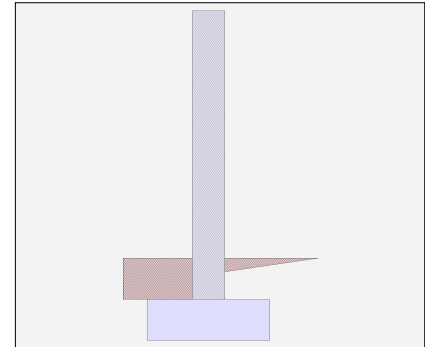
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	1.00 ft
Wall height above soil	=	6.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,667.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	38.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	158.0 #/ft
...Height to Top	=	4.50 ft
...Height to Bottom	=	3.50 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Strength Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Trash Enclosure CMU Wall

Design Summary

Wall Stability Ratios

Overturning	=	1.73	OK
Sliding	=	2.47	OK
Global Stability	=	4.03	
Total Bearing Load	=	1,165 lbs	
...resultant ecc.	=	8.66 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,470 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,667 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,058 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	8.5 psi	OK
Footing Shear @ Heel	=	2.4 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	234.0 lbs	
less 100% Passive Force	= -	375.0 lbs	
less 50% Friction Force	= -	203.8 lbs	
Added Force Req'd	=	0.0 lbs	OK
...for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS
 NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Design Height Above Ftc

ft =	Stem OK				
0.00					
Wall Material Above "Ht"	=	Masonry			
Design Method	=	ASD	SD	SD	SD
Thickness	=	8.00			
Rebar Size	=	# 4			
Rebar Spacing	=	16.00			
Rebar Placed at	=	Center			

Design Data

fb/FB + fa/Fa	=	0.747
---------------	---	-------

Total Force @ Section

Service Level	lbs =	177.0
Strength Level	lbs =	220.4

Moment....Actual

Service Level	ft-# =	638.3
Strength Level	ft-# =	770.1

Moment.....Allowable	=	854.2
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Shear.....Actual

Service Level	psi =	1.9
Strength Level	psi =	1.8

Shear.....Allowable	psi =	45.5
---------------------	-------	------

Anet (Masonry)	in2 =	91.50
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Wall Weight	psf =	84.0
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Rebar Depth 'd'	in =	3.81
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Masonry Data

f'm	psi =	1,500
Fs	psi =	20,000
Solid Grouting	=	Yes
Modular Ratio 'n'	=	21.48
Equiv. Solid Thick.	in =	7.63
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	
Fy	psi =	

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

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DESCRIPTION: Trash Enclosure CMU Wall

Footing Data

Toe Width	=	0.92 ft
Heel Width	=	1.58
Total Footing Width	=	2.50
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c =	2,500 psi	Fy = 60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	2.00	@ Btm.= 3.00 in

Footing Design Results

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	=	2,058	0 psf
Mu' : Upward	=	698	0 ft-#
Mu' : Downward	=	179	179 ft-#
Mu: Design	=	519 OK	179 ft-# OK
phiMn	=	2,500	2,500 ft-#
Actual 1-Way Shear	=	8.45	2.38 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: $\phi M_n = \phi'5 \lambda \sqrt{f_c} S_m$

Heel: $\phi M_n = \phi'5 \lambda \sqrt{f_c} S_m$

Key: No key defined

Min footing T&S reinf Area	0.65	in ²
Min footing T&S reinf Area per foot	0.26	in ² /ft

If one layer of horizontal bars:

- #4 @ 9.26 in
- #5 @ 14.35 in
- #6 @ 20.37 in

If two layers of horizontal bars:

- #4 @ 18.52 in
- #5 @ 28.70 in
- #6 @ 40.74 in

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Trash Enclosure CMU Wall

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	76.0	0.67	50.7	Soil Over HL (ab. water tbl)	100.8	2.04	205.9
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.04	205.9
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	158.0	5.00	790.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	100.8	0.46	46.2
				Surcharge Over Toe =			
				Stem Weight(s) =	588.0	1.25	735.0
				Earth @ Stem Transitions =			
Total	= 234.0	O.T.M. =	840.7	Footing Weight =	375.0	1.25	468.8
				Key Weight =			
				Vert. Component =			
Resisting/Overturning Ratio		= 1.73		Total =	1,164.7 lbs	R.M.=	1,455.8
Vertical Loads used for Soil Pressure =		1,164.7 lbs		* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.114 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Trash Enclosure CMU Wall

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Calculated Rebar Stress, f_s = 14946.12 psi

Lap Splice length for #4 bar specified in this stem design segment = 20.00 in

Development length for #4 bar specified in this stem design segment = 14.95 in

Hooked embedment length into footing for #4 bar specified in this stem design segment = 6.00 in

As Provided = 0.1500 in²/ft

As Required = 0.1127 in²/ft

Cantilevered Retaining Wall

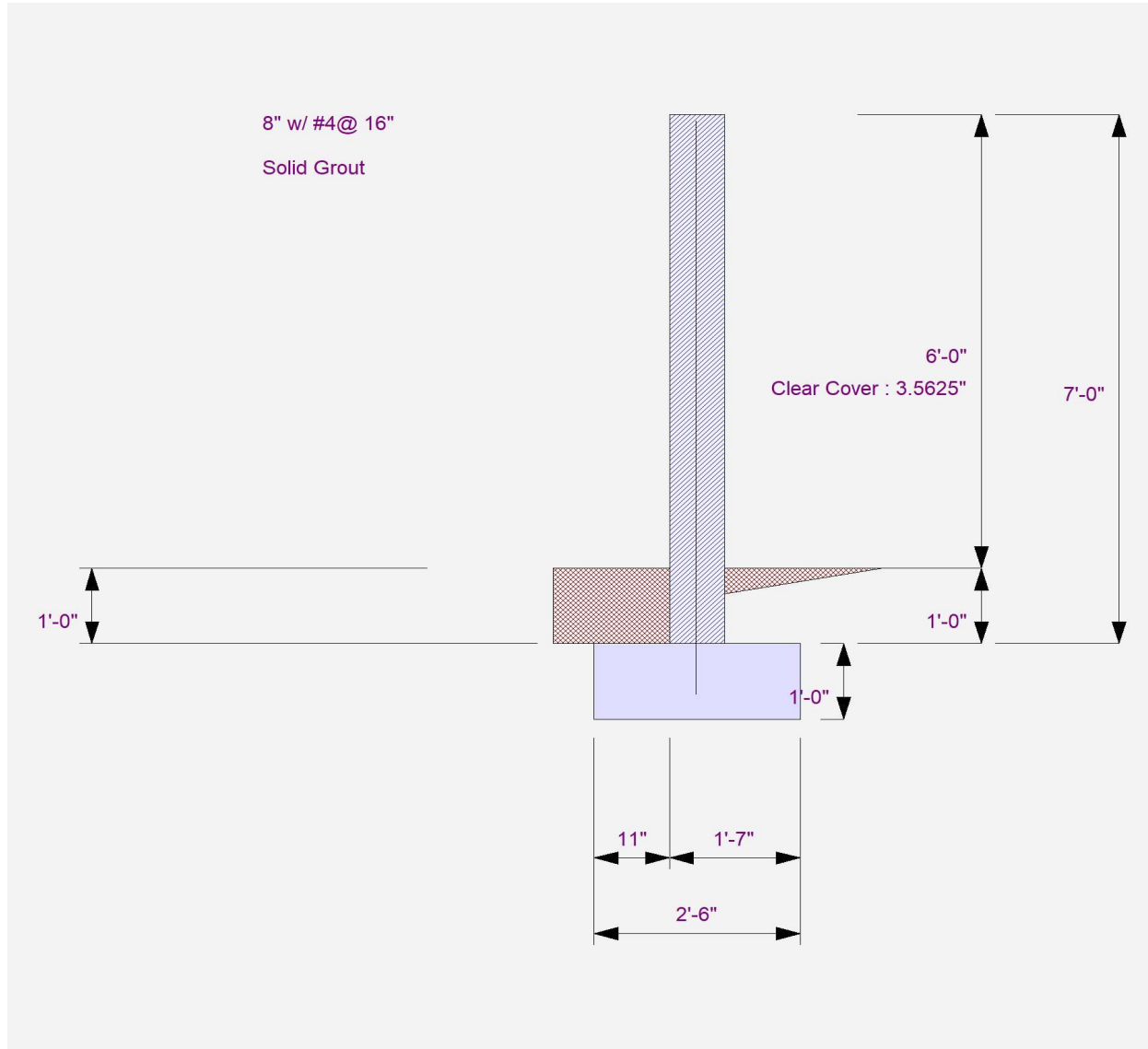
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LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Trash Enclosure CMU Wall



Cantilevered Retaining Wall

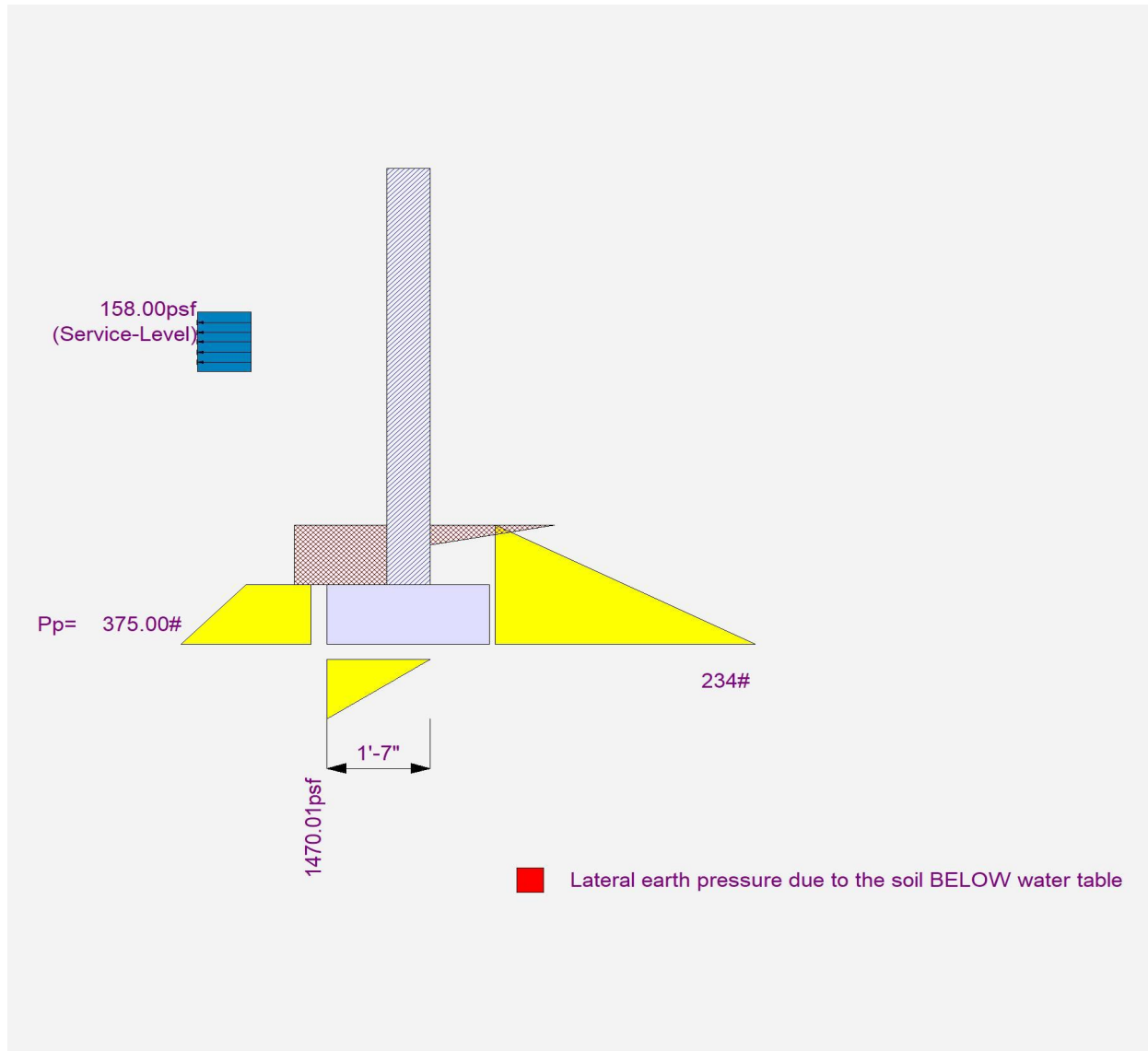
Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Trash Enclosure CMU Wall



Wood Beam

Project File: HS22244_Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Worst Case Trellis Beam

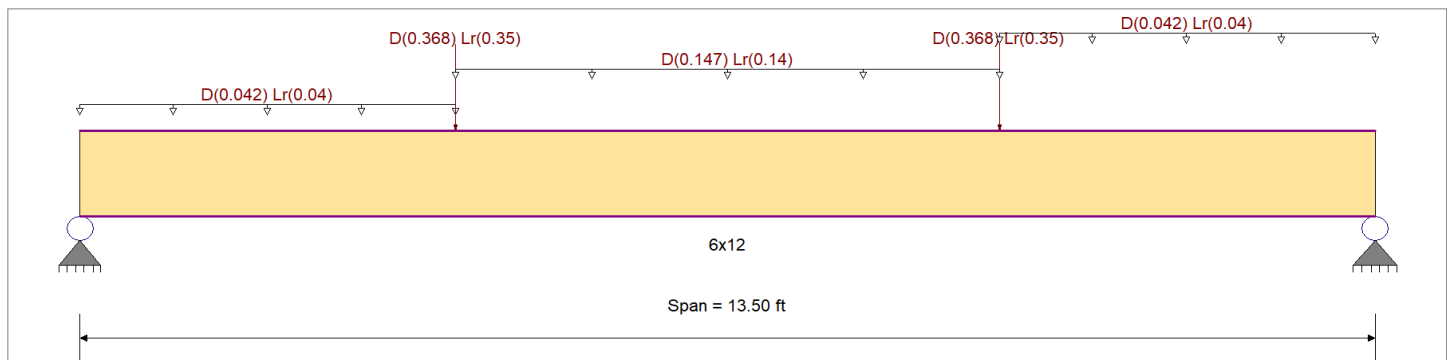
CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

Load Combination Set : HSNonBeams

Material Properties

Analysis Method : Allowable Stress Design	Fb +	1,000.0 psi	E : Modulus of Elasticity
Load Combination : HSNonBeams	Fb -	1,000.0 psi	Ebend- xx
	Fc - Prll	1,500.0 psi	Eminbend - xx
Wood Species : Douglas Fir-Larch	Fc - Perp	625.0 psi	
Wood Grade : No.1	Fv	180.0 psi	
	Ft	675.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			31.210pcf



Applied Loads

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

Beam self weight NOT internally calculated and added

Load for Span Number 1

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Extent = 0.0 -->> 3.920 ft, Tributary Width = 2.0 ft

Point Load : D = 0.3680, Lr = 0.350 k @ 3.920 ft, (GT#3)

Point Load : D = 0.3680, Lr = 0.350 k @ 9.580 ft, (GT#3)

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Extent = 3.920 -->> 9.580 ft, Tributary Width = 7.0 ft

Uniform Load : D = 0.0210, Lr = 0.020 ksf, Extent = 9.580 -->> 13.50 ft, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.770	1	Maximum Shear Stress Ratio	=	0.234	: 1
Section used for this span		6x12		Section used for this span		6x12	
fb: Actual	=	769.88psi		fv: Actual	=	42.07 psi	
F'b	=	1,000.00psi		F'v	=	180.00 psi	
Load Combination		+D+Lr		Load Combination		+D+Lr	
Location of maximum on span	=	6.773ft		Location of maximum on span	=	0.000ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		0.111 in	Ratio =	1462	>=360	Span: 1 : Lr Only	
Max Upward Transient Deflection		0 in	Ratio =	0	<360	n/a	
Max Downward Total Deflection		0.227 in	Ratio =	713	>=240	Span: 1 : +D+Lr	
Max Upward Total Deflection		0 in	Ratio =	0	<240	n/a	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values				
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v	
D Only	Length = 13.50 ft	1	0.548	0.166	0.90	1.00	1.00	1.00	1.000	1.00	0.80	1.00	3.98	394.4	720.0	0.0	0.00	0.0	0.0
+D+L	Length = 13.50 ft	1	0.493	0.150	1.00	1.00	1.00	1.00	1.000	1.00	0.80	1.00	3.98	394.4	800.0	0.0	0.00	0.0	0.0
+D+Lr	Length = 13.50 ft	1	0.770	0.234	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	7.78	769.9	1,000.0	1.77	42.1	180.0	

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Wood Beam

Project File: HS22244_Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Worst Case Trellis Beam

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values			
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v	
+D+0.750Lr+0.750L	Length = 13.50 ft	1	0.676	0.205	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	6.83	676.0	1,000.0	0.0	0.00	0.0	180.0
+D+0.750L	Length = 13.50 ft	1	0.429	0.130	1.15	1.00	1.00	1.00	1.000	1.00	0.80	1.00	3.98	394.4	920.0	0.0	0.00	0.0	165.6
+0.60D	Length = 13.50 ft	1	0.185	0.056	1.60	1.00	1.00	1.00	1.000	1.00	0.80	1.00	2.39	236.7	1,280.0	0.0	0.00	0.0	230.4

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+Lr	1	0.2271	6.773		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	1.852	1.852
Max Upward from Load Combinations	1.852	1.852
Max Upward from Load Cases	0.949	0.949
D Only	0.949	0.949
+D+L	0.949	0.949
+D+Lr	1.852	1.852
+D+0.750Lr+0.750L	1.626	1.626
+D+0.750L	0.949	0.949
+0.60D	0.569	0.569
Lr Only	0.903	0.903
L Only		

Wood Beam

Project File: HS22244_Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

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DESCRIPTION: GT#3: F-B GT over Trash Enclosure

Maximum Forces & Stresses for Load Combinations

Load Combination	Max Stress Ratios											Moment Values			Shear Values			
	Segment Length	Span #	M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F ^b	V	f _v	F ^v
+1.210D						1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 11.670 ft	1	0.133	0.049	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.30	210.9	1,584.0	0.37	14.2	288.0	
+1.158D+0.750L						1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 11.670 ft	1	0.127	0.047	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.24	201.9	1,584.0	0.36	13.6	288.0	
+0.60D						1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 11.670 ft	1	0.066	0.024	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.64	104.6	1,584.0	0.19	7.1	288.0	
+0.390D						1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 11.670 ft	1	0.043	0.016	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.42	68.0	1,584.0	0.12	4.6	288.0	

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+Lr+L	1	0.0777	5.855		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	0.718	0.718
Max Upward from Load Combinations	0.718	0.718
Max Upward from Load Cases	0.368	0.368
D Only	0.368	0.368
+D+L	0.368	0.368
+D+Lr	0.718	0.718
+D+0.750Lr+0.750L	0.630	0.630
+D+0.750L	0.368	0.368
+1.210D	0.445	0.445
+1.158D+0.750L	0.426	0.426
+0.60D	0.221	0.221
+0.390D	0.143	0.143
Lr Only	0.350	0.350
L Only		

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Column

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Steel Post

Code References

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

General Information

Steel Section Name : HSS4x4x1/4	Overall Column Height	8.0 ft
Analysis Method : Allowable Strength	Top & Bottom Fixity	Top Free, Bottom Fixed
Steel Stress Grade	Brace condition for deflection (buckling) along columns :	
Fy : Steel Yield	X-X (width) axis :	
E : Elastic Bending Modulus	Unbraced Length for buckling ABOUT Y-Y Axis = 8.0 ft, K = 2.1	
	Y-Y (depth) axis :	
	Unbraced Length for buckling ABOUT X-X Axis = 8.0 ft, K = 2.1	

Applied Loads

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

AXIAL LOADS . . .

Trellis Weight: Axial Load at 8.0 ft, D = 1.496 k

BENDING LOADS . . .

Wind: Lat. Point Load at 8.0 ft creating Mx-x, E = 0.4210 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.4258 : 1	Maximum Load Reactions . .	
Load Combination	+D+E	Top along X-X	0.0 k
Location of max.above base	0.0 ft	Bottom along X-X	0.0 k
At maximum location values are . . .		Top along Y-Y	0.0 k
Pa : Axial	1.496 k	Bottom along Y-Y	0.4210 k
Pn / Omega : Allowabl	28.776 k	Maximum Load Deflections . . .	
Ma-x : Applied	-3.368 k-ft	Along Y-Y	0.5461 in at 8.0ft above base
Mn-x / Omega : Allowable	8.425 k-ft	for load combination :+D+E	
Ma-y : Applied	0.0 k-ft	Along X-X	0.0 in at 0.0ft above base
Mn-y / Omega : Allowable	8.425 k-ft	for load combination :	
PASS Maximum Shear Stress Ratio	0.02116 : 1		
Load Combination	+D+E		
Location of max.above base	0.0 ft		
At maximum location values are . . .			
Va : Applied	0.4210 k		
Vn / Omega : Allowable	19.896 k		

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios				Cb _x	Cb _y	K _x L _x /R _y	K _y L _y /R _x	Maximum Shear Ratios		
	Stress Ratio	Status	Location	Stress Ratio					Status	Location	
D Only	0.052	PASS	0.00 ft	1.67	1.00	132.63	132.63	0.000	PASS	0.00 ft	
+D+E	0.426	PASS	0.00 ft	1.67	1.00	132.63	132.63	0.021	PASS	0.00 ft	
+D+0.750E	0.326	PASS	0.00 ft	1.67	1.00	132.63	132.63	0.016	PASS	0.00 ft	
+0.60D	0.031	PASS	0.00 ft	1.67	1.00	132.63	132.63	0.000	PASS	0.00 ft	
+0.60D+E	0.415	PASS	0.00 ft	1.67	1.00	132.63	132.63	0.021	PASS	0.00 ft	

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction	X-X Axis Reaction		k	Y-Y Axis Reaction		M _x - End Moments		M _y - End Moments	
	@ Base	@ Base	@ Top		@ Base	@ Top	@ Base	@ Top	@ Base	@ Top
D Only	1.496									
+D+E	1.496				0.421		-3.368			
+D+0.750E	1.496				0.316		-2.526			
+0.60D	0.898									
+0.60D+E	0.898				0.421		-3.368			
E Only					0.421		-3.368			

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Column

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Steel Post

Extreme Reactions

Item	Extreme Value	Axial Reaction	X-X Axis Reaction		k	Y-Y Axis Reaction		Mx - End Moments		k-ft	My - End Moments	
		@ Base	@ Base	@ Top		@ Base	@ Top	@ Base	@ Top		@ Base	@ Top
Axial @ Base	Maximum	1.496										
"	Minimum					0.421		-3.368				
Reaction, X-X Axis Base	Maximum	1.496										
"	Minimum	1.496										
Reaction, Y-Y Axis Base	Maximum	1.496				0.421		-3.368				
"	Minimum	1.496										
Reaction, X-X Axis Top	Maximum	1.496										
"	Minimum	1.496										
Reaction, Y-Y Axis Top	Maximum	1.496										
"	Minimum	1.496										
Moment, X-X Axis Base	Maximum	1.496										
"	Minimum	1.496	-3.368			0.421		-3.368				
Moment, Y-Y Axis Base	Maximum	1.496										
"	Minimum	1.496										
Moment, X-X Axis Top	Maximum	1.496										
"	Minimum	1.496										
Moment, Y-Y Axis Top	Maximum	1.496										
"	Minimum	1.496										

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.000 in	0.000 ft	0.000 in	0.000 ft
+D+E	0.000 in	0.000 ft	0.546 in	8.000 ft
+D+0.750E	0.000 in	0.000 ft	0.410 in	8.000 ft
+0.60D	0.000 in	0.000 ft	0.000 in	0.000 ft
+0.60D+E	0.000 in	0.000 ft	0.546 in	8.000 ft
E Only	0.000 in	0.000 ft	0.541 in	7.946 ft

Steel Section Properties : HSS4x4x1/4

Depth	=	4.000 in	I xx	=	7.80 in^4	J	=	12.800 in^4
Design Thick	=	0.233 in	S xx	=	3.90 in^3			
Width	=	4.000 in	R xx	=	1.520 in			
Wall Thick	=	0.250 in	Zx	=	4.690 in^3			
Area	=	3.370 in^2	I yy	=	7.800 in^4	C	=	6.560 in^3
Weight	=	12.210 plf	S yy	=	3.900 in^3			
			R yy	=	1.520 in			
Ycg	=	0.000 in						

Steel Column

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

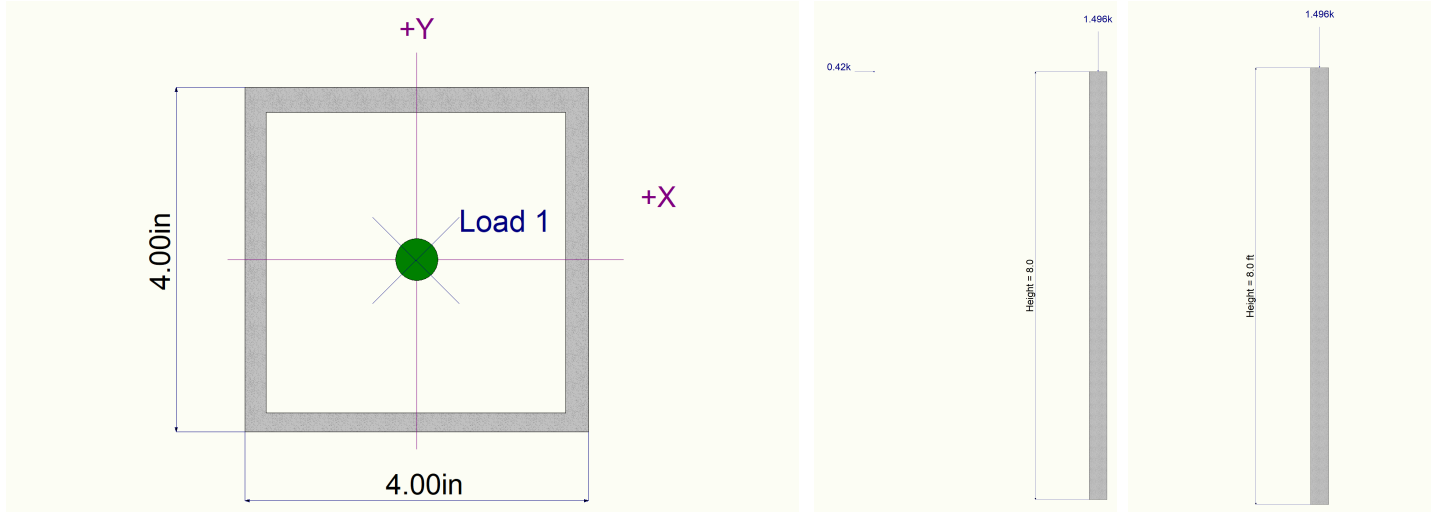
LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Steel Post

Sketches



Pole Footing Embedded in Soil

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC#: KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: Trash Enclosure Trellis Footing

Code References

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

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	24.0 in
Calculate Min. Depth for Allowable Pressures	
Lateral Restraint at Ground Surface	
Allow Passive	250.0 pcf
Max Passive	1,500.0 pcf

Controlling Values

Governing Load Combination	D+W
Lateral Load	0.1960 k
Moment	1.568 k-ft

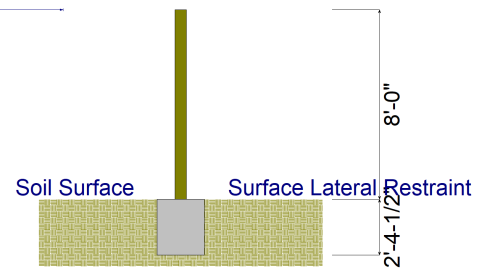
Restraint @ Ground Surface

Pressure at Depth	
Actual	590.71 psf
Allowable	593.75 psf
Surface Restraint Force	1,598.95 lbs

Minimum Required Depth	2.375 ft
-------------------------------	-----------------

Footing Base Area	3.142 ft^2
Maximum Soil Pressure	0.5762 ksf

Point Load



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (k)	Applied Moment (kft)	Vertical Load (k)
D : Dead Load	k/ft	0.0 k-ft	1.496 k
Lr : Roof Live	k/ft	k-ft	k
L : Live	k/ft	k-ft	k
S : Snow	k/ft	k-ft	k
W : Wind	0.1960 k	k-ft	k
E : Earthquake	k	k-ft	k
H : Lateral Earth	k	k-ft	k
Load distance above ground surface	8.0 ft		
	TOP of Load above ground surface		
	BOTTOM of Load above ground surface		

Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at Depth		Soil Increase Factor
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)	
D Only	0.000	0.000	0.13	0.0	31.3	1.000
+D+W	0.196	1.568	2.38	590.7	593.8	1.000
+D-W	0.196	1.568	2.38	590.7	593.8	1.000
+1.210D	0.000	0.000	0.13	0.0	31.3	1.000
+D+0.750W	0.147	1.176	2.25	493.6	562.5	1.000
+D-0.750W	0.147	1.176	2.25	493.6	562.5	1.000
+1.158D	0.000	0.000	0.13	0.0	31.3	1.000
+0.60D+W	0.196	1.568	2.38	590.7	593.8	1.000
+0.60D-W	0.196	1.568	2.38	590.7	593.8	1.000

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: T-Shaped 6' Concrete Wall/Footing

Code Reference

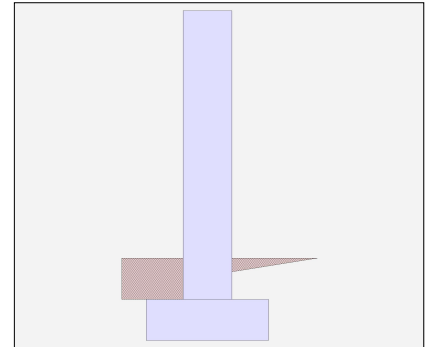
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	1.00 ft
Wall height above soil	=	6.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,667.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	38.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	190.0 #/ft
...Height to Top	=	4.50 ft
...Height to Bottom	=	3.50 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Strength Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: T-Shaped 6' Concrete Wall/Footing

Design Summary

Wall Stability Ratios

Overtuning	=	1.99	OK
Sliding	=	2.46	OK
Global Stability	=	3.77	

Total Bearing Load	=	1,590	lbs
...resultant ecc.	=	7.55	in

Eccentricity outside middle third

Soil Pressure @ Toe	=	1,708	psf	OK
Soil Pressure @ Heel	=	0	psf	OK
Allowable	=	2,667	psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	2,391	psf	
ACI Factored @ Heel	=	0	psf	
Footing Shear @ Toe	=	0.7	psi	OK
Footing Shear @ Heel	=	1.9	psi	OK
Allowable	=	82.2	psi	

Sliding Calcs

Lateral Sliding Force	=	266.0	lbs	
less 100% Passive Force	= -	375.0	lbs	
less 50% Friction Force	= -	278.3	lbs	
Added Force Req'd	=	0.0	lbs	OK
...for 1.5 Stability	=	0.0	lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Design Height Above Ftc	ft =	Stem OK	0.00
Wall Material Above "Ht"	=	Concrete	
Design Method	=	SD	SD SD
Thickness	=	12.00	
Rebar Size	=	# 4	
Rebar Spacing	=	8.00	
Rebar Placed at	=	Edge	

Design Data

fb/FB + fa/Fa	=	0.057
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Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	220.4

Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	770.1

Moment.....Allowable	=	13,439.3
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Shear.....Actual

Service Level	psi =	
Strength Level	psi =	1.8

Shear.....Allowable	psi =	82.2
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Anet (Masonry)	in2 =	
----------------	-------	--

Wall Weight	psf =	150.0
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Rebar Depth 'd'	in =	10.25
-----------------	------	-------

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: T-Shaped 6' Concrete Wall/Footing

Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
Bottom Stem			
As (based on applied moment) :	0.0172 in2/ft		
(4/3) * As :	0.023 in2/ft	Min Stem T&S Reinf Area 2.016 in2	
200bd/fy : 200(12)(10.25)/60000 :	0.41 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.3 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.6663 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Footing Data

Toe Width	=	0.75 ft
Heel Width	=	1.75
Total Footing Width	=	2.50
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 3,000 psi	Fy = 60,000 psi	
Footing Concrete Density = 150.00 pcf		
Min. As % = 0.0018		
Cover @ Top 3.00	@ Btm.= 3.00 in	

Footing Design Results

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	= 2,391		0 psf
Mu' : Upward	= 582		0 ft-#
Mu' : Downward	= 88		88 ft-#
Mu: Design	= 494 OK		87 ft-# OK
phiMn	= 2,739		2,739 ft-#
Actual 1-Way Shear	= 0.70		1.88 psi
Allow 1-Way Shear	= 43.82		43.82 psi
Toe Reinforcing	= None Spec'd		
Heel Reinforcing	= None Spec'd		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: $\phi M_n = \phi'5' \lambda \sqrt{f'c} S_m$

Heel: $\phi M_n = \phi'5' \lambda \sqrt{f'c} S_m$

Key: No key defined

Min footing T&S reinf Area 0.65 in2
 Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:

#4@ 9.26 in
 #5@ 14.35 in
 #6@ 20.37 in

If two layers of horizontal bars:

#4@ 18.52 in
 #5@ 28.70 in
 #6@ 40.74 in

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: T-Shaped 6' Concrete Wall/Footing

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	76.0	0.67	50.7	Soil Over HL (ab. water tbl)	82.5	2.13	175.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.13	175.3
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	190.0	5.00	950.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	82.5	0.38	30.9
				Surcharge Over Toe =			
				Stem Weight(s) =	1,050.0	1.25	1,312.5
				Earth @ Stem Transitions =			
Total	= 266.0	O.T.M.	= 1,000.7	Footing Weight =	375.0	1.25	468.8
				Key Weight =			
				Vert. Component =			
Resisting/Overturning Ratio		=	1.99	Total =	1,590.0 lbs	R.M.=	1,987.5
Vertical Loads used for Soil Pressure =		1,590.0	lbs	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.133 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: T-Shaped 6' Concrete Wall/Footing

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	17.09 in
Development length for #4 bar specified in this stem design segment =	13.15 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	7.67 in
As Provided =	0.3000 in ² /ft
As Required =	0.2592 in ² /ft

Cantilevered Retaining Wall

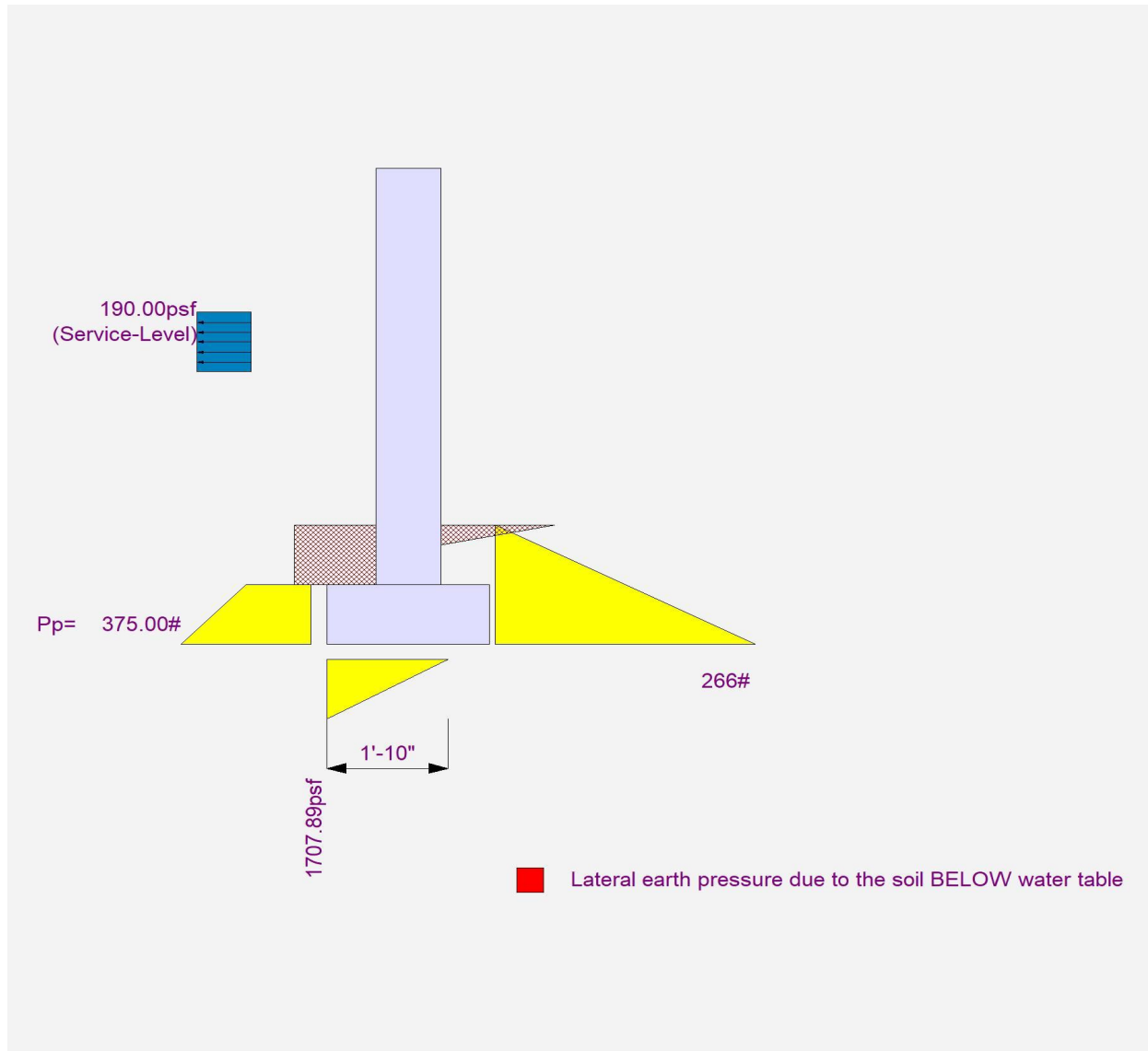
Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

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DESCRIPTION: T-Shaped 6' Concrete Wall/Footing



Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

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DESCRIPTION: L-Shaped 6' Concrete Wall/Footing

Code Reference

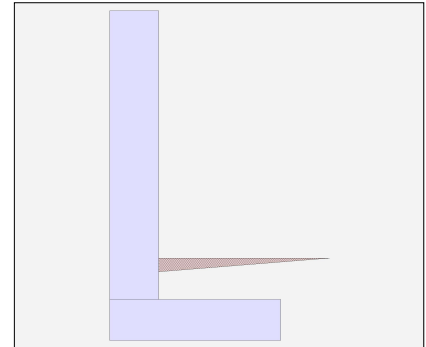
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	1.00 ft
Wall height above soil	=	6.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,667.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	38.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	190.0 #/ft
...Height to Top	=	4.50 ft
...Height to Bottom	=	3.50 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Strength Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: L-Shaped 6' Concrete Wall/Footing

Design Summary

Wall Stability Ratios

Overturning	=	2.06	OK
Sliding	=	2.63	OK
Global Stability	=	9.55	
Total Bearing Load	=	1,850 lbs	
...resultant ecc.	=	14.11 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	2,149 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,667 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	3,008 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	0.7 psi	OK
Footing Shear @ Heel	=	2.7 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	266.0 lbs	
less 100% Passive Force	= -	375.0 lbs	
less 50% Friction Force	= -	323.8 lbs	
Added Force Req'd	=	0.0 lbs	OK
...for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Design Height Above Ftc

ft =	Stem OK	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	12.00
Rebar Size	=	# 4
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa = 0.057

Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	220.4

Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	770.1

Moment.....Allowable = 13,439.3

Shear.....Actual

Service Level	psi =	
Strength Level	psi =	1.8

Shear.....Allowable psi = 82.2

Anet (Masonry) in2 =

Wall Weight psf = 150.0

Rebar Depth 'd' in = 10.25

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: L-Shaped 6' Concrete Wall/Footing

Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
Bottom Stem			
As (based on applied moment) :	0.0172 in2/ft		
(4/3) * As :	0.023 in2/ft	Min Stem T&S Reinf Area 2.016 in2	
200bd/fy : 200(12)(10.25)/60000 :	0.41 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.3 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.6663 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Footing Data

Toe Width	=	0.00 ft
Heel Width	=	3.50
Total Footing Width	=	3.50
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c =	3,000 psi	Fy = 60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	3.00	@ Btm.= 3.00 in

Footing Design Results

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	=	3,008	0 psf
Mu' : Upward	=	0	110 ft-#
Mu' : Downward	=	0	975 ft-#
Mu: Design	=	0 OK	865 ft-# OK
phiMn	=	OK - Flush	2,739
Actual 1-Way Shear	=	0.70	2.71 psi
Allow 1-Way Shear	=	43.82	43.82 psi
Toe Reinforcing	=	Flush toe condition. No reinforcing required.	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=	0.00	ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00	ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: Flush toe condition. No reinforcing required.

Heel: $\phi M_n = \phi'5' \lambda \sqrt{f_c}' S_m$

Key: No key defined

Min footing T&S reinf Area	0.91	in2
Min footing T&S reinf Area per foot	0.26	in2 /ft
<u>If one layer of horizontal bars:</u>		<u>If two layers of horizontal bars:</u>
#4@ 9.26 in		#4@ 18.52 in
#5@ 14.35 in		#5@ 28.70 in
#6@ 20.37 in		#6@ 40.74 in

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: L-Shaped 6' Concrete Wall/Footing

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	76.0	0.67	50.7	Soil Over HL (ab. water tbl)	275.0	2.25	618.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.25	618.8
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	190.0	5.00	950.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =			
				Surcharge Over Toe =			
				Stem Weight(s) =	1,050.0	0.50	525.0
				Earth @ Stem Transitions =			
Total	= 266.0	O.T.M.	= 1,000.7	Footing Weight =	525.0	1.75	918.8
				Key Weight =			
				Vert. Component =			
Resisting/Overturning Ratio		=	2.06	Total =	1,850.0 lbs	R.M.=	2,062.5
Vertical Loads used for Soil Pressure =		1,850.0 lbs		* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.119 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: HS22244_Attached Trellis & Trash Enclosure Site Structures.ec6

LIC# : KW-06014152, Build:20.22.10.25

HARRIS & SLOAN CONSULTING

(c) ENERCALC INC 1983-2022

DESCRIPTION: L-Shaped 6' Concrete Wall/Footing

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	17.09 in
Development length for #4 bar specified in this stem design segment =	13.15 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	7.67 in
As Provided =	0.3000 in ² /ft
As Required =	0.2592 in ² /ft

Cantilevered Retaining Wall

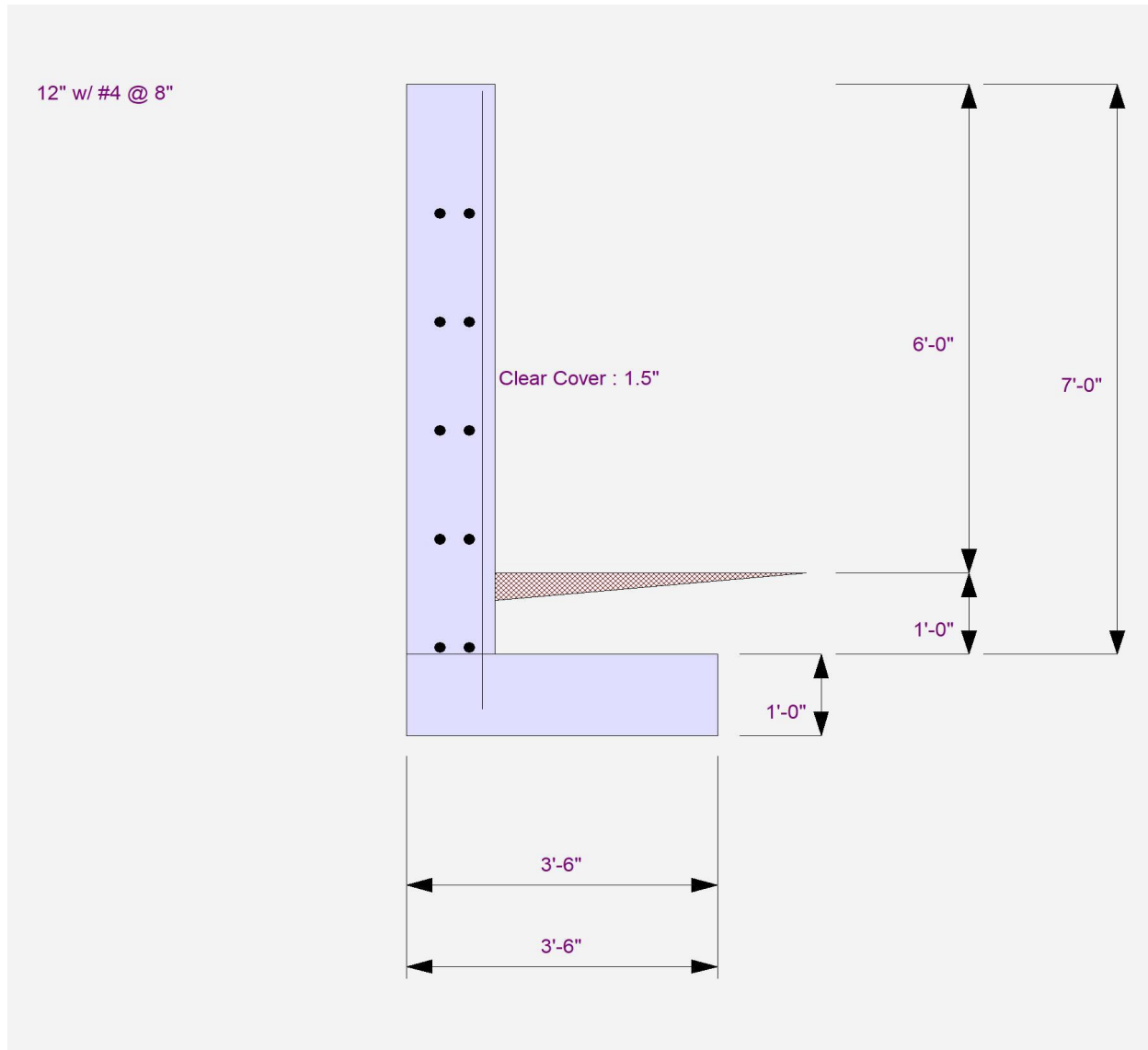
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LIC# : KW-06014152, Build:20.22.10.25

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DESCRIPTION: L-Shaped 6' Concrete Wall/Footing



Cantilevered Retaining Wall

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LIC# : KW-06014152, Build:20.22.10.25

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DESCRIPTION: L-Shaped 6' Concrete Wall/Footing

