

EAST TOWN CROSSING CARPORTS

2902 PIONEER WAY E
PUYALLUP, WA 98371

PRCP20250901

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

CALCULATIONS

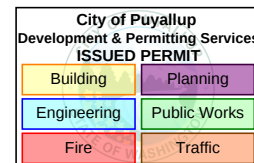
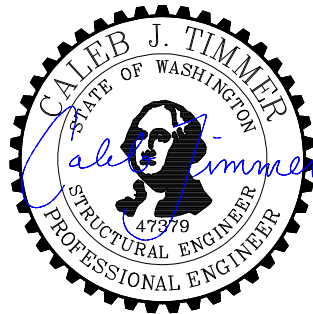
PREPARED FOR

CARPORTS OF WASHINGTON

P.O. BOX 2389
BUCKLEY, WA 98321

**City of Puyallup
Building
REVIEWED
FOR
COMPLIANCE**

SKinnear
07/07/2025
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02/13/25

PREPARED BY



4815 Center Street
Tacoma, WA 98409

February 13, 2025

S & H Job Number: 20,822

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BASIS FOR DESIGN

BUILDING CODE:

2021 edition of the International Building Code and State of Washington amendments shall be used and supplemented with ASCE 7-16.

RISK CATEGORY:

II.

GRAVITY LOADS:

Roof snow load: $S := 25 \text{ psf}$.

Roof dead load: self-weight.

LATERAL LOAD CRITERIA:

Wind speed: $V := 110 \text{ mph}$. Exposure: C.

Seismic site class: D.

Seismic design category: D.

FOUNDATIONS:

Allowable soil bearing pressure: $\sigma_{max} := 2000 \text{ psf}$.

Concrete footings shall bear on firm, undisturbed soil 12" minimum below finished grade.

STRUCTURAL STEEL:

Hollow Rectangular Steel	ASTM A500, Grade B	46 ksi
Bolts	ASTM 307, Grade A	
Nuts	ASTM A563	
Flat/Beveled Washers	ASTM F463	
Direct Tension Washers	ASTM F595	
Metal Roof Deck	ASTM A792	60 ksi
Cold-Formed Shapes	ASTM A653	50 ksi
Wide Flange Steel	ASTM A992, Grade 50	50 ksi



Tacoma, WA · (253) 474-9449

Designed: JPR

Date: 02/04/25

Project Number: 20.822

Checked: CJT

Date: 02/13/25

Project: EAST TOWN CROSSING CARPORTS

DESIGN LOADS

SNOW LOAD:

$S = 25$ *psf*

design roof snow load

DEAD LOAD:

$W_{roofing} := 0.91$ *psf*

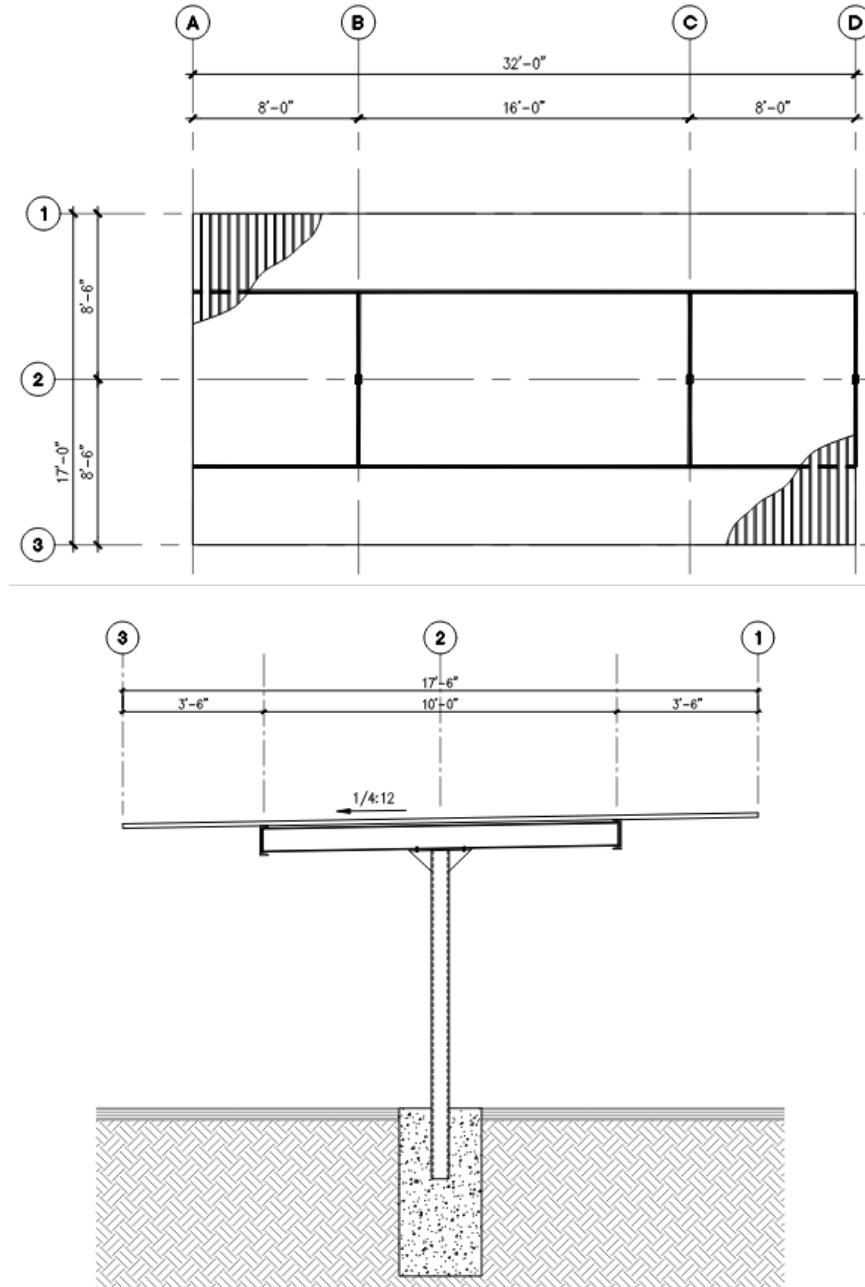
$W_{flashing} := 0.12$ *psf*

$W_{deck} := W_{roofing} + W_{flashing} = 1.03$ *psf*

$W_{deck} = 1.03$ *psf*

CARPORT SPECIFICATIONS

DESIGN IS BASED ON A TYPICAL 4-STALL CARPORT WITH 9'-0" X 18'-0" STALLS.
DESIGN IS ALSO VALID FOR OTHER CONFIGURATIONS.



CARPORT DIMENSIONS

$A := 32 \text{ ft}$	carport roof length
$B := 17 \text{ ft}$	carport roof width
$h_1 := 8 \text{ ft}$	carport structural height
$h_2 := 9 \text{ ft}$	carport structural height

LATERAL ANALYSIS

SEISMIC DESIGN CRITERIA

HORIZONTAL SEISMIC FORCES SHALL BE DETERMINED IN ASCE 7-16 SECTION 12.8 WITH THE ELF PROCEDURE.

$R := 1.25$	response modification coefficient	(ASCE TAB. 12.2-1)
$I_e := 1.00$	seismic importance factor	(ASCE TAB. 1.5-2)
$C_t := 0.02$	building period coefficient	(ASCE TAB. 12.8-2)
$x := 0.75$	building period coefficient	(ASCE TAB. 12.8-2)
$T_{a,1} := C_t h_1^x \left(\frac{s}{ft^x} \right) = 0.095 \text{ s}$	approximate fundamental period of 8' high carport	(ASCE SEC. 12.8.2.1)
$T_{a,2} := C_t h_2^x \left(\frac{s}{ft^x} \right) = 0.104 \text{ s}$	approximate fundamental period of 9' high carport	
$T_1 := T_{a,1}$	structural fundamental period of 8' high carport	(ASCE SEC. 12.8.2)
$T_2 := T_{a,2}$	structural fundamental period of 9' high carport	
D	Seismic Design Category	(ASCE SEC. 11.6)
$S_{DS} := 1.047$	design spectral response acceleration parameter at short periods	(ASCE EQ. 11.4-3)
$S_{D1} := (1.5) (0.451) (1.85) \left(\frac{2}{3} \right) = 0.83$	design spectral response acceleration parameter with exception 2 per section 11.4.8	(ASCE SEC. 11.4-4)
$C_{s1} := \frac{S_{DS}}{\left(\frac{R}{I_e} \right)} = 0.838$	seismic response coefficient	(ASCE SEC. 12.8-2)
$C_{s2,1} := \frac{S_{D1}}{T_1 \left(\frac{R}{I_e} \right)} (s) = 7.016$	seismic response coefficient of 8' high carport	(ASCE SEC. 12.8-2)
$C_{s2,2} := \frac{S_{D1}}{T_2 \left(\frac{R}{I_e} \right)} (s) = 6.423$	seismic response coefficient of 9' high carport	
$C_s := \max \left(\min (C_{s1}, C_{s2,1}, C_{s2,2}), 0.044 S_{DS} I_e, 0.01 \right) = 0.838$		(ASCE SEC. 12.8.1.1)

STRUCTURE SEISMIC WEIGHT:

$W_{deck} = 1.03 \text{ psf}$	$W_{beam} := 10 \text{ plf}$
$W_{purlin} := 6.31 \text{ plf}$	$W_{post} := 11.97 \text{ plf}$
$W_{E,1} := W_{deck} A B + 2 W_{purlin} A + 2 W_{beam} (10 \text{ ft}) + 2 \left(W_{post} \left(\frac{1}{2} h_1 \right) \right) = 1259.92 \text{ lbf}$	
$W_{E,2} := W_{deck} A B + 2 W_{purlin} A + 2 W_{beam} (10 \text{ ft}) + 2 \left(W_{post} \left(\frac{1}{2} h_2 \right) \right) = 1271.89 \text{ lbf}$	

HORIZONTAL SEISMIC FORCE:

$\rho := 1.3$	redundancy factor	(ASCE SEC. 12.3.4.2)
$E_{h,1} := \rho C_s W_{E,1} = 1371.9 \text{ lbf}$	seismic base shear of 8' high carport	(ASCE SEC. 12.4.2.1)
$E_{h,2} := \rho C_s W_{E,2} = 1384.9 \text{ lbf}$	seismic base shear of 9' high carport	

WIND DESIGN CRITERIA

VELOCITY PRESSURE SHALL BE DETERMINED IN ASCE 7-16 CHAPTER 26.

$V = 110$ **mph** *basic wind speed* (ASCE SEC. 26.5)

C *exposure category* (ASCE SEC. 26.7.3)

$K_z := 0.85$ *velocity pressure expose coefficient* (ASCE TAB. 26.10-1)

$K_{zt} := 1.0$ *topographic factor* (ASCE SEC. 26.8.2)

$K_d := 0.85$ *wind directionality factor* (ASCE TAB. 26.6-1)

$z_g := 24.36946$ *ground elevation in feet* (ASCE Hazards)

$K_e := e^{-0.0000362 \cdot z_g} = 0.999$ *ground elevation factor* (ASCE TAB. 26.9-1)

$q_z := 0.00256 K_z K_{zt} K_d K_e V^2 \left(\frac{\text{psf}}{\text{mph}^2} \right) = 22.36$ **psf** *velocity pressure* (ASCE EQ. 26.10-1)

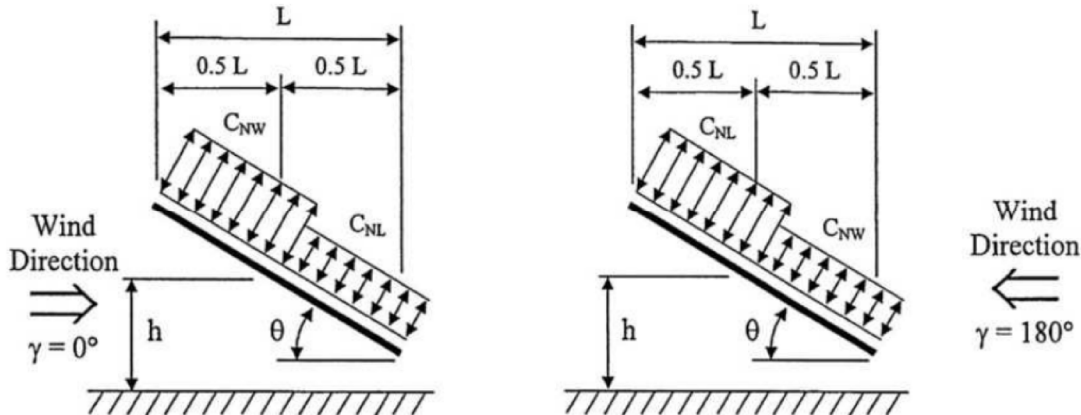
$q_h := q_z$ (ASCE SEC. 26.10.2)

Project: EAST TOWN CROSSING CARPORTS

WIND DESIGN CRITERIA FOR MAIN WINDFORCE-RESISTING SYSTEM

VERTICAL FORCES APPLIED TO MWFRS WILL BE DETERMINED USING THE DIRECTION PROCEDURE, AS OUTLINED IN CHAPTER 27 OF ASCE 7-16.

Diagrams



Notation

L = Horizontal dimension of roof, measured in the along-wind direction, ft (m).

h = Mean roof height, ft (m).

γ = Direction of wind, degrees.

θ = Angle of plane of roof from horizontal, degrees.

Net Pressure Coefficient, C_N

Roof Angle, θ	Load Case	Wind Direction, $\gamma = 0^\circ$				Wind Direction, $\gamma = 180^\circ$			
		Clear Wind Flow		Obstructed Wind Flow		Clear Wind Flow		Obstructed Wind Flow	
		C_{NW}	C_{NL}	C_{NW}	C_{NL}	C_{NW}	C_{NL}	C_{NW}	C_{NL}
0°	A	1.2	0.3	-0.5	-1.2	1.2	0.3	-0.5	-1.2
	B	-1.1	-0.1	-1.1	-0.6	-1.1	-0.1	-1.1	-0.6
7.5°	A	-0.6	-1.0	-1.0	-1.5	-0.9	-1.3	-0.2	-1.2

ASCE 7-16 TABLE 27.3-4

$$\theta := \text{atan}\left(\frac{0.25}{12}\right) = 1.2^\circ$$

roof slope, use 0 deg. load coefficients

$$G := 0.85$$

gust effect factor

(ASCE SEC. 26.11.1)

CASE A: $C_{NWA} := 1.2$

CASE B: $C_{NWB} := -1.1$

$$C_{NLA} := 0.3$$

$$C_{NLB} := -0.1$$

$$P_{NWA} := q_h G C_{NWA} = 22.8 \text{ psf} \quad \text{net design pressure for MWFRS}$$

(ASCE SEC. 27.3-2)

$$P_{NLA} := q_h G C_{NLA} = 5.7 \text{ psf} \quad \text{net design pressure for MWFRS}$$

(ASCE SEC. 27.3-2)

$$P_{NWB} := q_h G C_{NWB} = -20.9 \text{ psf} \quad \text{net design pressure for MWFRS}$$

(ASCE SEC. 27.3-2)

$$P_{NLB} := q_h G C_{NLB} = -1.9 \text{ psf} \quad \text{net design pressure for MWFRS}$$

(ASCE SEC. 27.3-2)

Project: EAST TOWN CROSSING CARPORTS

HORIZONTAL FORCES APPLIED TO MWFRS WILL BE DETERMINED USING THE DIRECTIONAL PROCEDURE, AS OUTLINED IN CHAPTER 29 OF ASCE 7-16

Force Coefficients, C_f

ϵ	Flat-Sided Members	Rounded Members	
		$\frac{D\sqrt{q_z}}{s} \leq 2.5$ ($\frac{D\sqrt{q_z}}{s} \leq 5.3$) s.i	$\frac{D\sqrt{q_z}}{s} > 2.5$ ($\frac{D\sqrt{q_z}}{s} > 5.3$) s.i
<0.1	2.0	1.2	0.8
0.1 to 0.29	1.8	1.3	0.9
0.3 to 0.7	1.6	1.5	1.1

Notation

ϵ = Ratio of solid area to gross area

D = Diameter of a typical round member, in ft (m)

q_z = Velocity pressure evaluated at height z above ground, in lb/ft² (N/m²)

Notes

1. Signs with openings making up 30% or more of the gross area are classified as open signs.
2. Calculation of the design wind forces shall be based on the area of all exposed members and elements projected on a plane normal to the wind direction. Forces shall be assumed to act parallel to the wind direction.
3. Area A_f consistent with these force coefficients is the solid area projected normal to the wind direction.

ASCE 7-16 Table 29.4-2

$D := 1 \text{ ft}$ approximate depth of purlin and roof decking

$\epsilon_1 := \frac{D B + h_1 (6 \text{ in})}{h_1 B} = 0.154$ ratio of solid area to gross area of 8' high carport

$\epsilon_2 := \frac{D B + h_2 (6 \text{ in})}{h_2 B} = 0.141$ ratio of solid area to gross area of 9' high carport

$C_f := 1.8$ force coefficient

(ASCE TAB. 29.4-2)

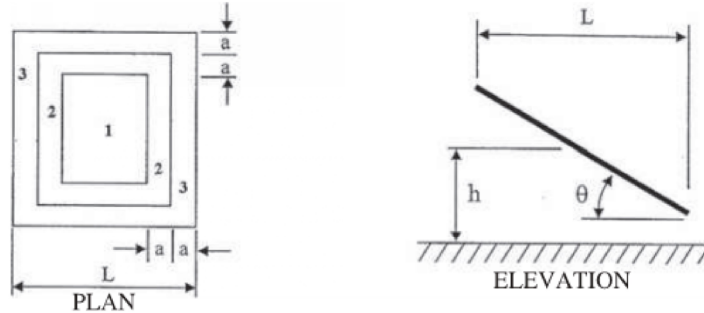
$P_f := \max(q_h G C_f, 16 \text{ psf}) = 34.21 \text{ psf}$

Project: EAST TOWN CROSSING CARPORTS

WIND DESIGN CRITERIA FOR COMPONENTS AND CLADDING

VERTICAL FORCES APPLIED TO C&C WILL BE DETERMINED USING THE DIRECTIONAL PROCEDURE, AS OUTLINED IN CHAPTER 30 OF ASCE 7-16

Diagrams



Notation

a = 10% of least horizontal dimension or $0.4h$, whichever is smaller but not less than 4% of least horizontal dimension or 3 ft (0.9 m).

h = Mean roof height, in ft (m).

L = Horizontal dimension of building, measured in along-wind direction, in ft (m).

θ = Angle of plane of roof from horizontal, in degrees.

Net Pressure Coefficients, C_N

Roof Angle, θ	Effective Wind Area	Clear Wind Flow					
		Zone 3		Zone 2		Zone 1	
0°	$\leq a^2$	2.4	-3.3	1.8	-1.7	1.2	-1.1
	$> a^2, \leq 4.0a^2$	1.8	-1.7	1.8	-1.7	1.2	-1.1
	$> 4.0a^2$	1.2	-1.1	1.2	-1.1	1.2	-1.1
7.5°	$\leq a^2$	3.2	-4.2	2.4	-2.1	1.6	-1.4

ASCE 7-16 TABLE 30.7-1

$$a := \max \left(\min \left(0.1 B, 0.4 h_1, 0.4 h_2 \right), 0.04 B, 3 \text{ ft} \right) = 3 \text{ ft}$$

$$a^2 = 9 \text{ ft}^2$$

$$4 a^2 = 36 \text{ ft}^2$$

EFFECTIVE WIND AREA MUST BE DETERMINED PER COMPONENT TO OBTAIN THE APPROPRIATE NET PRESSURE COEFFICIENT FOR C&C

TYPICAL MEMBER CHECKS

DECKING

V-LINE 32

SECTION PROPERTIES AND GENERAL INFORMATION

SECTION PROPERTIES

ALLOWABLE UNIFORM LOADS PSF
(3 or More Equal Spans)

Ga.	Width (in.)	Yield KSI	Weight PSF	Top in Compression		Bottom in Compression		Inward Load						Outward Load					
				I _{xx} In ⁴ /ft	S _{xx} In ³ /ft	I _{xx} In ⁴ /ft	S _{xx} In ³ /ft	5'	6'	7'	8'	9'	10'	5'	6'	7'	8'	9'	10'
26	32"	60	0.91	0.0619	0.0847	0.0619	0.0833	70	52	33	22	16	11	71	53	33	22	16	11
24	32"	50	1.20	0.0870	0.1217	0.0874	0.1209	102	70	44	29	21	15	103	70	44	29	21	15
22	32"	50	1.57	0.1163	0.1623	0.1200	0.1683	147	92	58	39	27	20	143	92	58	39	27	20

- Theoretical section properties have been calculated per AISI 2001 "Specification for the Design of Cold-formed Steel Structural Members." I_{xx} and S_{xx} are effective section properties for deflection and bending.
- Allowable load is calculated in accordance with AISI 2001 specifications considering bending, shear, combined bending and shear, deflection. Allowable load considers the worst case of 3 and 4 equal span conditions. Allowable load does not address web crippling or fasteners/support connection and panel weight is not considered.
- Deflection consideration is limited by a maximum deflection ratio of L/180 of span.
- Allowable loads do not include a 1/3 stress increase in uplift.

DECKING SPECIFICATIONS:

$$I := 0.0619 \frac{\text{in}^4}{\text{ft}}$$

$$S_{neg} := 0.0833 \frac{\text{in}^3}{\text{ft}}$$

$$S_{pos} := 0.0847 \frac{\text{in}^3}{\text{ft}}$$

$$F_{allow} := \frac{60 \text{ ksi}}{1.67} = 35.9 \text{ ksi}$$

$$l_{main} := 10 \text{ ft} \quad \text{length of main span}$$

$$l_{cant} := 3.5 \text{ ft} \quad \text{length of cantilevers}$$

$$b := 32 \text{ in} \quad \text{width of one sheet of decking}$$

LOADING:

$$D := W_{deck} = 1.03 \text{ psf} \quad \text{weight of decking}$$

$$S = 25 \text{ psf} \quad \text{snow load}$$

Project: EAST TOWN CROSSING CARPORTS

LOADING FOR MAX BEARING: D + S

$$w := D + S = 26.03 \text{ psf}$$

$$M_{neg} := \frac{1}{2} w l_{cant}^2 = 159.434 \frac{\text{lb} \cdot \text{ft}}{\text{ft}}$$

$$M_{pos} := \frac{1}{8} w l_{main}^2 - M_{neg} = 165.941 \frac{\text{lb} \cdot \text{ft}}{\text{ft}}$$

$$f_{neg} := \frac{M_{neg}}{S_{neg}} = 22.968 \text{ ksi}$$

$$f_{pos} := \frac{M_{pos}}{S_{pos}} = 23.51 \text{ ksi}$$

$$\frac{f_{neg}}{F_{allow}} = 63.9\%$$

$$\frac{f_{pos}}{F_{allow}} = 65\%$$

LOADING FOR MAX UPLIFT: 0.6D + 0.6W

$$A_T := B b = 45.333 \text{ ft}^2$$

$$C_N := -1.1$$

(ASCE TAB. 30.7-1)

$$W := \min(q_h G C_N, -16 \text{ psf}) = -20.907 \text{ psf}$$

$$w := 0.6 D + 0.6 W = -11.926 \text{ psf}$$

$$M_{pos} := -\frac{1}{2} w l_{cant}^2 = 73.048 \frac{\text{lb} \cdot \text{ft}}{\text{ft}}$$

$$M_{neg} := -\frac{1}{8} w l_{main}^2 - M_{pos} = 76.03 \frac{\text{lb} \cdot \text{ft}}{\text{ft}}$$

$$f_{pos} := \frac{M_{pos}}{S_{pos}} = 10.349 \text{ ksi}$$

$$f_{neg} := \frac{M_{neg}}{S_{neg}} = 10.953 \text{ ksi}$$

$$\frac{f_{pos}}{F_{allow}} = 29\%$$

$$\frac{f_{neg}}{F_{allow}} = 30\%$$

V-LINE 32, 26 GA. DECKING OK

Project: EAST TOWN CROSSING CARPORTS

DECKING-PURLIN CONNECTION

WIND LOADING (C&C ZONE 3)

$$A_T := \frac{1}{4} b \left(\frac{1}{2} l_{main} + l_{cant} \right) = 5.667 \text{ ft}^2 \quad \text{tributary area of (1) screw}$$

$$C_N := -3.3$$

(ASCE TAB. 30.7-1)

$$W := \min(q_h G C_N, -16 \text{ psf}) = -62.7 \text{ psf}$$

LOADING FOR MAX UPLIFT: 0.6D + 0.6W

$$R := (0.6 D + 0.6 W) A_T = -209.7 \text{ lbf} \quad \text{uplift reaction for (1) screw}$$

ALLOWABLE PULLOVER

$$t_1 := 0.0179 \text{ in}$$

$$t_2 := 0.415 \text{ in}$$

$$F_u := 82 \text{ ksi}$$

$$P_{pullover} := \frac{1.5}{3} t_1 t_2 F_u = 304.6 \text{ lbf} \quad \text{allowable pullover load}$$

$$\frac{-R}{P_{pullover}} = 69\%$$

ALLOWABLE PULLOUT

TABLE 2—ALLOWABLE TENSILE PULL-OUT LOADS (P_{NOT}/Ω), pounds-force^{1, 2, 3, 4, 5}

Steel $F_u = 45 \text{ ksi}$, Applied Factor of Safety, $\Omega = 3.0$												
Screw Designation	Nominal Diameter (in.)	Design Thickness of Member Not in Contact with the Screw Head (in)										
		0.018	0.024	0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250
10-16	0.190	44	58	73	87	116	145	182	254	303	⁶	⁶
12-14, 12-24	0.216	50	66	83	99	132	165	207	289	344	515	689
¹ / ₄ -14, ¹ / ₄ -28	0.250	57	77	96	115	153	191	239	335	398	596	797

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa.

¹For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.

²ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.

³The allowable pull-out capacity for other member thickness can be determined by interpolating within the table.

⁴To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

⁵For $F_u = 58 \text{ ksi}$, multiply values by 1.29; for $F_u = 65 \text{ ksi}$, multiply values by 1.44.

⁶Outside drilling capacity limits.

$$P_{pullout} := 289 \text{ lbf} \quad \text{allowable pullout load}$$

(ESR-1979 TAB. 2)

$$\frac{-R}{P_{pullout}} = 73\%$$

#12-14 TEK SCREWS @ 9" O.C. OK

TYPICAL PURLINS

PURLIN SPECIFICATIONS:

$$l_{main} := \frac{1}{2} A = 16 \text{ ft} \quad \text{length of main span}$$

$$l_{cant} := \frac{1}{4} A = 8 \text{ ft} \quad \text{length of cantilevers}$$

$$b := \frac{1}{2} B = 8.5 \text{ ft} \quad \text{tributary width of (1) purlin}$$

$$D := D \ b + W_{purlin} = 15.065 \text{ plf}$$

LOADING FOR MAX BEARING: D + S

$$w := D + S \ b = 227.565 \text{ plf}$$

$$R_1 := w \left(\frac{1}{2} l_{main} + l_{cant} \right) = 3.641 \text{ kip}$$

$$M_{x1} := \max \left(\frac{1}{2} w l_{cant}^2, \frac{1}{8} w l_{main}^2 \right) = 87.38 \text{ kip} \cdot \text{in}$$

$$V_{y1} := \max \left(\frac{w}{2 l_{main}} (l_{main}^2 + l_{cant}^2), \frac{w}{2 l_{main}} (l_{main}^2 - l_{cant}^2), w l_{cant} \right) = 2.276 \text{ kip}$$

LOADING FOR MAX BEARING: 0.6D + 0.6W

$$A_T := A \ b = 272 \text{ ft}^2 \quad \text{tributary of (1) purlin}$$

$$C_N := -1.1$$

(ASCE TAB. 30.7-1)

$$W := \min (q_h \ G \ C_N, -16 \text{ psf}) = -20.907 \text{ psf}$$

$$w := 0.6 \ D + 0.6 \ W \ b = -97.587 \text{ plf}$$

$$R_2 := w \left(\frac{1}{2} l_{main} + l_{cant} \right) = -1.561 \text{ kip}$$

$$M_{x2} := \max \left(\frac{1}{2} w l_{cant}^2, \frac{1}{8} w l_{main}^2 \right) = -37.47 \text{ kip} \cdot \text{in}$$

$$V_{y2} := \max \left(\frac{w}{2 l_{main}} (l_{main}^2 + l_{cant}^2), \frac{w}{2 l_{main}} (l_{main}^2 - l_{cant}^2), w l_{cant} \right) = -0.586 \text{ kip}$$

MAXIMUM VALUES:

$$R := \max (R_1, \text{abs} (R_2)) = 3.641 \text{ kip}$$

$$M_x := \max (M_{x1}, \text{abs} (M_{x2})) = 87.38 \text{ kip} \cdot \text{in}$$

$$V_y := \max (V_{y1}, \text{abs} (V_{y2})) = 2.276 \text{ kip}$$

Project: EAST TOWN CROSSING CARPORTS
Deflection Check:

$$\Delta_a := \frac{l_{main}}{180} = 1.06667 \text{ in} \quad \text{allowable deflection}$$

(IBC TAB. 1604.3)

$$w := S \ b = 212.5 \text{ plf}$$

$$I_x := 26.615 \text{ in}^4$$

(AEP SPAN)

$$E := 29000 \text{ ksi}$$

$$\Delta := \frac{5 \ w \ l_{main}^4}{384 \ E \ I_x} = 0.406 \text{ in}$$

$$\frac{\Delta}{\Delta_a} = 38\%$$

PER ATTACHED, (2) CS 10"x3 1/2", 12 GA. PURLINS OK

(CFS 14)

Fully Braced Strength - AISI S100-16, US, ASD

Material Type: A653 SS Grade 50/1, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
Pao	32.374 k	Maxo	153.71 k-in	Mayo	35.93 k-in
Ae	1.1655 in ²	Ixe	26.615 in ⁴	Iye	2.995 in ⁴
Ta	55.552 k	Sxe(t)	5.1339 in ³	Sye(l)	2.9799 in ³
		Sxe(b)	5.5263 in ³	Sye(r)	1.2002 in ³

Shear

Vay		Negative Bending		Negative Bending	
Vay	9.862 k	Maxo	153.71 k-in	Mayo	33.80 k-in
Vax	11.409 k	Ixe	26.615 in ⁴	Iye	2.505 in ⁴
		Sxe(t)	5.5263 in ³	Sye(l)	1.9553 in ³
		Sxe(b)	5.1339 in ³	Sye(r)	1.1291 in ³

Torsion

Ba	128.31 k-in ²				
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Member Check - AISI S100-16, US, ASD

Material Type: A653 SS Grade 50/1, Fy=50 ksi

Design Parameters:

Lx	16.000 ft	Ly	0.000 ft	Lt	16.000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: Top		kφ	0 k		
Red. Factor, R: 0.4		Lm	16.000 ft		

Loads:		P	Mx	Vy	My	Vx
		(k)	(k-in)	(k)	(k-in)	(k)
Entered		0.000	87.38	2.276	0.00	0.000
Applied		0.000	87.38	2.276	0.00	0.000
Strength		15.418	140.78	9.862	26.56	11.409

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	0.000 + 0.621 + 0.000 = 0.621	<= 1.0
Eq. H2-1	(Mx, Vy)	Sqrt(0.323 + 0.053) = 0.614	<= 1.0
Eq. H2-1	(My, Vx)	Sqrt(0.000 + 0.000) = 0.000	<= 1.0

Project: EAST TOWN CROSSING CARPORTS

PURLIN-BEAM CONNECTION

$$R_1 = 3641.04 \text{ lbf} \quad \text{ASD-level bearing force}$$

$$-R_2 = 1561.387 \text{ lbf} \quad \text{ASD-level uplift force}$$

SHEAR DUE TO LATERAL FORCES (SEISMIC AND C&C)
ARE OMITTED AS VERTICAL FORCES WILL GOVERN.

SHEAR IN PURLIN:

$$\Omega_{v1} := 2.00 \quad \text{shear safety factor}$$

$$F_u := 60 \text{ ksi} \quad \text{ultimate stress for ASTM A307 Gr. A} \quad (\text{AISC TAB. 2-6})$$

$$t := 0.1017 \text{ in} \quad \text{design thickness of purlin}$$

$$e := 4.5 \text{ in} \quad \text{distance between bolt holes}$$

$$P_{nv1} := 4 \text{ t e } F_u = 109.84 \text{ kip}$$

SHEAR IN BOLTS:

$$\Omega_{v2} := 2.00 \quad \text{shear safety factor}$$

$$F_{nv} := 27 \text{ ksi} \quad \text{nominal shear strength for ASTM A307 bolts} \quad (\text{AISC TAB. J3.2})$$

$$d := 0.5 \text{ in} \quad \text{bolt diameter}$$

$$A_b := \frac{\pi}{4} d^2 = 0.196 \text{ in}^2$$

$$P_{nv2} := 4 A_b F_{nv} = 21.206 \text{ kip}$$

BEARING CAPACITY OF BOLTS:

$$\Omega_b := 2.50 \quad \text{shear safety factor} \quad (\text{AISI SEC. J3.3.1})$$

$$\frac{d}{t} = 4.916$$

$$C := 3.0 \quad \text{bearing factor} \quad (\text{AISI TAB. J3.3.1-1})$$

$$m_f := 0.75 \quad \text{modification factor for bearing connection type} \quad (\text{AISI TAB. J3.3.1-2})$$

$$P_{nb} := 4 C m_f d t F_u = 27.459 \text{ kip} \quad (\text{AISI EQ. J3.3.1-1})$$

$$P_a := \min \left(\frac{P_{nv1}}{\Omega_{v1}}, \frac{P_{nv2}}{\Omega_{v2}}, \frac{P_{nb}}{\Omega_b} \right) = 10.603 \text{ kip} \quad \text{allowable shear for (4) 0.5-in bolts}$$

$$\frac{\max(R_1, -R_2)}{P_a} = 34\%$$

(4) 1/2" A307 GR. A BOLTS OK

Project: EAST TOWN CROSSING CARPORTS

TYPICAL BEAM

BEAM SPECIFICATIONS:

$$L := 10 \text{ ft} \quad \text{length of beam}$$

NOMINAL LOADS: *FOR USE IN ENERCALC (SEE APPENDIX)*

$$P_D := \frac{1}{4} A B W_{deck} + \frac{1}{2} A W_{purlin} = 0.241 \text{ kip} \quad \text{dead load at each end of beam}$$

$$P_S := \frac{1}{4} A B S = 3.4 \text{ kip} \quad \text{snow load at each end of beam}$$

$$P_{W1} := \frac{1}{4} A B P_{NW1} = -2.843 \text{ kip} \quad \text{MWFRS force at one end of beam}$$

$$P_{W2} := \frac{1}{4} A B P_{NLB} = -0.258 \text{ kip} \quad \text{MWFRS force at other end of beam}$$

W8x10 BEAMS OK
(ENERCALC)

TYPICAL POST

NOMINAL LOADS: *FOR USE IN ENERCALC (SEE APPENDIX)*

$$P_D := 2 P_D + L W_{beam} = 0.582 \text{ kip} \quad \text{axial dead load}$$

$$P_S := 2 P_S = 6.8 \text{ kip} \quad \text{axial snow load}$$

$$V_W := \frac{1}{2} (1 \text{ ft}) A P_f = 0.547 \text{ kip} \quad \text{wind load about weak axis of post}$$

$$V_{E,1} := \frac{1}{2} E_{h,1} = 0.686 \text{ kip} \quad \text{seismic load about weak axis of 8'-0" post}$$

$$V_{E,2} := \frac{1}{2} E_{h,2} = 0.692 \text{ kip} \quad \text{seismic load about weak axis of 9'-0" post}$$

HSS6x4x3/16 OK

(ENERCALC)

Project: EAST TOWN CROSSING CARPORTS

TYPICAL FOOTING

NOMINAL LOADS: *FOR USE IN ENERCALC (SEE APPENDIX)*

$$P_{D,1} := P_D + h_1 W_{post} = 0.678 \text{ kip} \quad \text{axial dead load of 8'-0" post}$$

$$P_{D,2} := P_D + h_2 W_{post} = 0.69 \text{ kip} \quad \text{axial dead load of 9'-0" post}$$

$$P_S = 6.8 \text{ kip} \quad \text{axial snow load}$$

$$V_W = 0.547 \text{ kip} \quad \text{lateral wind load}$$

$$V_{E,1} = 0.686 \text{ kip} \quad \text{lateral seismic load of 8'-0" post}$$

$$V_{E,2} = 0.692 \text{ kip} \quad \text{lateral seismic load of 9'-0" post}$$

POLE FOOTING SPECIFICATIONS

$$\gamma_{conc} := 150 \text{ pcf} \quad \text{concrete unit weight}$$

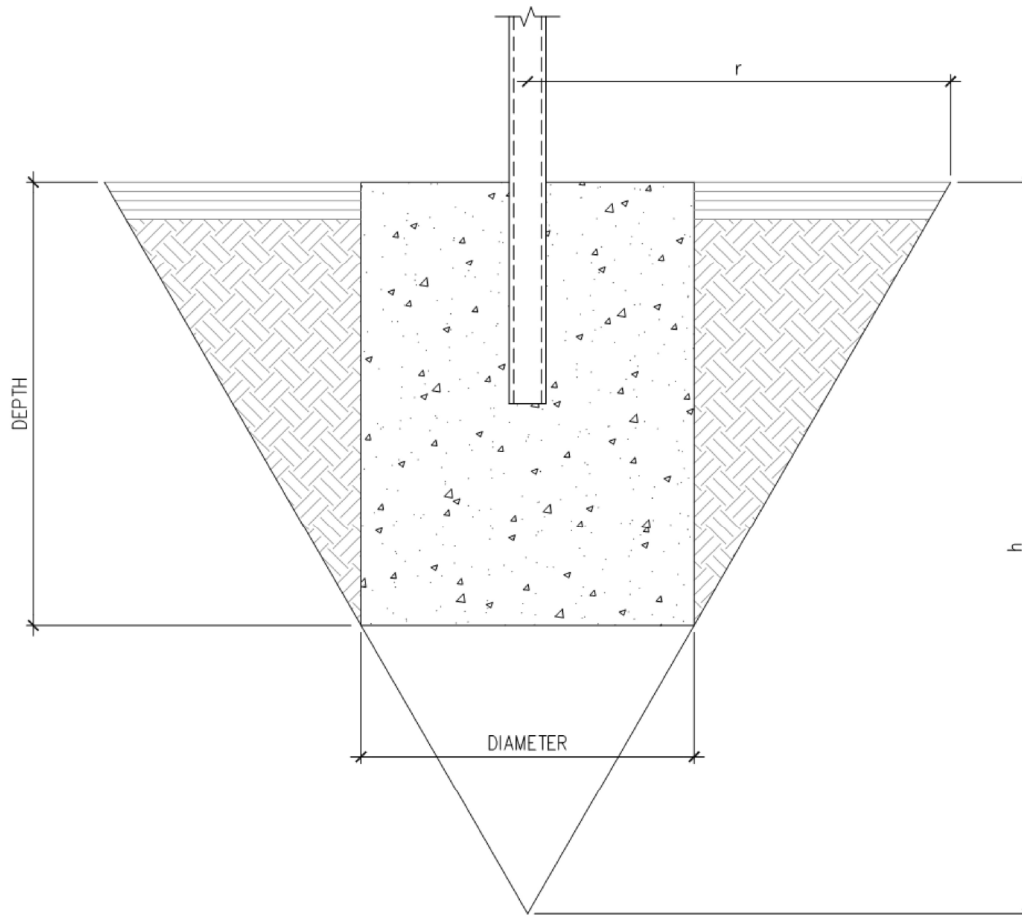
$$D_{min} := \sqrt{\frac{4 (P_D + P_S)}{\pi \cdot \sigma_{max}}} = 26 \text{ in} \quad \text{minimum diameter}$$

$$DIAMETER := 36 \text{ in}$$

$$DEPTH := 3.75 \text{ ft}$$

Project: EAST TOWN CROSSING CARPORTS

UPLIFT CHECK WITH SOIL CONE THEORY



$$\phi := 30^\circ$$

$$\gamma := 110 \text{ pcf} \quad \text{soil unit weight}$$

$$V_{FTG} := \frac{\pi}{4} \text{ DEPTH DIAMETER}^2 = 26.507 \text{ ft}^3$$

$$r := \text{DEPTH} \tan(\phi) + \frac{1}{2} \text{ DIAMETER} = 3.665 \text{ ft}$$

$$h_{cone} := \frac{r}{\tan(\phi)} = 6.348 \text{ ft}$$

$$V_{soil} := \left(\frac{\pi}{3} r^2 h_{cone} \right) - V_{FTG} = 62.789 \text{ ft}^3$$

$$W_{FTG\&cone} := \gamma_{conc} V_{FTG} + \gamma V_{soil} = 10.88 \text{ kip}$$

$$P_{Dreq'd} := \frac{1}{4} A B (-P_{NWB} - P_{NLB}) = 3.1 \text{ kip}$$

$$\frac{P_{Dreq'd}}{W_{FTG\&cone}} = 29\%$$

3-FT DIAMETER x 3.75-FT DEEP FOOTING OK

(ENERCALC)

TYPICAL ALTERNATE FOOTING

NOMINAL LOADS: *FOR USE IN ENERCALC (SEE APPENDIX)*

$$P_{D,1} = 0.678 \text{ kip} \quad \text{axial dead load of 8'-0" post}$$

$$P_{D,2} = 0.69 \text{ kip} \quad \text{axial dead load of 9'-0" post}$$

$$P_S = 6.8 \text{ kip} \quad \text{axial snow load}$$

$$P_W := -P_{Dreq'd} = -3.102 \text{ kip} \quad \text{axial wind load}$$

$$V_W = 0.547 \text{ kip} \quad M_W := V_W h_1 = 4.379 \text{ kip} \cdot \text{ft} \quad \text{wind lateral load \& moment of 8' high carport}$$

$$V_W = 0.547 \text{ kip} \quad M_W := V_W h_2 = 4.926 \text{ kip} \cdot \text{ft} \quad \text{wind lateral load \& moment of 9' high carport}$$

$$V_{E,1} = 0.686 \text{ kip} \quad M_E := V_{E,1} h_1 = 5.488 \text{ kip} \cdot \text{ft} \quad \text{seismic lateral load \& moment of 8' high carport}$$

$$V_{E,2} = 0.692 \text{ kip} \quad M_E := V_{E,2} h_2 = 6.232 \text{ kip} \cdot \text{ft} \quad \text{seismic lateral load \& moment of 9' high carport}$$

**4.5-FT SQUARE x 2-FT DEEP FOOTING w/
(6) #4 BARS E.W. TOP & BOTTOM OK**

(ENERCALC)

LONG-SPAN MEMBER CHECKS

LONG-SPAN PURLINS

PURLIN SPECIFICATIONS:

$$l_{main} := 24 \text{ ft} \quad \text{length of main span}$$

$$l_{cant} := 8 \text{ ft} \quad \text{length of cantilevers}$$

$$b := \frac{1}{4} B = 4.25 \text{ ft} \quad \text{tributary width of (1) purlin}$$

$$D := W_{deck} b + W_{purlin} = 10.688 \text{ plf}$$

LOADING FOR MAX BEARING: D + S

$$w := D + S b = 116.938 \text{ plf}$$

$$R_1 := w \left(\frac{1}{2} l_{main} + l_{cant} \right) = 2.339 \text{ kip}$$

$$M_{x1} := \max \left(\frac{1}{2} w l_{cant}^2, \frac{1}{8} w l_{main}^2 \right) = 101.03 \text{ kip} \cdot \text{in}$$

$$V_{y1} := \max \left(\frac{w}{2 l_{main}} (l_{main}^2 + l_{cant}^2), \frac{w}{2 l_{main}} (l_{main}^2 - l_{cant}^2), w l_{cant} \right) = 1.559 \text{ kip}$$

LOADING FOR MAX BEARING: 0.6D + 0.6W

$$A_T := A b = 136 \text{ ft}^2 \quad \text{tributary of (1) purlin}$$

$$C_N := -1.1 \quad (\text{ASCE TAB. 30.7-1})$$

$$W := \min (q_h G C_N, -16 \text{ psf}) = -20.907 \text{ psf}$$

$$w := 0.6 D + 0.6 W b = -46.9 \text{ plf}$$

$$R_2 := w \left(\frac{1}{2} l_{main} + l_{cant} \right) = -0.938 \text{ kip}$$

$$M_{x2} := \max \left(\frac{1}{2} w l_{cant}^2, \frac{1}{8} w l_{main}^2 \right) = -18.01 \text{ kip} \cdot \text{in}$$

$$V_{y2} := \max \left(\frac{w}{2 l_{main}} (l_{main}^2 + l_{cant}^2), \frac{w}{2 l_{main}} (l_{main}^2 - l_{cant}^2), w l_{cant} \right) = -0.375 \text{ kip}$$

MAXIMUM VALUES:

$$R := \max (R_1, \text{abs} (R_2)) = 2.339 \text{ kip}$$

$$M_x := \max (M_{x1}, \text{abs} (M_{x2})) = 101.03 \text{ kip} \cdot \text{in}$$

$$V_y := \max (V_{y1}, \text{abs} (V_{y2})) = 1.559 \text{ kip}$$

Project: EAST TOWN CROSSING CARPORTS
Deflection Check:

$$\Delta_a := \frac{l_{main}}{180} = 1.6 \text{ in} \quad \text{allowable deflection}$$

(IBC TAB. 1604.3)

$$w := S \ b = 106.25 \text{ plf}$$

$$I_x := 26.615 \text{ in}^4 \quad E := 29000 \text{ ksi}$$

$$\Delta := \frac{5 \ w \ l_{main}^4}{384 \ E \ I_x} = 1.028 \text{ in}$$

$$\frac{\Delta}{\Delta_a} = 64\%$$

PER ATTACHED, (4) CS 10"x3 1/2", 12 GA. PURLINS OK (CFS 14)

Fully Braced Strength - AISI S100-16/S3-22, US, ASD

Material Type: A653 SS Grade 50/1, Fy=50 ksi

Axial		Positive Bending		Positive Bending	
Pao	32.374 k	Maxo	153.71 k-in	Mayo	35.93 k-in
Ae	1.1655 in ²	Ixe	26.615 in ⁴	Iye	2.995 in ⁴
Ta	55.552 k	Sxe(t)	5.1339 in ³	Sye(l)	2.9799 in ³
		Sxe(b)	5.5263 in ³	Sye(r)	1.2002 in ³
Shear		Negative Bending		Negative Bending	
Vay	9.717 k	Maxo	153.71 k-in	Mayo	33.80 k-in
Vax	10.931 k	Ixe	26.615 in ⁴	Iye	2.505 in ⁴
		Sxe(t)	5.5263 in ³	Sye(l)	1.9553 in ³
Torsion		Sxe(b)	5.1339 in ³	Sye(r)	1.1291 in ³
Ba	128.31 k-in ²				

Member Check - AISI S100-16/S3-22, US, ASD

Material Type: A653 SS Grade 50/1, Fy=50 ksi

Design Parameters:

Lx	24.000 ft	Ly	0.000 ft	Lt	24.000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: Top		kφ	0 k		
Red. Factor, R: 0.4		Lm	24.000 ft		

Loads:	P	Mx	Vy	My	Vx
	(k)	(k-in)	(k)	(k-in)	(k)
Entered	0.000	101.03	1.559	0.00	0.000
Applied	0.000	101.03	1.559	0.00	0.000
Strength	15.418	142.63	9.717	15.41	10.931

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	0.000 + 0.708 + 0.000 = 0.708 <= 1.0
Eq. H2-1	(Mx, Vy)	Sqrt(0.432 + 0.026) = 0.677 <= 1.0
Eq. H2-1	(My, Vx)	Sqrt(0.000 + 0.000) = 0.000 <= 1.0

Project: EAST TOWN CROSSING CARPORTS

PURLIN-BEAM CONNECTION

$$R_1 := 2 \cdot R_f = 4677.5 \text{ lbf} \quad \text{ASD-level bearing force}$$

$$R_2 := -2 \cdot R_2 = 1876.014 \text{ lbf} \quad \text{ASD-level uplift force}$$

SHEAR DUE TO LATERAL FORCES (SEISMIC AND C&C)
ARE OMITTED AS VERTICAL FORCES WILL GOVERN.

SHEAR IN PURLIN:

$$\Omega_{v1} := 2.00 \quad \text{shear safety factor}$$

$$F_u := 60 \text{ ksi} \quad \text{ultimate stress for ASTM A307 Gr. A} \quad (\text{AISC TAB. 2-6})$$

$$t := 0.1017 \text{ in} \quad \text{design thickness of purlin}$$

$$e := 4.5 \text{ in} \quad \text{distance between bolt holes}$$

$$P_{nv1} := 4 \cdot t \cdot e \cdot F_u = 109.84 \text{ kip}$$

SHEAR IN BOLTS:

$$\Omega_{v2} := 2.00 \quad \text{shear safety factor}$$

$$F_{nv} := 27 \text{ ksi} \quad \text{nominal shear strength for ASTM A307 bolts} \quad (\text{AISC TAB. J3.2})$$

$$d := 0.5 \text{ in} \quad \text{bolt diameter}$$

$$A_b := \frac{\pi}{4} d^2 = 0.196 \text{ in}^2$$

$$P_{nv2} := 4 \cdot A_b \cdot F_{nv} = 21.206 \text{ kip}$$

BEARING CAPACITY OF BOLTS:

$$\Omega_b := 2.50 \quad \text{shear safety factor} \quad (\text{AISI SEC. J3.3.1})$$

$$\frac{d}{t} = 4.916$$

$$C := 3.0 \quad \text{bearing factor} \quad (\text{AISI TAB. J3.3.1-1})$$

$$m_f := 0.75 \quad \text{modification factor for bearing connection type} \quad (\text{AISI TAB. J3.3.1-2})$$

$$P_{nb} := 4 \cdot C \cdot m_f \cdot d \cdot t \cdot F_u = 27.459 \text{ kip} \quad (\text{AISI EQ. J3.3.1-1})$$

$$P_a := \min \left(\frac{P_{nv1}}{\Omega_{v1}}, \frac{P_{nv2}}{\Omega_{v2}}, \frac{P_{nb}}{\Omega_b} \right) = 10.603 \text{ kip} \quad \text{allowable shear for (4) 0.5-in bolts}$$

$$\frac{\max(R_1, -R_2)}{P_a} = 44\%$$

(4) 1/2" A307 GR. A BOLTS OK

LONG-SPAN BEAM

SPECIFICATIONS:

$$A := l_{main} + 2 \ l_{cant} = 40 \text{ ft} \quad \text{length of carports}$$

$$L := 10 \text{ ft} \quad \text{length of beam}$$

$$W_{beam} := 10 \text{ plf} \quad \text{weight of beam}$$

NOMINAL LOADS: FOR USE IN ENERCALC (SEE APPENDIX)

$$P_D := \frac{1}{4} A B W_{deck} + 2 \left(\frac{1}{2} \right) A W_{purlin} = 0.428 \text{ kip} \quad \text{dead load at each end of beam}$$

$$P_S := \frac{1}{4} A B S = 4.25 \text{ kip} \quad \text{snow load at each end of beam}$$

$$P_{W1} := \frac{1}{4} A B P_{NWB} = -3.554 \text{ kip} \quad \text{MWFRS force at one end of beam}$$

$$P_{W2} := \frac{1}{4} A B P_{NLB} = -0.323 \text{ kip} \quad \text{MWFRS force at other end of beam}$$

W8x10 BEAMS OK

(ENERCALC)

LONG-SPAN POST

NOMINAL LOADS: FOR USE IN ENERCALC (SEE APPENDIX)

$$P_D := 2 P_D + L W_{beam} = 0.955 \text{ kip} \quad \text{axial dead load}$$

$$P_S := 2 P_S = 8.5 \text{ kip} \quad \text{axial snow load}$$

$$V_W := (1 \text{ ft}) \left(\frac{1}{2} A \right) P_f = 0.684 \text{ kip} \quad \text{wind load about weak axis of post}$$

$$W_{E,1} := W_{deck} A B + 4 W_{purlin} A \downarrow = 2006 \text{ lbf} \\ + 2 W_{beam} L + 2 W_{post} \left(\frac{h_1}{2} \right)$$

$$E_{h,1} := \rho C_s W_{E,1} = 2184 \text{ lbf}$$

$$W_{E,2} := W_{deck} A B + 4 W_{purlin} A \downarrow = 2018 \text{ lbf} \\ + 2 W_{beam} L + 2 W_{post} \left(\frac{h_2}{2} \right)$$

$$E_{h,2} := \rho C_s W_{E,2} = 2197 \text{ lbf}$$

$$V_{E,1} := \frac{1}{2} E_{h,1} = 1.092 \text{ kip} \quad \text{seismic load about weak axis of 8' post}$$

$$V_{E,2} := \frac{1}{2} E_{h,2} = 1.099 \text{ kip} \quad \text{seismic load about weak axis of 9' post}$$

HSS6x4x3/16 OK (ENERCALC)

LONG-SPAN FOOTING

NOMINAL LOADS: FOR USE IN ENERCALC (SEE APPENDIX)

$$P_{D,1} := P_D + h_1 W_{post} = 1.051 \text{ kip} \quad \text{axial dead load of 8' post}$$

$$P_{D,2} := P_D + h_2 W_{post} = 1.063 \text{ kip} \quad \text{axial dead load of 9' post}$$

$$P_S = 8.5 \text{ kip} \quad \text{axial snow load}$$

$$V_W = 0.684 \text{ kip} \quad \text{lateral wind load}$$

$$V_{E,1} = 1.092 \text{ kip} \quad \text{lateral seismic load of 8' post}$$

$$V_{E,2} = 1.099 \text{ kip} \quad \text{lateral seismic load of 9' post}$$

POLE FOOTING SPECIFICATIONS

$$\gamma_{conc} := 150 \text{ pcf} \quad \text{concrete unit weight}$$

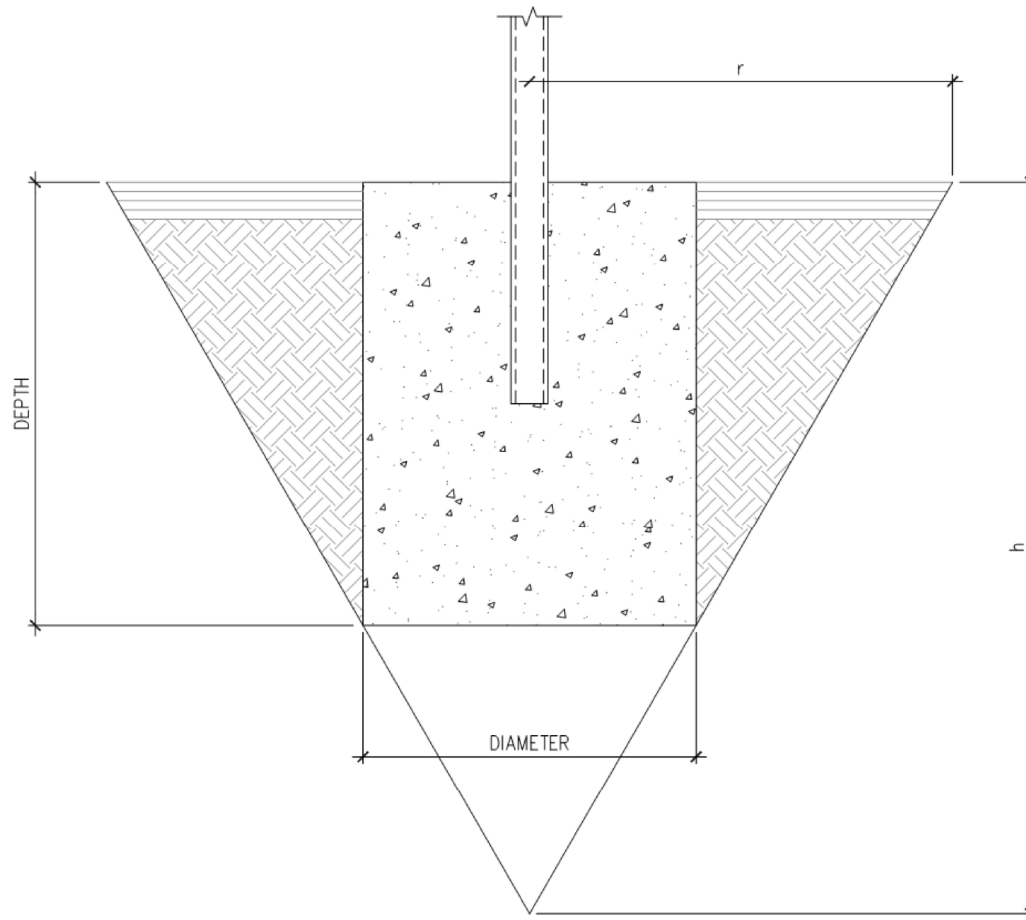
$$D_{min} := \sqrt{\frac{4 (P_D + P_S)}{\pi \cdot \sigma_{max}}} = 29.4 \text{ in} \quad \text{minimum diameter}$$

$$DIAMETER := 36 \text{ in}$$

$$DEPTH := 4.50 \text{ ft}$$

Project: EAST TOWN CROSSING CARPORTS

UPLIFT CHECK WITH SOIL CONE THEORY



$$\phi := 30^\circ$$

$$\gamma := 110 \text{ } \text{pcf} \quad \text{soil unit weight}$$

$$V_{FTG} := \frac{\pi}{4} \text{ DEPTH } \text{ DIAMETER}^2 = 31.809 \text{ } \text{ft}^3$$

$$r := \text{DEPTH } \tan(\phi) + \frac{1}{2} \text{ DIAMETER} = 4.098 \text{ } \text{ft}$$

$$h_{cone} := \frac{r}{\tan(\phi)} = 7.098 \text{ } \text{ft}$$

$$V_{soil} := \left(\frac{\pi}{3} r^2 h_{cone} \right) - V_{FTG} = 93.024 \text{ } \text{ft}^3$$

$$W_{FTG\&cone} := \gamma_{conc} V_{FTG} + \gamma V_{soil} = 15 \text{ } \text{kip}$$

$$P_{Dreq'd} := \frac{1}{4} A B (-P_{NWB} - P_{NLB}) = 3.88 \text{ } \text{kip}$$

$$\frac{P_{Dreq'd}}{W_{FTG\&cone}} = 26\%$$

3-FT DIAMETER x 4.5-FT DEEP FOOTING OK

(ENERCALC)

Project: EAST TOWN CROSSING CARPORTS

LONG-SPAN ALTERNATE FOOTING

NOMINAL LOADS: *FOR USE IN ENERCALC (SEE APPENDIX)*

$$P_D = 0.955 \text{ kip} \quad \text{axial dead load}$$

$$P_S = 8.5 \text{ kip} \quad \text{axial snow load}$$

$$P_W := -P_{Dreq'd} = -3.877 \text{ kip} \quad \text{axial wind load}$$

$$V_W = 0.684 \text{ kip} \quad M_W := V_W h_1 = 5.474 \text{ kip} \cdot \text{ft} \quad \text{wind lateral load \& moment of 8' post}$$

$$V_W = 0.684 \text{ kip} \quad M_W := V_W h_2 = 6.158 \text{ kip} \cdot \text{ft} \quad \text{wind lateral load \& moment of 9' post}$$

$$V_{E,1} = 1.092 \text{ kip} \quad M_E := V_{E,1} h_1 = 8.736 \text{ kip} \cdot \text{ft} \quad \text{seismic lateral load \& moment of 8' post}$$

$$V_{E,2} = 1.099 \text{ kip} \quad M_E := V_{E,2} h_2 = 9.887 \text{ kip} \cdot \text{ft} \quad \text{seismic lateral load \& moment of 9' post}$$

**4.75-FT SQUARE x 2-FT DEEP FOOTING w/
(7) #4 BARS E.W. TOP & BOTTOM OK**

(ENERCALC)

APPENDIX A

ENERCALC REPORTS

Steel Beam

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: TYPICAL BEAM

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021

Load Combination Set : ASCE 7-16

Material Properties

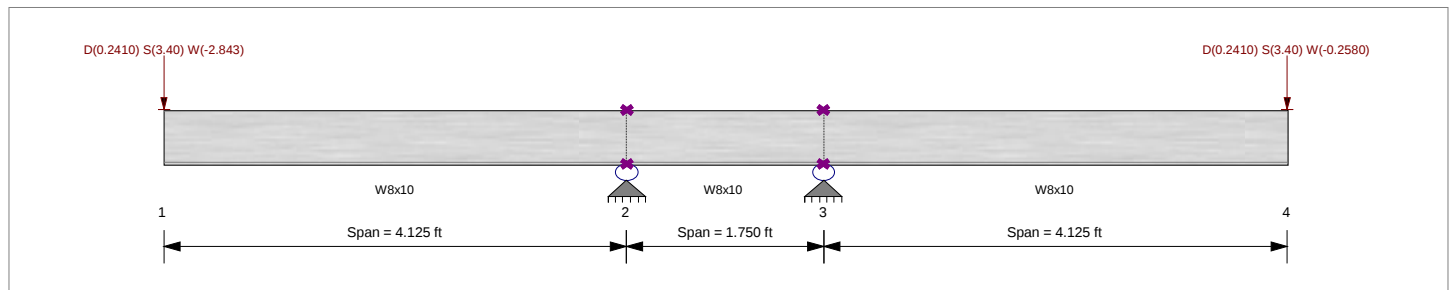
Analysis Method : Allowable Strength Design

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

Load(s) for Span Number 1

Point Load : D = 0.2410, S = 3.40, W = -2.843 k @ 0.0 ft

Load(s) for Span Number 3

Point Load : D = 0.2410, S = 3.40, W = -0.2580 k @ 4.125 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =

0.741 : 1

Maximum Shear Stress Ratio =

0.137 : 1

Section used for this span

W8x10

Section used for this span

W8x10

Ma : Applied

15.104 k-ft

Va : Applied

3.682 k

Mn / Omega : Allowable

20.377 k-ft

Vn/Omega : Allowable

26.826 k

Load Combination

+D+S

Load Combination

+D+S

Span # where maximum occurs

Span # 1

Location of maximum on span

4.125 ft

Span # where maximum occurs

Span # 1

Maximum Deflection

Max Downward Transient Deflection

0.253 in Ratio =

391 >=180.

Span: 3 : S Only

Max Upward Transient Deflection

-0.186 in Ratio =

531 >=180.

Span: 3 : W Only

Max Downward Total Deflection

0.272 in Ratio =

364 >=120.

Span: 3 : +D+S

Max Upward Total Deflection

-0.100 in Ratio =

987 >=120.

Span: 3 : +0.60D+0.60W

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx/Vnx/Omega	
D Only													
Dsgn. L = 4.13 ft	1	0.053	0.011		-1.08	1.08	34.03	20.38	1.00	1.00	0.28	40.24	26.83
Dsgn. L = 1.75 ft	2	0.049	0.011	-0.00	-1.08	1.08	36.52	21.87	1.00	1.00	0.28	40.24	26.83
Dsgn. L = 4.13 ft	3	0.053	0.011		-1.08	1.08	34.03	20.38	1.00	1.00	0.28	40.24	26.83
+D+S													
Dsgn. L = 4.13 ft	1	0.741	0.137		-15.10	15.10	34.03	20.38	1.00	1.00	3.68	40.24	26.83
Dsgn. L = 1.75 ft	2	0.691	0.137	-0.00	-15.10	15.10	36.52	21.87	1.00	1.00	3.68	40.24	26.83
Dsgn. L = 4.13 ft	3	0.741	0.137		-15.10	15.10	34.03	20.38	1.00	1.00	3.68	40.24	26.83
+D+0.750S													
Dsgn. L = 4.13 ft	1	0.569	0.106		-11.60	11.60	34.03	20.38	1.00	1.00	2.83	40.24	26.83
Dsgn. L = 1.75 ft	2	0.530	0.106	-0.00	-11.60	11.60	36.52	21.87	1.00	1.00	2.83	40.24	26.83
Dsgn. L = 4.13 ft	3	0.569	0.106		-11.60	11.60	34.03	20.38	1.00	1.00	2.83	40.24	26.83
+D+0.60W													
Dsgn. L = 4.13 ft	1	0.292	0.136	5.96		5.96	34.03	20.38	1.00	1.00	3.65	40.24	26.83
Dsgn. L = 1.75 ft	2	0.272	0.137	5.96	-0.44	5.96	36.52	21.87	1.75	1.00	3.66	40.24	26.83
Dsgn. L = 4.13 ft	3	0.022	0.005		-0.44	0.44	34.03	20.38	1.00	1.00	0.13	40.24	26.83
+D+0.450W													
Dsgn. L = 4.13 ft	1	0.206	0.102	4.20		4.20	34.03	20.38	1.00	1.00	2.73	40.24	26.83
Dsgn. L = 1.75 ft	2	0.192	0.103	4.20	-0.60	4.20	36.52	21.87	1.84	1.00	2.75	40.24	26.83
Dsgn. L = 4.13 ft	3	0.029	0.006		-0.60	0.60	34.03	20.38	1.00	1.00	0.17	40.24	26.83
+D+0.750S+0.450W													

Steel Beam

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: TYPICAL BEAM

Maximum Forces & Stresses for Load Combinations

Load Combination			Max Stress Ratios		Summary of Moment Values						Summary of Shear Values			
Segment Length	Span #		M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	VnxVnx/Omega	
Dsgn. L = 4.13 ft	1		0.310	0.102		-6.32	6.32	34.03	20.38	1.00	1.00	2.73	40.24	26.83
Dsgn. L = 1.75 ft	2		0.508	0.103	-0.00	-11.12	11.12	36.52	21.87	1.21	1.00	2.75	40.24	26.83
Dsgn. L = 4.13 ft	3		0.546	0.101		-11.12	11.12	34.03	20.38	1.00	1.00	2.72	40.24	26.83
+0.60D+0.60W														
Dsgn. L = 4.13 ft	1		0.314	0.136	6.39		6.39	34.03	20.38	1.00	1.00	3.65	40.24	26.83
Dsgn. L = 1.75 ft	2		0.292	0.136	6.39	-0.01	6.39	36.52	21.87	1.67	1.00	3.66	40.24	26.83
Dsgn. L = 4.13 ft	3		0.000	0.001	0.01	-0.01	0.01	34.03	20.38	1.00	1.00	0.01	40.24	26.83
+0.60D														
Dsgn. L = 4.13 ft	1		0.032	0.006		-0.65	0.65	34.03	20.38	1.00	1.00	0.17	40.24	26.83
Dsgn. L = 1.75 ft	2		0.030	0.006	-0.00	-0.65	0.65	36.52	21.87	1.00	1.00	0.17	40.24	26.83
Dsgn. L = 4.13 ft	3		0.032	0.006		-0.65	0.65	34.03	20.38	1.00	1.00	0.17	40.24	26.83

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.2718	0.000		0.0000	0.000
	2	0.0000	0.000	+D+S	-0.0113	0.875
+D+S	3	0.2701	4.125		0.0000	0.875

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		3.691	5.835	
Max Upward from Load Combinations		3.691	5.467	
Max Upward from Load Cases		3.400	5.835	
Max Downward from all Load Conditions (Resis)		-8.936		
Max Downward from Load Combinations (Resis)		-5.187		
Max Downward from Load Cases (Resisting Up)		-8.936		
D Only		0.291	0.291	
+D+S		3.691	3.691	
+D+0.750S		2.841	2.841	
+D+0.60W		-5.071	3.792	
+D+0.450W		-3.730	2.917	
+D+0.750S+0.450W		-1.180	5.467	
+0.60D+0.60W		-5.187	3.676	
+0.60D		0.175	0.175	
S Only		3.400	3.400	
W Only		-8.936	5.835	

Steel Section Properties : W8x10

Depth	=	7.890 in	I xx	=	30.80 in^4	J	=	0.043 in^4
Web Thick	=	0.170 in	S xx	=	7.81 in^3	Cw	=	30.90 in^6
Flange Width	=	3.940 in	R xx	=	3.220 in			
Flange Thick	=	0.205 in	Zx	=	8.870 in^3			
Area	=	2.960 in^2	I yy	=	2.090 in^4			
Weight	=	10.000 plf	S yy	=	1.060 in^3	Wno	=	7.570 in^2
Kdesign	=	0.505 in	R yy	=	0.841 in	Sw	=	1.530 in^4
K1	=	0.500 in	Zy	=	1.660 in^3	Qf	=	1.480 in^3
rts	=	1.010 in				Qw	=	4.290 in^3
Ycg	=	3.945 in						

Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL 8'-0" POST

Code References

Calculations per AISC 360-16, IBC 2021
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name :	HSS6x4x3/16	Overall Column Height	8.0 ft
Analysis Method :	Allowable Strength	Top & Bottom Fixity	Top Free, Bottom Fixed
Steel Stress Grade		Brace condition :	
Fy : Steel Yield	46.0 ksi	Unbraced Length for buckling ABOUT X-X Axis =	8.0 ft, K = 2.1
E : Elastic Bending Modulus	29,000.0 ksi	Unbraced Length for buckling ABOUT Y-Y Axis =	8.0 ft, K = 2.1

Applied Loads

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

Column self weight included : 95.760 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 8.0 ft, Xecc = 2.0 in, D = 0.5820, S = 6.80 k

BENDING LOADS . . .

Lat. Point Load at 8.0 ft creating My-y, W = 0.5470, E = 0.6860 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.4232** : 1
Load Combination +D+0.750S+0.5250E
Location of max.above base 0.0 ft
At maximum location values are . . .
Pa : Axial 5.778 k
Pn / Omega : Allowable 32.229 k
Ma-x : Applied 0.0 k-ft
Mn-x / Omega : Allowable 15.150 k-ft
Ma-y : Applied -3.828 k-ft
Mn-y / Omega : Allowable 11.477 k-ft

Maximum Load Reactions . .
Top along X-X 0.0 k
Bottom along X-X 0.6920 k
Top along Y-Y 0.0 k
Bottom along Y-Y 0.0 k

Maximum Load Deflections . . .
Along Y-Y 0.0 in at 0.0ft above base
for load combination :
Along X-X 1.138 in at 9.0ft above base
for load combination : E Only

PASS Maximum Shear Stress Ratio = **0.02401** : 1
Load Combination +0.60D+0.70E
Location of max.above base 0.0 ft
At maximum location values are . . .
Va : Applied 0.4802 k
Vn / Omega : Allowable 20.003 k

Load Combination Results

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

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base @ Top	k	Y-Y Axis Reaction @ Base @ Top	Mx - End Moments @ Base @ Top	k-ft	My - End Moments @ Base @ Top
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Extreme Reactions

Item	Axial Reaction Extreme Value	X-X Axis Reaction @ Base @ Top	k	Y-Y Axis Reaction @ Base @ Top	Mx - End Moments @ Base @ Top	k-ft	My - End Moments @ Base @ Top
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Maximum Deflections for Load Combinations

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

Steel Section Properties : HSS6x4x3/16**Steel Section Properties :** HSS6x4x3/16

Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

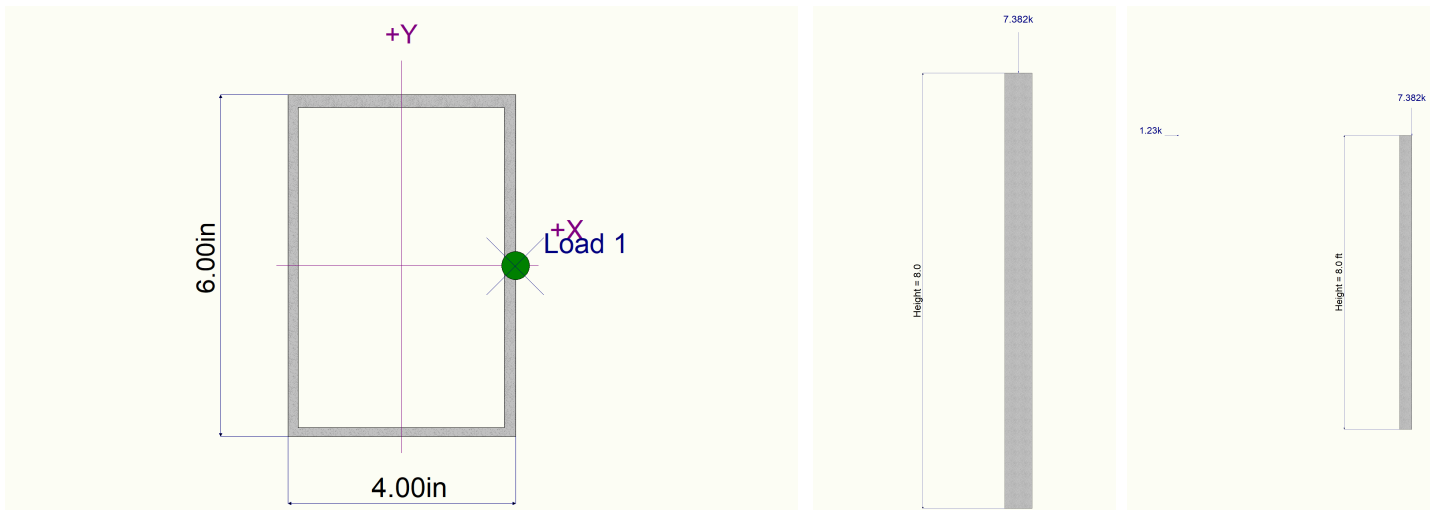
SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL 8'-0" POST

Depth	=	6.000 in	I xx	=	16.40 in ⁴	J	=	18.200 in ⁴
Design Thick	=	0.174 in	S xx	=	5.46 in ³	Cw	=	7.74 in ⁶
Width	=	4.000 in	R xx	=	2.230 in			
Wall Thick	=	0.187 in	Zx	=	6.600 in ³			
Area	=	3.280 in ²	I yy	=	8.760 in ⁴	C	=	7.740 in ³
Weight	=	11.970 plf	S yy	=	4.380 in ³			
			R yy	=	1.630 in			
			Zy	=	5.000 in ³			
Ycg	=	0.000 in						

Sketches



Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL 9'-0" POST

Code References

Calculations per AISC 360-16, IBC 2021
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name :	HSS6x4x3/16	Overall Column Height	9.0 ft
Analysis Method :	Allowable Strength	Top & Bottom Fixity	Top Free, Bottom Fixed
Steel Stress Grade		Brace condition :	
Fy : Steel Yield	46.0 ksi	Unbraced Length for buckling ABOUT X-X Axis = 9.0 ft, K = 2.1	
E : Elastic Bending Modulus	29,000.0 ksi	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 : 107.730 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 9.0 ft, Xecc = 2.0 in, D = 0.5820, S = 6.80 k
BENDING LOADS . . .
Lat. Point Load at 9.0 ft creating My-y, W = 0.5470, E = 0.6920 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.5539** : 1
Load Combination +D+0.750S+0.5250E
Location of max.above base 0.0 ft
At maximum location values are . . .
Pa : Axial 5.790 k
Pn / Omega : Allowable 25.465 k
Ma-x : Applied 0.0 k-ft
Mn-x / Omega : Allowable 15.150 k-ft
Ma-y : Applied -4.217 k-ft
Mn-y / Omega : Allowable 11.477 k-ft

Maximum Load Reactions . .
Top along X-X 0.0 k
Bottom along X-X 0.6920 k
Top along Y-Y 0.0 k
Bottom along Y-Y 0.0 k

Maximum Load Deflections . . .
Along Y-Y 0.0 in at 0.0ft above base
for load combination :
Along X-X 1.138 in at 9.0ft above base
for load combination : E Only

PASS Maximum Shear Stress Ratio = **0.02422** : 1
Load Combination +D+0.70E
Location of max.above base 0.0 ft
At maximum location values are . . .
Va : Applied 0.4844 k
Vn / Omega : Allowable 20.003 k

Load Combination Results

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

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base @ Top	k	Y-Y Axis Reaction @ Base @ Top	Mx - End Moments @ Base @ Top	k-ft	My - End Moments @ Base @ Top
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Extreme Reactions

Item	Axial Reaction Extreme Value	X-X Axis Reaction @ Base @ Top	k	Y-Y Axis Reaction @ Base @ Top	Mx - End Moments @ Base @ Top	k-ft	My - End Moments @ Base @ Top
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Maximum Deflections for Load Combinations

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

Steel Section Properties : HSS6x4x3/16**Steel Section Properties :** HSS6x4x3/16

Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

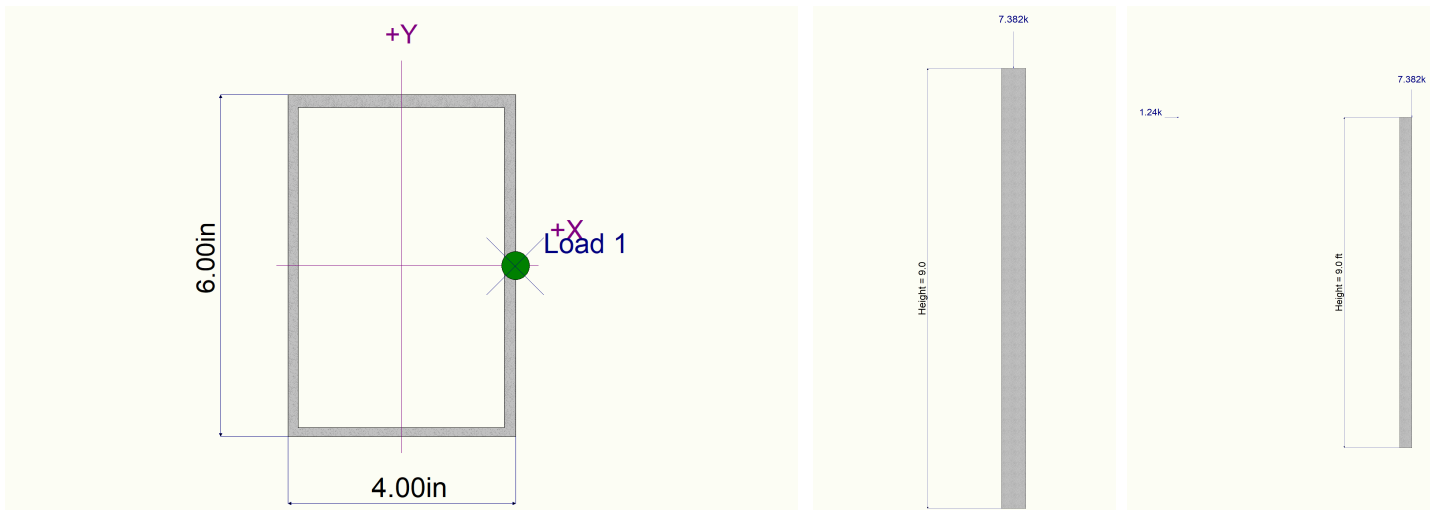
SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL 9'-0" POST

Depth	=	6.000 in	I xx	=	16.40 in ⁴	J	=	18.200 in ⁴
Design Thick	=	0.174 in	S xx	=	5.46 in ³	Cw	=	7.74 in ⁶
Width	=	4.000 in	R xx	=	2.230 in			
Wall Thick	=	0.187 in	Zx	=	6.600 in ³			
Area	=	3.280 in ²	I yy	=	8.760 in ⁴	C	=	7.740 in ³
Weight	=	11.970 plf	S yy	=	4.380 in ³			
			R yy	=	1.630 in			
			Zy	=	5.000 in ³			
Ycg	=	0.000 in						

Sketches



Pole Footing Embedded in Soil

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL FOOTING FOR 8'-0" POST

Code References

Calculations per IBC 2021 1807.3

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape Circular
 Pole Footing Diameter 36.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive 300.0 pcf
 Max Passive psf

Controlling Values

Governing Load Combination **D+0.70E**
 Lateral Load 0.4802 k
 Moment 3.842 k-ft

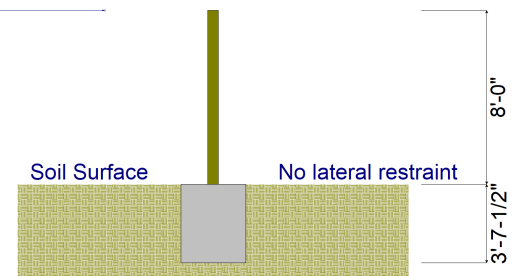
NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual **357.316** psf
 Allowable **359.258** psf

Minimum Required Depth 3.625 ft

Footing Base Area 7.069 ft²
 Maximum Soil Pressure 1.058 ksf

Point Load



Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (k)		Vertical Load (k)
D : Dead Load	k		k/ft	0.6780 k
Lr : Roof Live	k		k/ft	k
L : Live	k		k/ft	k
S : Snow	k		k/ft	6.80 k
W : Wind	0.5470 k		k/ft	k
E : Earthquake	0.6860 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	ft	
		BOTTOM of Load above ground surface	ft	

Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at 1/3 Depth		Soil Increase Factor
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)	
D Only	0.000	0.000	0.13	0.0	0.0	1.000
+D+S	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750S	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.60W	0.328	2.626	3.13	310.7	312.4	1.000
+D+0.450W	0.246	1.969	2.88	279.7	281.4	1.000
+D+0.750S+0.450W	0.246	1.969	2.88	279.7	281.4	1.000
+0.60D+0.60W	0.328	2.626	3.13	310.7	312.4	1.000
+D+0.70E	0.480	3.842	3.63	357.3	359.3	1.000
+D+0.750S+0.5250E	0.360	2.881	3.25	321.5	323.1	1.000

Pole Footing Embedded in Soil

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30 SITTS & HILL ENGINEERING, INC. (c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL FOOTING FOR 8'-0" POST

+0.60D+0.70E	0.480	3.842	3.63	357.3	359.3	1.000
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Pole Footing Embedded in Soil

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: TYPICAL FOOTING FOR 9'-0" POST

Code References

Calculations per IBC 2021 1807.3

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape Circular
 Pole Footing Diameter 36.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive 300.0 pcf
 Max Passive psf

Controlling Values

Governing Load Combination **D+0.70E**
 Lateral Load 0.4844 k
 Moment 4.360 k-ft

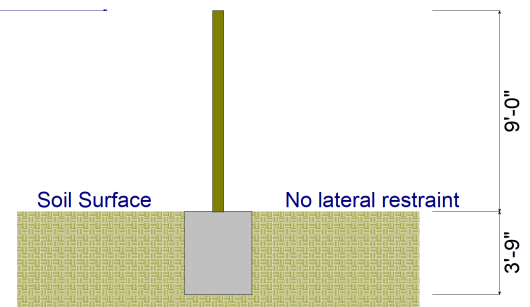
NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual **369.792 psf**
 Allowable **371.778 psf**

Minimum Required Depth 3.750 ft

Footing Base Area 7.069 ft²
 Maximum Soil Pressure 1.060 ksf

Point Load



Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (k)		Vertical Load (k)
D : Dead Load	k		k/ft	0.690 k
Lr : Roof Live	k		k/ft	k
L : Live	k		k/ft	k
S : Snow	k		k/ft	6.80 k
W : Wind	0.5470 k		k/ft	k
E : Earthquake	0.6920 k		k/ft	k
H : Lateral Earth	k		k/ft	k
Load distance above ground surface	9.0 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 1/3 Depth		Soil Increase Factor
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)	
D Only	0.000	0.000	0.13	0.0	0.0	1.000
+D+S	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750S	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.60W	0.328	2.954	3.25	321.5	322.1	1.000
+D+0.450W	0.246	2.215	3.00	289.1	290.6	1.000
+D+0.750S+0.450W	0.246	2.215	3.00	289.1	290.6	1.000
+0.60D+0.60W	0.328	2.954	3.25	321.5	322.1	1.000
+D+0.70E	0.484	4.360	3.75	369.8	371.8	1.000
+D+0.750S+0.5250E	0.363	3.270	3.38	333.7	334.2	1.000

Pole Footing Embedded in Soil

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30 SITTS & HILL ENGINEERING, INC. (c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL FOOTING FOR 9'-0" POST

+0.60D+0.70E	0.484	4.360	3.75	369.8	371.8	1.000
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General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL ALTERNATE FOOTING FOR 8'-0" POST

Code References

Calculations per ACI 318-19, IBC 2021

Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00090
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	150.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

Increases based on footing Depth

Footing base depth below soil surface	=	2.0 ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

Increases based on footing plan dimension

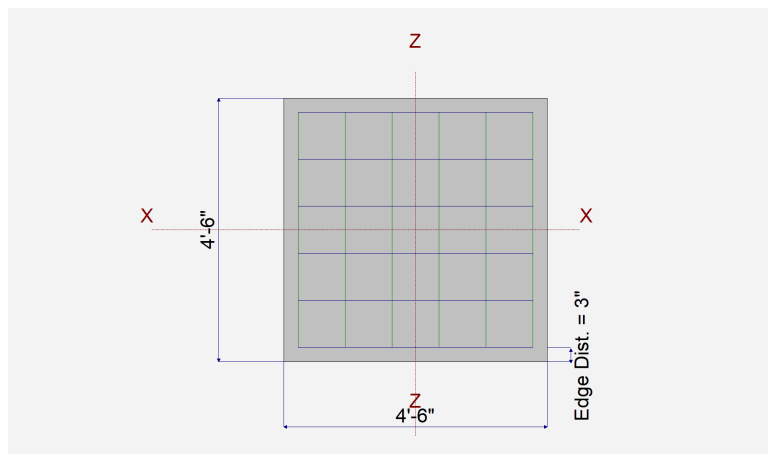
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
---	---	--------

Dimensions

Width parallel to X-X Axis	=	4.50 ft
Length parallel to Z-Z Axis	=	4.50 ft
Footing Thickness	=	24.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



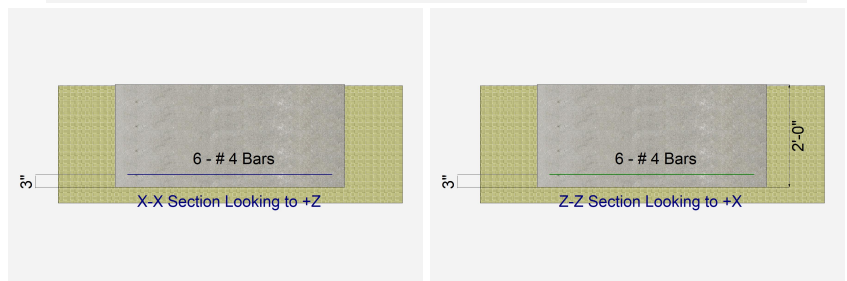
Reinforcing

Bars parallel to X-X Axis	=	6.0
Number of Bars	=	# 4

Bars parallel to Z-Z Axis	=	6.0
Number of Bars	=	# 4

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.6780		6.80	-3.102		k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=				4.379	5.488	k-ft
V-x	=				0.5470	0.6860	k
V-z	=						k

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL ALTERNATE FOOTING FOR 8'-0" POST

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.3297	Soil Bearing	0.6593 ksf	2.0 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	1.184	Overturning - Z-Z	7.472 k-ft	8.843 k-ft	+0.60D+0.60W
PASS	4.858	Sliding - X-X	0.4802 k	2.333 k	+0.60D+0.70E
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	2.112	Uplift	-1.861 k	3.930 k	+0.60D+0.60W
PASS	0.06332	Z Flexure (+X)	1.572 k-ft/ft	24.824 k-ft/ft	+1.20D+1.60S+0.50W
PASS	0.05888	Z Flexure (-X)	1.462 k-ft/ft	24.824 k-ft/ft	+1.20D+1.60S
PASS	0.05888	X Flexure (+Z)	1.462 k-ft/ft	24.824 k-ft/ft	+1.20D+1.60S
PASS	0.05888	X Flexure (-Z)	1.462 k-ft/ft	24.824 k-ft/ft	+1.20D+1.60S
PASS	0.04873	1-way Shear (+X)	1.490 psi	30.571 psi	+0.90D+W
PASS	0.03710	1-way Shear (-X)	1.134 psi	30.571 psi	+1.20D+1.60S
PASS	0.03710	1-way Shear (+Z)	1.134 psi	30.571 psi	+1.20D+1.60S
PASS	0.03710	1-way Shear (-Z)	1.134 psi	30.571 psi	+1.20D+1.60S
PASS	0.03781	2-way Punching	5.672 psi	150.0 psi	+1.20D+1.60S



Top reinforcing mat required (see 'Bending' tab).

Hand check required for anchor pullout.

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	2.0	n/a	0.0	0.3235	0.3235	n/a	n/a	0.162
X-X, +D+S	2.0	n/a	0.0	0.6593	0.6593	n/a	n/a	0.330
X-X, +D+0.750S	2.0	n/a	0.0	0.5753	0.5753	n/a	n/a	0.288
X-X, +D+0.60W	2.660	n/a	0.0	0.2316	0.2316	n/a	n/a	0.087
X-X, +D+0.450W	2.660	n/a	0.0	0.2545	0.2545	n/a	n/a	0.096
X-X, +D+0.750S+0.450W	2.660	n/a	0.0	0.5064	0.5064	n/a	n/a	0.190
X-X, +0.60D+0.60W	2.660	n/a	0.0	0.1022	0.1022	n/a	n/a	0.038
X-X, +D+0.70E	2.660	n/a	0.0	0.3235	0.3235	n/a	n/a	0.122
X-X, +D+0.750S+0.5250E	2.660	n/a	0.0	0.5753	0.5753	n/a	n/a	0.216
X-X, +0.60D+0.70E	2.660	n/a	0.0	0.1941	0.1941	n/a	n/a	0.073
Z-Z, D Only	2.0	0.0	n/a	n/a	n/a	0.3235	0.3235	0.162
Z-Z, +D+S	2.0	0.0	n/a	n/a	n/a	0.6593	0.6593	0.330
Z-Z, +D+0.750S	2.0	0.0	n/a	n/a	n/a	0.5753	0.5753	0.288
Z-Z, +D+0.60W	2.660	8.403	n/a	n/a	n/a	0.01752	0.4456	0.168
Z-Z, +D+0.450W	2.660	5.734	n/a	n/a	n/a	0.09401	0.4151	0.156
Z-Z, +D+0.750S+0.450W	2.660	2.882	n/a	n/a	n/a	0.3459	0.6669	0.251
Z-Z, +0.60D+0.60W	2.660	19.045	n/a	n/a	n/a	0.0	0.4572	0.172
Z-Z, +D+0.70E	2.660	8.797	n/a	n/a	n/a	0.01046	0.6365	0.239
Z-Z, +D+0.750S+0.5250E	2.660	3.710	n/a	n/a	n/a	0.3406	0.8101	0.305
Z-Z, +0.60D+0.70E	2.660	14.661	n/a	n/a	n/a	0.0	0.5622	0.211

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, D Only	None	0.0 k-ft	Infinity	OK
X-X, +D+S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.70E	None	0.0 k-ft	Infinity	OK
Z-Z, D Only	None	0.0 k-ft	Infinity	OK
Z-Z, +D+S	None	0.0 k-ft	Infinity	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC#: KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL ALTERNATE FOOTING FOR 8'-0" POST

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Z-Z, +D+0.750S	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.60W	7.472 k-ft	14.739 k-ft	1.973	OK
Z-Z, +D+0.450W	5.604 k-ft	14.739 k-ft	2.630	OK
Z-Z, +D+0.750S+0.450W	5.604 k-ft	26.214 k-ft	4.678	OK
Z-Z, +0.60D+0.60W	7.472 k-ft	8.843 k-ft	1.184	OK
Z-Z, +D+0.70E	4.802 k-ft	14.739 k-ft	3.069	OK
Z-Z, +D+0.750S+0.5250E	3.602 k-ft	26.214 k-ft	7.279	OK
Z-Z, +0.60D+0.70E	4.802 k-ft	8.843 k-ft	1.842	OK

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, D Only	0.0 k	2.988 k	No Sliding	OK
X-X, +D+S	0.0 k	4.688 k	No Sliding	OK
X-X, +D+0.750S	0.0 k	4.263 k	No Sliding	OK
X-X, +D+0.60W	0.3282 k	2.522 k	7.685	OK
X-X, +D+0.450W	0.2462 k	2.639 k	10.720	OK
X-X, +D+0.750S+0.450W	0.2462 k	3.914 k	15.899	OK
X-X, +0.60D+0.60W	0.3282 k	1.867 k	5.689	OK
X-X, +D+0.70E	0.4802 k	2.988 k	6.222	OK
X-X, +D+0.750S+0.5250E	0.3602 k	4.263 k	11.836	OK
X-X, +0.60D+0.70E	0.4802 k	2.333 k	4.858	OK
Z-Z, D Only	0.0 k	2.988 k	No Sliding	OK
Z-Z, +D+S	0.0 k	4.688 k	No Sliding	OK
Z-Z, +D+0.750S	0.0 k	4.263 k	No Sliding	OK
Z-Z, +D+0.60W	0.0 k	2.522 k	No Sliding	OK
Z-Z, +D+0.70E	0.0 k	2.988 k	No Sliding	OK
Z-Z, +D+0.750S+0.5250E	0.0 k	4.263 k	No Sliding	OK
Z-Z, +0.60D+0.70E	0.0 k	2.333 k	No Sliding	OK
Z-Z, +D+0.450W	0.0 k	2.639 k	No Sliding	OK
Z-Z, +D+0.750S+0.450W	0.0 k	3.914 k	No Sliding	OK
Z-Z, +0.60D+0.60W	0.0 k	1.867 k	No Sliding	OK

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.1187	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.40D	0.1187	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D	0.1017	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D	0.1017	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50S	0.5267	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50S	0.5267	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50W	0.09218	+Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50W	0.09218	-Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+1.60S	1.462	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+1.60S	1.462	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+1.60S+0.50W	1.268	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+1.60S+0.50W	1.268	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+W	0.2861	+Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+W	0.2861	-Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50S+W	0.1390	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50S+W	0.1390	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +0.90D+W	0.3115	+Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +0.90D+W	0.3115	-Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.20S+E	0.2717	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.20S+E	0.2717	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +0.90D+E	0.07628	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +0.90D+E	0.07628	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.40D	0.1187	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.40D	0.1187	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D	0.1017	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D	0.1017	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL ALTERNATE FOOTING FOR 8'-0" POST

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in ²	Gvrn. As in ²	Actual As in ²	Phi*Mn k-ft	Status
Z-Z, +1.20D+0.50S	0.5267	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50S	0.5267	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50W	0.3962	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50W	0.2119	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+1.60S	1.462	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+1.60S	1.462	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+1.60S+0.50W	0.9638	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+1.60S+0.50W	1.572	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+W	0.8434	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+W	0.3727	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50S+W	0.4691	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50S+W	0.7470	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +0.90D+W	0.6607	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +0.90D+W	0.5550	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.20S+E	0.4904	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.20S+E	1.034	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +0.90D+E	0.6184	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +0.90D+E	0.9059	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.09 psi	0.09 psi	0.09 psi	30.57 psi	0.00	OK
+1.20D	0.08 psi	0.08 psi	0.08 psi	30.57 psi	0.00	OK
+1.20D+0.50S	0.41 psi	0.41 psi	0.41 psi	30.57 psi	0.01	OK
+1.20D+0.50W	0.39 psi	0.24 psi	0.39 psi	30.57 psi	0.01	OK
+1.20D+1.60S	1.13 psi	1.13 psi	1.13 psi	30.57 psi	0.04	OK
+1.20D+1.60S+0.50W	0.67 psi	1.30 psi	1.30 psi	30.57 psi	0.04	OK
+1.20D+W	0.68 psi	0.48 psi	0.68 psi	30.57 psi	0.02	OK
+1.20D+0.50S+W	0.52 psi	0.74 psi	0.74 psi	30.57 psi	0.02	OK
+0.90D+W	0.51 psi	1.49 psi	1.49 psi	30.57 psi	0.05	OK
+1.20D+0.20S+E	0.58 psi	1.00 psi	1.00 psi	30.57 psi	0.03	OK
+0.90D+E	0.51 psi	0.95 psi	0.95 psi	30.57 psi	0.03	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.09 psi	0.09 psi	0.09 psi	30.57 psi	0.00	OK
+1.20D	0.08 psi	0.08 psi	0.08 psi	30.57 psi	0.00	OK
+1.20D+0.50S	0.41 psi	0.41 psi	0.41 psi	30.57 psi	0.01	OK
+1.20D+0.50W	0.07 psi	0.07 psi	0.07 psi	30.57 psi	0.00	OK
+1.20D+1.60S	1.13 psi	1.13 psi	1.13 psi	30.57 psi	0.04	OK
+1.20D+1.60S+0.50W	0.98 psi	0.98 psi	0.98 psi	30.57 psi	0.03	OK
+1.20D+W	0.22 psi	0.22 psi	0.22 psi	30.57 psi	0.01	OK
+1.20D+0.50S+W	0.11 psi	0.11 psi	0.11 psi	30.57 psi	0.00	OK
+0.90D+W	0.24 psi	0.24 psi	0.24 psi	30.57 psi	0.01	OK
+1.20D+0.20S+E	0.21 psi	0.21 psi	0.21 psi	30.57 psi	0.01	OK
+0.90D+E	0.06 psi	0.06 psi	0.06 psi	30.57 psi	0.00	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.46 psi	150.00psi	0.003069	OK
+1.20D	0.39 psi	150.00psi	0.002631	OK
+1.20D+0.50S	2.04 psi	150.00psi	0.01363	OK
+1.20D+0.50W	0.36 psi	150.00psi	0.002384	OK
+1.20D+1.60S	5.67 psi	150.00psi	0.03781	OK
+1.20D+1.60S+0.50W	4.92 psi	150.00psi	0.0328	OK
+1.20D+W	1.11 psi	150.00psi	0.0074	OK
+1.20D+0.50S+W	0.54 psi	150.00psi	0.003594	OK
+0.90D+W	1.21 psi	150.00psi	0.008057	OK
+1.20D+0.20S+E	1.05 psi	150.00psi	0.007028	OK
+0.90D+E	0.37 psi	150.00psi	0.002439	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL ALTERNATE FOOTING FOR 9'-0" POST

Code References

Calculations per ACI 318-19, IBC 2021

Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00090
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	150.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

Increases based on footing Depth

Footing base depth below soil surface	=	2.0 ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

Increases based on footing plan dimension

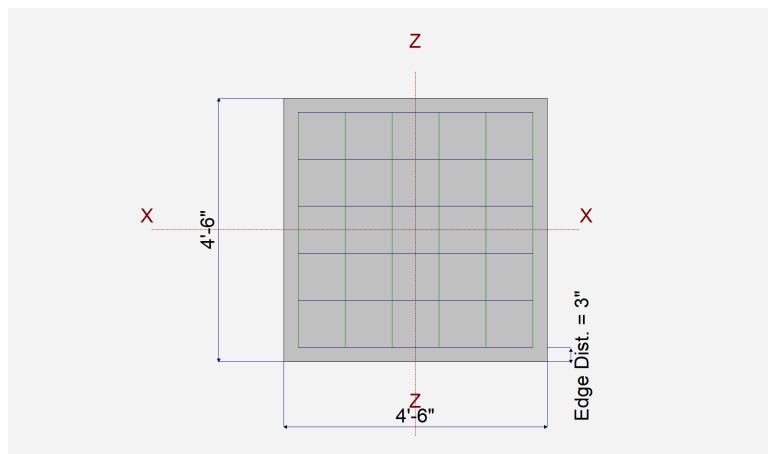
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
---	---	--------

Dimensions

Width parallel to X-X Axis	=	4.50 ft
Length parallel to Z-Z Axis	=	4.50 ft
Footing Thickness	=	24.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



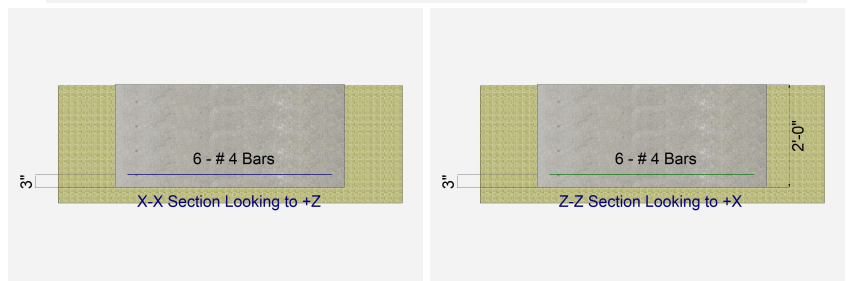
Reinforcing

Bars parallel to X-X Axis	=	6.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	# 4

Bars parallel to Z-Z Axis	=	6.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	# 4

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.690		6.80	-3.102		k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=				4.926	6.232	k-ft
V-x	=				0.5470	0.6920	k
V-z	=						k

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: TYPICAL ALTERNATE FOOTING FOR 9'-0" POST

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.330	Soil Bearing	0.6599 ksf	2.0 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	1.136	Overturning - Z-Z	7.80 k-ft	8.859 k-ft	+0.60D+0.60W
PASS	4.819	Sliding - X-X	0.4844 k	2.334 k	+0.60D+0.70E
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	2.116	Uplift	-1.861 k	3.938 k	+0.60D+0.60W
PASS	0.06462	Z Flexure (+X)	1.604 k-ft/ft	24.824 k-ft/ft	+1.20D+1.60S+0.50W
PASS	0.05896	Z Flexure (-X)	1.464 k-ft/ft	24.824 k-ft/ft	+1.20D+1.60S
PASS	0.05896	X Flexure (+Z)	1.464 k-ft/ft	24.824 k-ft/ft	+1.20D+1.60S
PASS	0.05896	X Flexure (-Z)	1.464 k-ft/ft	24.824 k-ft/ft	+1.20D+1.60S
PASS	0.06410	1-way Shear (+X)	1.960 psi	30.571 psi	+0.90D+W
PASS	0.03715	1-way Shear (-X)	1.136 psi	30.571 psi	+1.20D+1.60S
PASS	0.03715	1-way Shear (+Z)	1.136 psi	30.571 psi	+1.20D+1.60S
PASS	0.03715	1-way Shear (-Z)	1.136 psi	30.571 psi	+1.20D+1.60S
PASS	0.03786	2-way Punching	5.679 psi	150.0 psi	+1.20D+1.60S



Top reinforcing mat required (see 'Bending' tab).

Hand check required for anchor pullout.

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	2.0	n/a	0.0	0.3241	0.3241	n/a	n/a	0.162
X-X, +D+S	2.0	n/a	0.0	0.6599	0.6599	n/a	n/a	0.330
X-X, +D+0.750S	2.0	n/a	0.0	0.5759	0.5759	n/a	n/a	0.288
X-X, +D+0.60W	2.660	n/a	0.0	0.2322	0.2322	n/a	n/a	0.087
X-X, +D+0.450W	2.660	n/a	0.0	0.2551	0.2551	n/a	n/a	0.096
X-X, +D+0.750S+0.450W	2.660	n/a	0.0	0.5070	0.5070	n/a	n/a	0.191
X-X, +0.60D+0.60W	2.660	n/a	0.0	0.1025	0.1025	n/a	n/a	0.039
X-X, +D+0.70E	2.660	n/a	0.0	0.3241	0.3241	n/a	n/a	0.122
X-X, +D+0.750S+0.5250E	2.660	n/a	0.0	0.5759	0.5759	n/a	n/a	0.217
X-X, +0.60D+0.70E	2.660	n/a	0.0	0.1944	0.1944	n/a	n/a	0.073
Z-Z, D Only	2.0	0.0	n/a	n/a	n/a	0.3241	0.3241	0.162
Z-Z, +D+S	2.0	0.0	n/a	n/a	n/a	0.6599	0.6599	0.330
Z-Z, +D+0.750S	2.0	0.0	n/a	n/a	n/a	0.5759	0.5759	0.288
Z-Z, +D+0.60W	2.660	9.220	n/a	n/a	n/a	0.0	0.4677	0.176
Z-Z, +D+0.450W	2.660	6.292	n/a	n/a	n/a	0.07855	0.4317	0.162
Z-Z, +D+0.750S+0.450W	2.660	3.166	n/a	n/a	n/a	0.3304	0.6836	0.257
Z-Z, +0.60D+0.60W	2.660	20.876	n/a	n/a	n/a	0.0	0.5938	0.223
Z-Z, +D+0.70E	2.660	9.748	n/a	n/a	n/a	0.0	0.6727	0.253
Z-Z, +D+0.750S+0.5250E	2.660	4.114	n/a	n/a	n/a	0.3153	0.8366	0.315
Z-Z, +0.60D+0.70E	2.660	16.247	n/a	n/a	n/a	0.0	0.6456	0.243

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, D Only	None	0.0 k-ft	Infinity	OK
X-X, +D+S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.70E	None	0.0 k-ft	Infinity	OK
Z-Z, D Only	None	0.0 k-ft	Infinity	OK
Z-Z, +D+S	None	0.0 k-ft	Infinity	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL ALTERNATE FOOTING FOR 9'-0" POST

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Z-Z, +D+0.750S	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.60W	7.80 k-ft	14.766 k-ft	1.893	OK
Z-Z, +D+0.450W	5.850 k-ft	14.766 k-ft	2.524	OK
Z-Z, +D+0.750S+0.450W	5.850 k-ft	26.241 k-ft	4.486	OK
Z-Z, +0.60D+0.60W	7.80 k-ft	8.859 k-ft	1.136	OK
Z-Z, +D+0.70E	5.331 k-ft	14.766 k-ft	2.770	OK
Z-Z, +D+0.750S+0.5250E	3.998 k-ft	26.241 k-ft	6.563	OK
Z-Z, +0.60D+0.70E	5.331 k-ft	8.859 k-ft	1.662	OK

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, D Only	0.0 k	2.991 k	No Sliding	OK
X-X, +D+S	0.0 k	4.691 k	No Sliding	OK
X-X, +D+0.750S	0.0 k	4.266 k	No Sliding	OK
X-X, +D+0.60W	0.3282 k	2.525 k	7.694	OK
X-X, +D+0.450W	0.2462 k	2.642 k	10.732	OK
X-X, +D+0.750S+0.450W	0.2462 k	3.917 k	15.912	OK
X-X, +0.60D+0.60W	0.3282 k	1.869 k	5.695	OK
X-X, +D+0.70E	0.4844 k	2.991 k	6.174	OK
X-X, +D+0.750S+0.5250E	0.3633 k	4.266 k	11.741	OK
X-X, +0.60D+0.70E	0.4844 k	2.334 k	4.819	OK
Z-Z, D Only	0.0 k	2.991 k	No Sliding	OK
Z-Z, +D+S	0.0 k	4.691 k	No Sliding	OK
Z-Z, +D+0.750S	0.0 k	4.266 k	No Sliding	OK
Z-Z, +D+0.60W	0.0 k	2.525 k	No Sliding	OK
Z-Z, +D+0.70E	0.0 k	2.991 k	No Sliding	OK
Z-Z, +D+0.750S+0.5250E	0.0 k	4.266 k	No Sliding	OK
Z-Z, +0.60D+0.70E	0.0 k	2.334 k	No Sliding	OK
Z-Z, +D+0.450W	0.0 k	2.642 k	No Sliding	OK
Z-Z, +D+0.750S+0.450W	0.0 k	3.917 k	No Sliding	OK
Z-Z, +0.60D+0.60W	0.0 k	1.869 k	No Sliding	OK

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.1208	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.40D	0.1208	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D	0.1035	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D	0.1035	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50S	0.5285	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50S	0.5285	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50W	0.09038	+Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50W	0.09038	-Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+1.60S	1.464	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+1.60S	1.464	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+1.60S+0.50W	1.270	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+1.60S+0.50W	1.270	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+W	0.2843	+Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+W	0.2843	-Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50S+W	0.1408	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.50S+W	0.1408	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +0.90D+W	0.3101	+Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +0.90D+W	0.3101	-Z	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.20S+E	0.2735	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +1.20D+0.20S+E	0.2735	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +0.90D+E	0.07763	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
X-X, +0.90D+E	0.07763	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.40D	0.1208	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.40D	0.1208	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D	0.1035	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D	0.1035	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: TYPICAL ALTERNATE FOOTING FOR 9'-0" POST

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in ²	Gvrn. As in ²	Actual As in ²	Phi*Mn k-ft	Status
Z-Z, +1.20D+0.50S	0.5285	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50S	0.5285	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50W	0.4248	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50W	0.2440	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+1.60S	1.464	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+1.60S	1.464	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+1.60S+0.50W	0.9352	-X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+1.60S+0.50W	1.604	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+W	0.8661	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+W	0.4716	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50S+W	0.5281	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.50S+W	0.8096	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +0.90D+W	0.6607	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +0.90D+W	0.6761	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.20S+E	0.5697	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +1.20D+0.20S+E	1.123	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +0.90D+E	0.6474	-X	Top	0.2592	ACI 7.6.1.1	0.2667	24.824	OK
Z-Z, +0.90D+E	1.045	+X	Bottom	0.2592	ACI 7.6.1.1	0.2667	24.824	OK

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.09 psi	0.09 psi	0.09 psi	30.57 psi	0.00	OK
+1.20D	0.08 psi	0.08 psi	0.08 psi	30.57 psi	0.00	OK
+1.20D+0.50S	0.41 psi	0.41 psi	0.41 psi	30.57 psi	0.01	OK
+1.20D+0.50W	0.42 psi	0.28 psi	0.42 psi	30.57 psi	0.01	OK
+1.20D+1.60S	1.14 psi	1.14 psi	1.14 psi	30.57 psi	0.04	OK
+1.20D+1.60S+0.50W	0.64 psi	1.33 psi	1.33 psi	30.57 psi	0.04	OK
+1.20D+W	0.68 psi	0.60 psi	0.68 psi	30.57 psi	0.02	OK
+1.20D+0.50S+W	0.58 psi	0.80 psi	0.80 psi	30.57 psi	0.03	OK
+0.90D+W	0.51 psi	1.96 psi	1.96 psi	30.57 psi	0.06	OK
+1.20D+0.20S+E	0.65 psi	1.09 psi	1.09 psi	30.57 psi	0.04	OK
+0.90D+E	0.51 psi	1.12 psi	1.12 psi	30.57 psi	0.04	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.09 psi	0.09 psi	0.09 psi	30.57 psi	0.00	OK
+1.20D	0.08 psi	0.08 psi	0.08 psi	30.57 psi	0.00	OK
+1.20D+0.50S	0.41 psi	0.41 psi	0.41 psi	30.57 psi	0.01	OK
+1.20D+0.50W	0.07 psi	0.07 psi	0.07 psi	30.57 psi	0.00	OK
+1.20D+1.60S	1.14 psi	1.14 psi	1.14 psi	30.57 psi	0.04	OK
+1.20D+1.60S+0.50W	0.99 psi	0.99 psi	0.99 psi	30.57 psi	0.03	OK
+1.20D+W	0.22 psi	0.22 psi	0.22 psi	30.57 psi	0.01	OK
+1.20D+0.50S+W	0.11 psi	0.11 psi	0.11 psi	30.57 psi	0.00	OK
+0.90D+W	0.24 psi	0.24 psi	0.24 psi	30.57 psi	0.01	OK
+1.20D+0.20S+E	0.21 psi	0.21 psi	0.21 psi	30.57 psi	0.01	OK
+0.90D+E	0.06 psi	0.06 psi	0.06 psi	30.57 psi	0.00	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.47 psi	150.00psi	0.003124	OK
+1.20D	0.40 psi	150.00psi	0.002677	OK
+1.20D+0.50S	2.05 psi	150.00psi	0.01367	OK
+1.20D+0.50W	0.35 psi	150.00psi	0.002338	OK
+1.20D+1.60S	5.68 psi	150.00psi	0.03786	OK
+1.20D+1.60S+0.50W	4.93 psi	150.00psi	0.03284	OK
+1.20D+W	1.10 psi	150.00psi	0.007353	OK
+1.20D+0.50S+W	0.55 psi	150.00psi	0.003641	OK
+0.90D+W	1.20 psi	150.00psi	0.008022	OK
+1.20D+0.20S+E	1.06 psi	150.00psi	0.007089	OK
+0.90D+E	0.45 psi	150.00psi	0.002974	OK

Steel Beam

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LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN BEAM

CODE REFERENCES

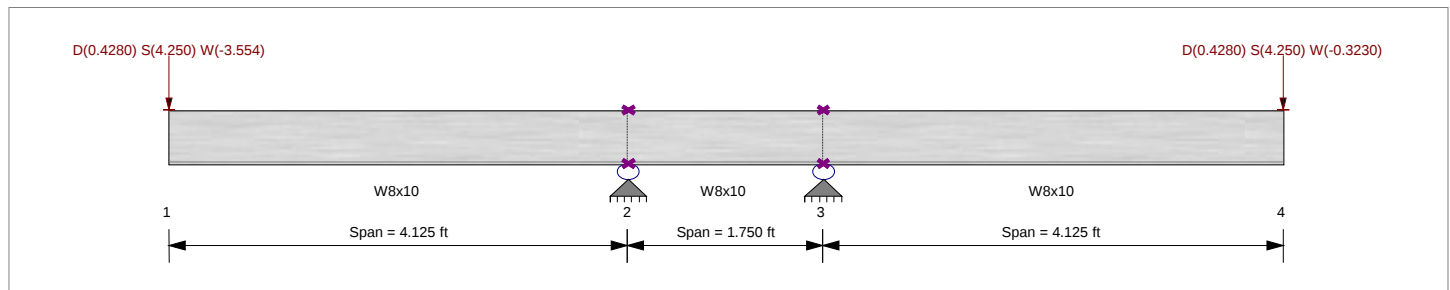
Calculations per AISC 360-16, IBC 2021

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

Load(s) for Span Number 1

Point Load : D = 0.4280, S = 4.250, W = -3.554 k @ 0.0 ft

Load(s) for Span Number 3

Point Load : D = 0.4280, S = 4.250, W = -0.3230 k @ 4.125 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =

0.951 : 1

Maximum Shear Stress Ratio =

0.176 : 1

Section used for this span

W8x10

Section used for this span

W8x10

Ma : Applied

19.382 k-ft

Va : Applied

4.719 k

Mn / Omega : Allowable

20.377 k-ft

Vn/Omega : Allowable

26.826 k

Load Combination

+D+S

Load Combination

+D+S

Span # where maximum occurs

Span # 1

Location of maximum on span

4.125 ft

Span # where maximum occurs

Span # 1

Maximum Deflection

Max Downward Transient Deflection

0.316 in Ratio =

313 >=180.

Span: 3 : S Only

Max Upward Transient Deflection

-0.233 in Ratio =

424 >=180.

Span: 3 : W Only

Max Downward Total Deflection

0.349 in Ratio =

284 >=120.

Span: 3 : +D+S

Max Upward Total Deflection

-0.120 in Ratio =

825 >=120.

Span: 3 : +0.60D+0.60W

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx/Vnx/Omega	
D Only													
Dsgn. L = 4.13 ft	1	0.091	0.017		-1.85	1.85	34.03	20.38	1.00	1.00	0.47	40.24	26.83
Dsgn. L = 1.75 ft	2	0.085	0.017	-0.00	-1.85	1.85	36.52	21.87	1.00	1.00	0.47	40.24	26.83
Dsgn. L = 4.13 ft	3	0.091	0.017		-1.85	1.85	34.03	20.38	1.00	1.00	0.47	40.24	26.83
+D+S													
Dsgn. L = 4.13 ft	1	0.951	0.176		-19.38	19.38	34.03	20.38	1.00	1.00	4.72	40.24	26.83
Dsgn. L = 1.75 ft	2	0.886	0.176	-0.00	-19.38	19.38	36.52	21.87	1.00	1.00	4.72	40.24	26.83
Dsgn. L = 4.13 ft	3	0.951	0.176		-19.38	19.38	34.03	20.38	1.00	1.00	4.72	40.24	26.83
+D+0.750S													
Dsgn. L = 4.13 ft	1	0.736	0.136		-15.00	15.00	34.03	20.38	1.00	1.00	3.66	40.24	26.83
Dsgn. L = 1.75 ft	2	0.686	0.136	-0.00	-15.00	15.00	36.52	21.87	1.00	1.00	3.66	40.24	26.83
Dsgn. L = 4.13 ft	3	0.736	0.136		-15.00	15.00	34.03	20.38	1.00	1.00	3.66	40.24	26.83
+D+0.60W													
Dsgn. L = 4.13 ft	1	0.341	0.170	6.95		6.95	34.03	20.38	1.00	1.00	4.56	40.24	26.83
Dsgn. L = 1.75 ft	2	0.318	0.171	6.95	-1.05	6.95	36.52	21.87	1.85	1.00	4.58	40.24	26.83
Dsgn. L = 4.13 ft	3	0.052	0.010		-1.05	1.05	34.03	20.38	1.00	1.00	0.28	40.24	26.83
+D+0.450W													
Dsgn. L = 4.13 ft	1	0.233	0.127	4.75		4.75	34.03	20.38	1.00	1.00	3.42	40.24	26.83
Dsgn. L = 1.75 ft	2	0.217	0.128	4.75	-1.25	4.75	36.52	21.87	2.02	1.00	3.44	40.24	26.83
Dsgn. L = 4.13 ft	3	0.061	0.012		-1.25	1.25	34.03	20.38	1.00	1.00	0.32	40.24	26.83
+D+0.750S+0.450W													

Steel Beam

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN BEAM

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	VnxVnx/Omega
Dsgn. L = 4.13 ft	1	0.412	0.127		-8.40	8.40	34.03	20.38	1.00	1.00	3.42	40.24
Dsgn. L = 1.75 ft	2	0.658	0.131	-0.00	-14.40	14.40	36.52	21.87	1.20	1.00	3.51	40.24
Dsgn. L = 4.13 ft	3	0.707	0.131		-14.40	14.40	34.03	20.38	1.00	1.00	3.51	40.24
+0.60D+0.60W												
Dsgn. L = 4.13 ft	1	0.377	0.170	7.69		7.69	34.03	20.38	1.00	1.00	4.56	40.24
Dsgn. L = 1.75 ft	2	0.351	0.171	7.69	-0.31	7.69	36.52	21.87	1.71	1.00	4.57	40.24
Dsgn. L = 4.13 ft	3	0.015	0.003		-0.31	0.31	34.03	20.38	1.00	1.00	0.09	40.24
+0.60D												
Dsgn. L = 4.13 ft	1	0.054	0.010		-1.11	1.11	34.03	20.38	1.00	1.00	0.28	40.24
Dsgn. L = 1.75 ft	2	0.051	0.010	-0.00	-1.11	1.11	36.52	21.87	1.00	1.00	0.28	40.24
Dsgn. L = 4.13 ft	3	0.054	0.010		-1.11	1.11	34.03	20.38	1.00	1.00	0.28	40.24

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.3488	0.000		0.0000	0.000
	2	0.0000	0.000	+D+S	-0.0145	0.875
+D+S	3	0.3467	4.125		0.0000	0.875

Vertical Reactions

Support notation : Far left is #:

Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Max Upward from all Load Conditions		4.728	7.293	
Max Upward from Load Combinations		4.728	6.947	
Max Upward from Load Cases		4.250	7.293	
Max Downward from all Load Conditions (Resis		-11.170		
Max Downward from Load Combinations (Resi		-6.415		
Max Downward from Load Cases (Resisting Up		-11.170		
D Only		0.478	0.478	
+D+S		4.728	4.728	
+D+0.750S		3.666	3.666	
+D+0.60W		-6.224	4.854	
+D+0.450W		-4.548	3.760	
+D+0.750S+0.450W		-1.361	6.947	
+0.60D+0.60W		-6.415	4.663	
+0.60D		0.287	0.287	
S Only		4.250	4.250	
W Only		-11.170	7.293	

Steel Section Properties : W8x10

Depth	=	7.890 in	I xx	=	30.80 in^4	J	=	0.043 in^4
Web Thick	=	0.170 in	S xx	=	7.81 in^3	Cw	=	30.90 in^6
Flange Width	=	3.940 in	R xx	=	3.220 in			
Flange Thick	=	0.205 in	Zx	=	8.870 in^3			
Area	=	2.960 in^2	I yy	=	2.090 in^4			
Weight	=	10.000 plf	S yy	=	1.060 in^3	Wno	=	7.570 in^2
Kdesign	=	0.505 in	R yy	=	0.841 in	Sw	=	1.530 in^4
K1	=	0.500 in	Zy	=	1.660 in^3	Qf	=	1.480 in^3
rts	=	1.010 in				Qw	=	4.290 in^3
Ycg	=	3.945 in						

Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN 8'-0" POST

Code References

Calculations per AISC 360-16, IBC 2021

Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS6x4x3/16**

Analysis Method : Allowable Strength

Steel Stress Grade

Fy : Steel Yield 46.0 ksi

E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height

8.0 ft

Top & Bottom Fixity

Top Free, Bottom Fixed

Brace condition :

Unbraced Length for buckling ABOUT X-X Axis = 8.0 ft, K = 2.1

Unbraced Length for buckling ABOUT Y-Y Axis = 8.0 ft, K = 2.1

Applied Loads

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

Column self weight included : 95.760 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 8.0 ft, Xecc = 2.0 in, D = 0.9550, S = 8.50 k

BENDING LOADS . . .

Lat. Point Load at 8.0 ft creating My-y, W = 0.6840, E = 1.092 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.6802** : 1

Load Combination +D+0.750S+0.5250E

Location of max.above base 0.0 ft

At maximum location values are . . .

Pa : Axial 7.426 k

Pn / Omega : Allowable 32.229 k

Ma-x : Applied 0.0 k-ft

Mn-x / Omega : Allowable 15.150 k-ft

Ma-y : Applied -5.808 k-ft

Mn-y / Omega : Allowable 11.477 k-ft

Maximum Load Reactions . .

Top along X-X 0.0 k

Bottom along X-X 1.092 k

Top along Y-Y 0.0 k

Bottom along Y-Y 0.0 k

Maximum Load Deflections . . .

Along Y-Y 0.0 in at 0.0ft above base
for load combination :Along X-X 1.261 in at 8.0ft above base
for load combination : E Only**PASS** Maximum Shear Stress Ratio = **0.03821** : 1

Load Combination +D+0.70E

Location of max.above base 0.0 ft

At maximum location values are . . .

Va : Applied 0.7644 k

Vn / Omega : Allowable 20.003 k

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios			Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios		
	Stress Ratio	Status	Location					Stress Ratio	Status	Location
D Only	0.030	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.000	PASS	0.00 ft
+D+S	0.418	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.000	PASS	0.00 ft
+D+0.750S	0.325	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.000	PASS	0.00 ft
+D+0.60W	0.316	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.021	PASS	0.00 ft
+D+0.450W	0.245	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.015	PASS	0.00 ft
+D+0.750S+0.450W	0.516	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.015	PASS	0.00 ft
+0.60D+0.60W	0.304	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.021	PASS	0.00 ft
+D+0.70E	0.563	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.038	PASS	0.00 ft
+D+0.750S+0.5250E	0.680	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.029	PASS	0.00 ft
+0.60D+0.70E	0.551	PASS	0.00 ft	1.00	1.54	90.40	123.68	0.038	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		Mx - End Moments		My - End Moments	
	@ Base		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top	@ Base	@ Top
D Only	1.051									-0.159	
+D+S	9.551									-1.576	
+D+0.750S	7.426									-1.222	
+D+0.60W	1.051		-0.410							-3.442	

Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN 8'-0" POST**Maximum Reactions**

Note: Only non-zero reactions are listed.

Load Combination	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
+D+0.450W	1.051	-0.308								-2.622	
+D+0.750S+0.450W	7.426	-0.308								-3.684	
+0.60D+0.60W	0.630	-0.410								-3.379	
+D+0.70E	1.051	-0.764								-6.274	
+D+0.750S+0.5250E	7.426	-0.573								-5.808	
+0.60D+0.70E	0.630	-0.764								-6.211	
S Only	8.500									-1.417	
W Only		-0.684								-5.472	
E Only		-1.092								-8.736	

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	9.551									-1.576	
"	Minimum		-0.684								-5.472	
Reaction, X-X Axis Base	Maximum	1.051									-0.159	
"	Minimum		-1.092								-8.736	
Reaction, Y-Y Axis Base	Maximum	1.051									-0.159	
"	Minimum	1.051						-0.159				
Reaction, X-X Axis Top	Maximum	1.051									-0.159	
"	Minimum	1.051									-0.159	
Reaction, Y-Y Axis Top	Maximum	1.051									-0.159	
"	Minimum		-1.092								-8.736	
Moment, X-X Axis Base	Maximum	1.051									-0.159	
"	Minimum	1.051									-0.159	
Moment, Y-Y Axis Base	Maximum	1.051									-0.159	
"	Minimum		-1.092								-8.736	
Moment, X-X Axis Top	Maximum	1.051									-0.159	
"	Minimum	1.051									-0.159	
Moment, Y-Y Axis Top	Maximum	1.051									-0.159	
"	Minimum	1.051									-0.159	

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir		Distance	Max. Deflection in Y dir		Distance
D Only	0.0344	in	8.000 ft	0.000	in	0.000 ft
+D+S	0.3407	in	8.000 ft	0.000	in	0.000 ft
+D+0.750S	0.2641	in	8.000 ft	0.000	in	0.000 ft
+D+0.60W	0.5084	in	8.000 ft	0.000	in	0.000 ft
+D+0.450W	0.3899	in	8.000 ft	0.000	in	0.000 ft
+D+0.750S+0.450W	0.6197	in	8.000 ft	0.000	in	0.000 ft
+0.60D+0.60W	0.4947	in	8.000 ft	0.000	in	0.000 ft
+D+0.70E	0.9173	in	8.000 ft	0.000	in	0.000 ft
+D+0.750S+0.5250E	0.9263	in	8.000 ft	0.000	in	0.000 ft
+0.60D+0.70E	0.9036	in	8.000 ft	0.000	in	0.000 ft
S Only	0.3063	in	8.000 ft	0.000	in	0.000 ft
W Only	0.7900	in	8.000 ft	0.000	in	0.000 ft
E Only	1.2485	in	7.946 ft	0.000	in	0.000 ft

Steel Section Properties : HSS6x4x3/16**Steel Section Properties : HSS6x4x3/16**

Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

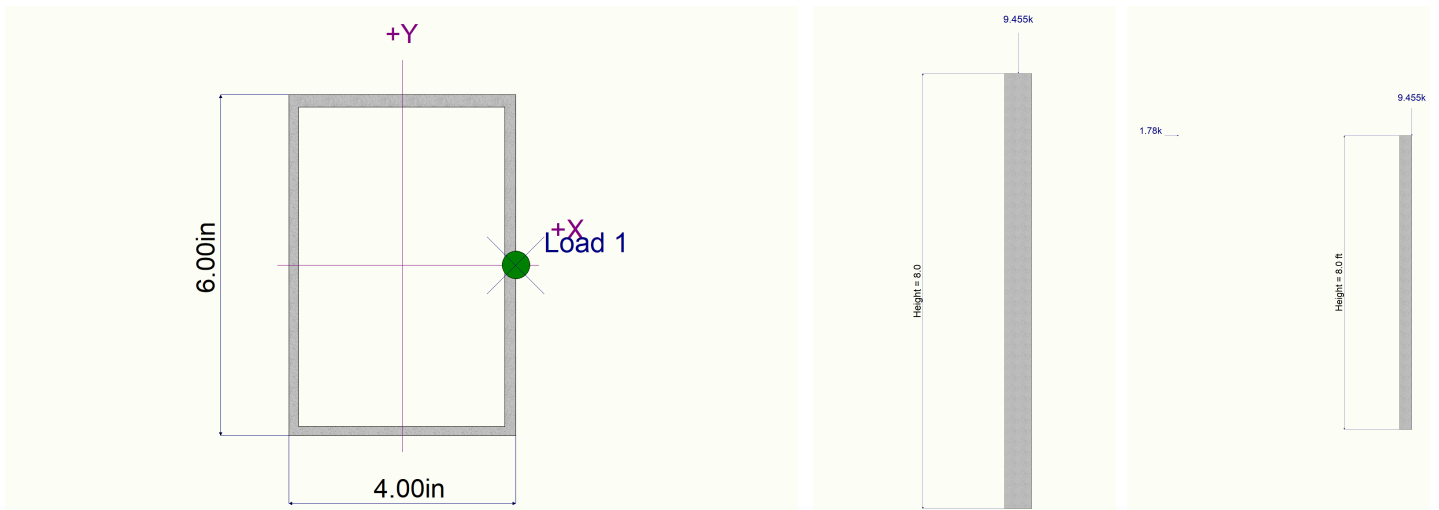
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DESCRIPTION: LONG SPAN 8'-0" POST

Depth	=	6.000 in	I xx	=	16.40 in ⁴	J	=	18.200 in ⁴
Design Thick	=	0.174 in	S xx	=	5.46 in ³	Cw	=	7.74 in ⁶
Width	=	4.000 in	R xx	=	2.230 in			
Wall Thick	=	0.187 in	Zx	=	6.600 in ³			
Area	=	3.280 in ²	I yy	=	8.760 in ⁴	C	=	7.740 in ³
Weight	=	11.970 plf	S yy	=	4.380 in ³			
			R yy	=	1.630 in			
			Zy	=	5.000 in ³			
Ycg	=	0.000 in						

Sketches



Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN 9'-0" POST

Code References

Calculations per AISC 360-16, IBC 2021

Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS6x4x3/16**

Analysis Method : Allowable Strength

Steel Stress Grade

Fy : Steel Yield 46.0 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 : 107.730 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 9.0 ft, Xecc = 2.0 in, D = 0.9550, S = 8.50 k

BENDING LOADS . . .

Lat. Point Load at 9.0 ft creating My-y, W = 0.6840, E = 1.099 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.7889** : 1

Load Combination +D+0.750S+0.5250E

Location of max.above base 0.0 ft

At maximum location values are . . .

Pa : Axial 7.438 k

Pn / Omega : Allowable 25.465 k

Ma-x : Applied 0.0 k-ft

Mn-x / Omega : Allowable 15.150 k-ft

Ma-y : Applied -6.414 k-ft

Mn-y / Omega : Allowable 11.477 k-ft

Maximum Load Reactions . .

Top along X-X 0.0 k

Bottom along X-X 1.099 k

Top along Y-Y 0.0 k

Bottom along Y-Y 0.0 k

Maximum Load Deflections . . .

Along Y-Y 0.0 in at 0.0ft above base
for load combination :Along X-X 1.807 in at 9.0ft above base
for load combination : E Only**PASS** Maximum Shear Stress Ratio **0.03846** : 1

Load Combination +D+0.70E

Location of max.above base 0.0 ft

At maximum location values are . . .

Va : Applied 0.7693 k

Vn / Omega : Allowable 20.003 k

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios			Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios		
	Stress Ratio	Status	Location					Stress Ratio	Status	Location
D Only	0.035	PASS	6.04 ft	1.00	1.57	101.70	139.14	0.000	PASS	0.00 ft
+D+S	0.498	PASS	0.00 ft	1.00	1.57	101.70	139.14	0.000	PASS	0.00 ft
+D+0.750S	0.387	PASS	0.00 ft	1.00	1.57	101.70	139.14	0.000	PASS	0.00 ft
+D+0.60W	0.357	PASS	0.00 ft	1.00	1.57	101.70	139.14	0.021	PASS	0.00 ft
+D+0.450W	0.276	PASS	0.00 ft	1.00	1.57	101.70	139.14	0.015	PASS	0.00 ft
+D+0.750S+0.450W	0.601	PASS	0.00 ft	1.00	1.57	101.70	139.14	0.015	PASS	0.00 ft
+0.60D+0.60W	0.343	PASS	0.00 ft	1.00	1.57	101.70	139.14	0.021	PASS	0.00 ft
+D+0.70E	0.638	PASS	0.00 ft	1.00	1.57	101.70	139.14	0.038	PASS	0.00 ft
+D+0.750S+0.5250E	0.789	PASS	0.00 ft	1.00	1.57	101.70	139.14	0.029	PASS	0.00 ft
+0.60D+0.70E	0.624	PASS	0.00 ft	1.00	1.57	101.70	139.14	0.038	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		Mx - End Moments		My - End Moments	
	@ Base		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top	@ Base	@ Top
D Only	1.063									-0.159	
+D+S	9.563									-1.576	
+D+0.750S	7.438									-1.222	
+D+0.60W	1.063		-0.410							-3.853	

Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN 9'-0" POST**Maximum Reactions**

Note: Only non-zero reactions are listed.

Load Combination	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
+D+0.450W	1.063	-0.308								-2.929	
+D+0.750S+0.450W	7.438	-0.308								-3.992	
+0.60D+0.60W	0.638	-0.410								-3.789	
+D+0.70E	1.063	-0.769								-7.083	
+D+0.750S+0.5250E	7.438	-0.577								-6.414	
+0.60D+0.70E	0.638	-0.769								-7.019	
S Only	8.500									-1.417	
W Only		-0.684								-6.156	
E Only		-1.099								-9.891	

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	9.563									-1.576	
"	Minimum		-0.684								-6.156	
Reaction, X-X Axis Base	Maximum	1.063									-0.159	
"	Minimum		-1.099								-9.891	
Reaction, Y-Y Axis Base	Maximum	1.063									-0.159	
"	Minimum	1.063						-0.159				
Reaction, X-X Axis Top	Maximum	1.063									-0.159	
"	Minimum	1.063									-0.159	
Reaction, Y-Y Axis Top	Maximum	1.063									-0.159	
"	Minimum		-1.099								-9.891	
Moment, X-X Axis Base	Maximum	1.063									-0.159	
"	Minimum	1.063									-0.159	
Moment, Y-Y Axis Base	Maximum	1.063									-0.159	
"	Minimum		-1.099								-9.891	
Moment, X-X Axis Top	Maximum	1.063									-0.159	
"	Minimum	1.063									-0.159	
Moment, Y-Y Axis Top	Maximum	1.063									-0.159	
"	Minimum	1.063									-0.159	

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir		Distance	Max. Deflection in Y dir		Distance
D Only	0.0436	in	9.000 ft	0.000	in	0.000 ft
+D+S	0.4312	in	9.000 ft	0.000	in	0.000 ft
+D+0.750S	0.3343	in	9.000 ft	0.000	in	0.000 ft
+D+0.60W	0.7185	in	9.000 ft	0.000	in	0.000 ft
+D+0.450W	0.5498	in	9.000 ft	0.000	in	0.000 ft
+D+0.750S+0.450W	0.8405	in	9.000 ft	0.000	in	0.000 ft
+0.60D+0.60W	0.7011	in	9.000 ft	0.000	in	0.000 ft
+D+0.70E	1.3087	in	9.000 ft	0.000	in	0.000 ft
+D+0.750S+0.5250E	1.2832	in	9.000 ft	0.000	in	0.000 ft
+0.60D+0.70E	1.2913	in	9.000 ft	0.000	in	0.000 ft
S Only	0.3877	in	9.000 ft	0.000	in	0.000 ft
W Only	1.1249	in	9.000 ft	0.000	in	0.000 ft
E Only	1.7891	in	8.940 ft	0.000	in	0.000 ft

Steel Section Properties : HSS6x4x3/16**Steel Section Properties : HSS6x4x3/16**

Steel Column

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

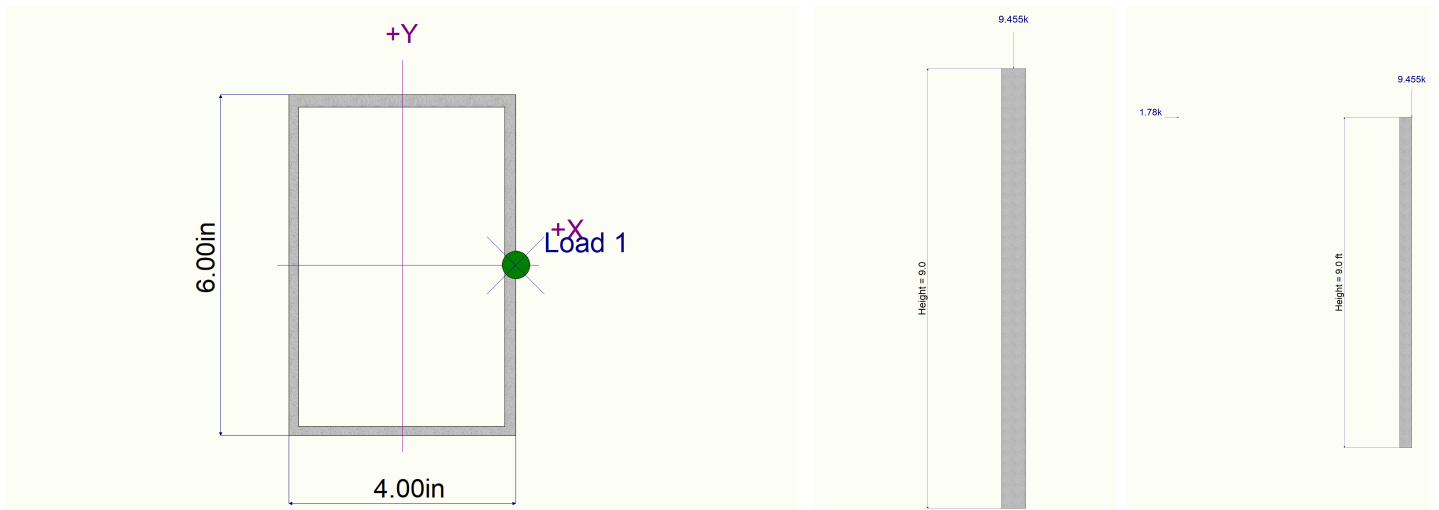
SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN 9'-0" POST

Depth	=	6.000 in	I xx	=	16.40 in ⁴	J	=	18.200 in ⁴
Design Thick	=	0.174 in	S xx	=	5.46 in ³	Cw	=	7.74 in ⁶
Width	=	4.000 in	R xx	=	2.230 in			
Wall Thick	=	0.187 in	Zx	=	6.600 in ³			
Area	=	3.280 in ²	I yy	=	8.760 in ⁴	C	=	7.740 in ³
Weight	=	11.970 plf	S yy	=	4.380 in ³			
			R yy	=	1.630 in			
			Zy	=	5.000 in ³			
Ycg	=	0.000 in						

Sketches



Pole Footing Embedded in Soil

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: LONG SPAN FOOTING FOR 8'-0" POST

Code References

Calculations per IBC 2021 1807.3

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape Circular
 Pole Footing Diameter 36.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive 300.0 pcf
 Max Passive psf

Controlling Values

Governing Load Combination **D+0.70E**
 Lateral Load 0.7644 k
 Moment 6.115 k-ft

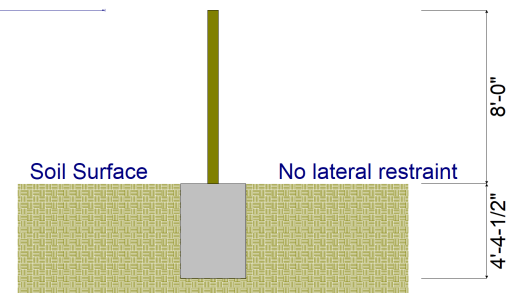
NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual **425.533** psf
 Allowable **426.550** psf

Minimum Required Depth 4.375 ft

Footing Base Area 7.069 ft²
 Maximum Soil Pressure 1.351 ksf

Point Load



Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (k)		Vertical Load (k)
D : Dead Load	k		k/ft	1.051 k
Lr : Roof Live	k		k/ft	k
L : Live	k		k/ft	k
S : Snow	k		k/ft	8.50 k
W : Wind	0.6840 k		k/ft	k
E : Earthquake	1.092 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	ft	
		BOTTOM of Load above ground surface	ft	

Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at 1/3 Depth		Soil Increase Factor
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)	
D Only	0.000	0.000	0.13	0.0	0.0	1.000
+D+S	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750S	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.60W	0.410	3.283	3.50	337.6	338.8	1.000
+D+0.450W	0.308	2.462	3.13	303.1	305.4	1.000
+D+0.750S+0.450W	0.308	2.462	3.13	303.1	305.4	1.000
+0.60D+0.60W	0.410	3.283	3.50	337.6	338.8	1.000
+D+0.70E	0.764	6.115	4.38	425.5	426.6	1.000
+D+0.750S+0.5250E	0.573	4.586	3.88	382.4	383.1	1.000

Pole Footing Embedded in Soil

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30 SITTS & HILL ENGINEERING, INC. (c) ENERCALC, LLC 1982-2025

DESCRIPTION: LONG SPAN FOOTING FOR 8'-0" POST

+0.60D+0.70E	0.764	6.115	4.38	425.5	426.6	1.000
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Pole Footing Embedded in Soil

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: LONG SPAN FOOTING FOR 9'-0" POST

Code References

Calculations per IBC 2021 1807.3

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape Circular
 Pole Footing Diameter 36.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive 300.0 pcf
 Max Passive psf

Controlling Values

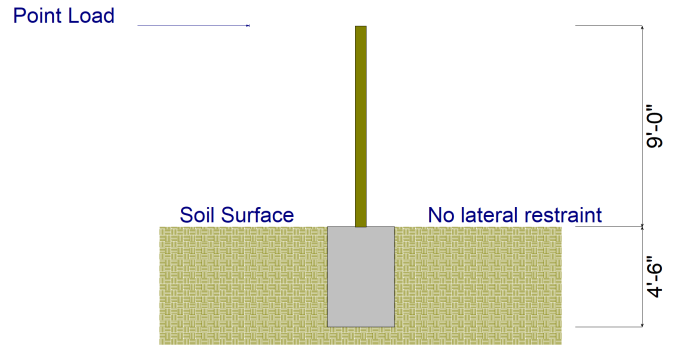
Governing Load Combination **D+0.70E**
 Lateral Load 0.7693 k
 Moment 6.924 k-ft

NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual **439.679** psf
 Allowable **440.446** psf

Minimum Required Depth 4.50 ft

Footing Base Area 7.069 ft²
 Maximum Soil Pressure 1.353 ksf



Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (k)		Vertical Load (k)
D : Dead Load	k		k/ft	1.063 k
Lr : Roof Live	k		k/ft	k
L : Live	k		k/ft	k
S : Snow	k		k/ft	8.50 k
W : Wind	0.6840 k		k/ft	k
E : Earthquake	1.099 k		k/ft	k
H : Lateral Earth	k		k/ft	k
Load distance above ground surface	9.0 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 1/3 Depth		Soil Increase Factor
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)	
D Only	0.000	0.000	0.13	0.0	0.0	1.000
+D+S	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.750S	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.60W	0.410	3.694	3.50	348.3	349.7	1.000
+D+0.450W	0.308	2.770	3.25	314.2	314.7	1.000
+D+0.750S+0.450W	0.308	2.770	3.25	314.2	314.7	1.000
+0.60D+0.60W	0.410	3.694	3.50	348.3	349.7	1.000
+D+0.70E	0.769	6.924	4.50	439.7	440.4	1.000
+D+0.750S+0.5250E	0.577	5.193	4.00	394.8	396.2	1.000

Pole Footing Embedded in Soil

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30 SITTS & HILL ENGINEERING, INC. (c) ENERCALC, LLC 1982-2025

DESCRIPTION: LONG SPAN FOOTING FOR 9'-0" POST

+0.60D+0.70E	0.769	6.924	4.50	439.7	440.4	1.000
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General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN ALTERNATE FOOTING FOR 8'-0" POST

Code References

Calculations per ACI 318-19, IBC 2021

Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'_c : Concrete 28 day strength	=	2.50 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
ϕ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00090
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	150.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

Increases based on footing Depth

Footing base depth below soil surface	=	2.0 ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

Increases based on footing plan dimension

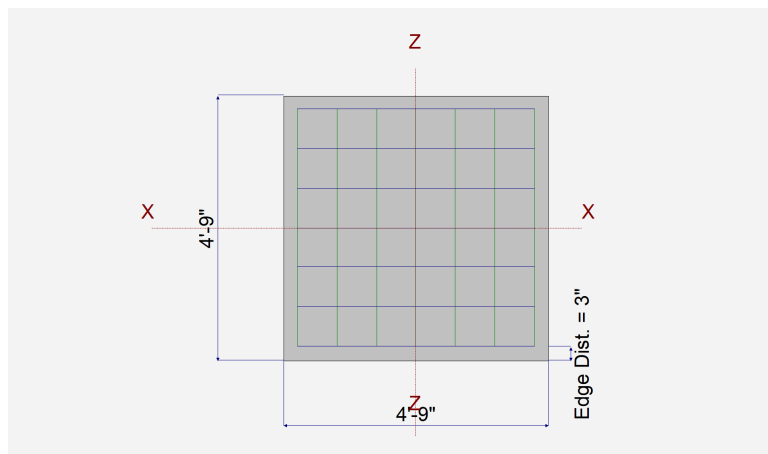
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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Dimensions

Width parallel to X-X Axis	=	4.750 ft
Length parallel to Z-Z Axis	=	4.750 ft
Footing Thickness	=	24.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



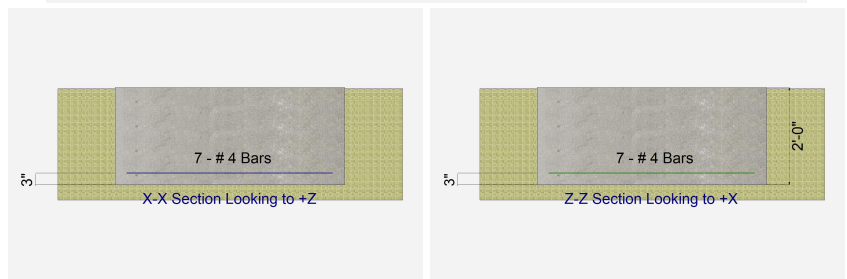
Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars	=	7.0
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis	=	
Number of Bars	=	7.0
Reinforcing Bar Size	=	# 4

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.9550		8.50	-3.877		k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=				5.474	8.736	k-ft
V-x	=				0.6840	1.092	k
V-z	=						k

General Footing

Project File: 20822 ENERCALC.ec6

LIC#: KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: LONG SPAN ALTERNATE FOOTING FOR 8'-0" POST

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.3546	Soil Bearing	0.7091 ksf	2.0 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	1.110	Overturning - Z-Z	9.630 k-ft	10.685 k-ft	+0.60D+0.60W
PASS	3.336	Sliding - X-X	0.7644 k	2.550 k	+0.60D+0.70E
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	1.934	Uplift	-2.326 k	4.499 k	+0.60D+0.60W
PASS	0.07159	Z Flexure (+X)	1.961 k-ft/ft	27.393 k-ft/ft	+1.20D+1.60S+0.50W
PASS	0.06729	Z Flexure (-X)	1.843 k-ft/ft	27.393 k-ft/ft	+1.20D+1.60S
PASS	0.06729	X Flexure (+Z)	1.843 k-ft/ft	27.393 k-ft/ft	+1.20D+1.60S
PASS	0.06729	X Flexure (-Z)	1.843 k-ft/ft	27.393 k-ft/ft	+1.20D+1.60S
PASS	0.06359	1-way Shear (+X)	2.010 psi	31.608 psi	+0.90D+E
PASS	0.05067	1-way Shear (-X)	1.601 psi	31.608 psi	+1.20D+1.60S
PASS	0.05067	1-way Shear (+Z)	1.601 psi	31.608 psi	+1.20D+1.60S
PASS	0.05067	1-way Shear (-Z)	1.601 psi	31.608 psi	+1.20D+1.60S
PASS	0.04851	2-way Punching	7.276 psi	150.0 psi	+1.20D+1.60S



Top reinforcing mat required (see 'Bending' tab).

Hand check required for anchor pullout.

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	2.0	n/a	0.0	0.3323	0.3323	n/a	n/a	0.166
X-X, +D+S	2.0	n/a	0.0	0.7091	0.7091	n/a	n/a	0.355
X-X, +D+0.750S	2.0	n/a	0.0	0.6149	0.6149	n/a	n/a	0.308
X-X, +D+0.60W	2.660	n/a	0.0	0.2292	0.2292	n/a	n/a	0.086
X-X, +D+0.450W	2.660	n/a	0.0	0.2550	0.2550	n/a	n/a	0.096
X-X, +D+0.750S+0.450W	2.660	n/a	0.0	0.5376	0.5376	n/a	n/a	0.202
X-X, +0.60D+0.60W	2.660	n/a	0.0	0.09630	0.09630	n/a	n/a	0.036
X-X, +D+0.70E	2.660	n/a	0.0	0.3323	0.3323	n/a	n/a	0.125
X-X, +D+0.750S+0.5250E	2.660	n/a	0.0	0.6149	0.6149	n/a	n/a	0.231
X-X, +0.60D+0.70E	2.660	n/a	0.0	0.1994	0.1994	n/a	n/a	0.075
Z-Z, D Only	2.0	0.0	n/a	n/a	n/a	0.3323	0.3323	0.166
Z-Z, +D+S	2.0	0.0	n/a	n/a	n/a	0.7091	0.7091	0.355
Z-Z, +D+0.750S	2.0	0.0	n/a	n/a	n/a	0.6149	0.6149	0.308
Z-Z, +D+0.60W	2.660	9.525	n/a	n/a	n/a	0.001694	0.4568	0.172
Z-Z, +D+0.450W	2.660	6.422	n/a	n/a	n/a	0.08435	0.4257	0.160
Z-Z, +D+0.750S+0.450W	2.660	3.046	n/a	n/a	n/a	0.3669	0.7082	0.266
Z-Z, +0.60D+0.60W	2.660	22.674	n/a	n/a	n/a	0.0	0.6178	0.232
Z-Z, +D+0.70E	2.660	12.233	n/a	n/a	n/a	0.0	0.7718	0.290
Z-Z, +D+0.750S+0.5250E	2.660	4.959	n/a	n/a	n/a	0.2971	0.9326	0.351
Z-Z, +0.60D+0.70E	2.660	20.389	n/a	n/a	n/a	0.0	0.9232	0.347

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, D Only	None	0.0 k-ft	Infinity	OK
X-X, +D+S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.70E	None	0.0 k-ft	Infinity	OK
Z-Z, D Only	None	0.0 k-ft	Infinity	OK
Z-Z, +D+S	None	0.0 k-ft	Infinity	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC#: KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN ALTERNATE FOOTING FOR 8'-0" POST

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Z-Z, +D+0.750S	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.60W	9.630 k-ft	17.808 k-ft	1.849	OK
Z-Z, +D+0.450W	7.222 k-ft	17.808 k-ft	2.466	OK
Z-Z, +D+0.750S+0.450W	7.222 k-ft	32.949 k-ft	4.562	OK
Z-Z, +0.60D+0.60W	9.630 k-ft	10.685 k-ft	1.110	OK
Z-Z, +D+0.70E	7.644 k-ft	17.808 k-ft	2.330	OK
Z-Z, +D+0.750S+0.5250E	5.733 k-ft	32.949 k-ft	5.747	OK
Z-Z, +0.60D+0.70E	7.644 k-ft	10.685 k-ft	1.398	OK

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, D Only	0.0 k	3.30 k	No Sliding	OK
X-X, +D+S	0.0 k	5.425 k	No Sliding	OK
X-X, +D+0.750S	0.0 k	4.893 k	No Sliding	OK
X-X, +D+0.60W	0.4104 k	2.718 k	6.623	OK
X-X, +D+0.450W	0.3078 k	2.863 k	9.303	OK
X-X, +D+0.750S+0.450W	0.3078 k	4.457 k	14.481	OK
X-X, +0.60D+0.60W	0.4104 k	1.968 k	4.796	OK
X-X, +D+0.70E	0.7644 k	3.30 k	4.317	OK
X-X, +D+0.750S+0.5250E	0.5733 k	4.893 k	8.535	OK
X-X, +0.60D+0.70E	0.7644 k	2.550 k	3.336	OK
Z-Z, D Only	0.0 k	3.30 k	No Sliding	OK
Z-Z, +D+S	0.0 k	5.425 k	No Sliding	OK
Z-Z, +D+0.750S	0.0 k	4.893 k	No Sliding	OK
Z-Z, +D+0.60W	0.0 k	2.718 k	No Sliding	OK
Z-Z, +D+0.70E	0.0 k	3.30 k	No Sliding	OK
Z-Z, +D+0.750S+0.5250E	0.0 k	4.893 k	No Sliding	OK
Z-Z, +0.60D+0.70E	0.0 k	2.550 k	No Sliding	OK
Z-Z, +D+0.450W	0.0 k	2.863 k	No Sliding	OK
Z-Z, +D+0.750S+0.450W	0.0 k	4.457 k	No Sliding	OK
Z-Z, +0.60D+0.60W	0.0 k	1.968 k	No Sliding	OK

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.1671	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.40D	0.1671	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D	0.1433	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D	0.1433	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50S	0.6745	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50S	0.6745	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50W	0.09906	+Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50W	0.09906	-Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+1.60S	1.843	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+1.60S	1.843	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+1.60S+0.50W	1.601	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+1.60S+0.50W	1.601	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+W	0.3414	+Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+W	0.3414	-Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50S+W	0.1899	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50S+W	0.1899	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +0.90D+W	0.3772	+Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +0.90D+W	0.3772	-Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.20S+E	0.3558	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.20S+E	0.3558	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +0.90D+E	0.1074	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +0.90D+E	0.1074	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.40D	0.1671	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.40D	0.1671	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D	0.1433	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D	0.1433	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: LONG SPAN ALTERNATE FOOTING FOR 8'-0" POST

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in ²	Gvrn. As in ²	Actual As in ²	Phi*Mn k-ft	Status
Z-Z, +1.20D+0.50S	0.6745	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50S	0.6745	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50W	0.4591	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50W	0.2610	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+1.60S	1.843	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+1.60S	1.843	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+1.60S+0.50W	1.241	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+1.60S+0.50W	1.961	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+W	0.9664	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+W	0.4739	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50S+W	0.5303	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50S+W	0.910	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +0.90D+W	0.7361	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +0.90D+W	0.7361	+X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.20S+E	0.7629	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.20S+E	1.536	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +0.90D+E	0.7361	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +0.90D+E	1.563	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.15 psi	0.15 psi	0.15 psi	31.61 psi	0.00	OK
+1.20D	0.12 psi	0.12 psi	0.12 psi	31.61 psi	0.00	OK
+1.20D+0.50S	0.59 psi	0.59 psi	0.59 psi	31.61 psi	0.02	OK
+1.20D+0.50W	0.49 psi	0.32 psi	0.49 psi	31.61 psi	0.02	OK
+1.20D+1.60S	1.60 psi	1.60 psi	1.60 psi	31.61 psi	0.05	OK
+1.20D+1.60S+0.50W	0.98 psi	1.80 psi	1.80 psi	31.61 psi	0.06	OK
+1.20D+W	0.85 psi	0.67 psi	0.85 psi	31.61 psi	0.03	OK
+1.20D+0.50S+W	0.65 psi	0.98 psi	0.98 psi	31.61 psi	0.03	OK
+0.90D+W	0.64 psi	0.64 psi	0.64 psi	31.61 psi	0.02	OK
+1.20D+0.20S+E	0.85 psi	1.66 psi	1.66 psi	31.61 psi	0.05	OK
+0.90D+E	0.64 psi	2.01 psi	2.01 psi	31.61 psi	0.06	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.15 psi	0.15 psi	0.15 psi	31.61 psi	0.00	OK
+1.20D	0.12 psi	0.12 psi	0.12 psi	31.61 psi	0.00	OK
+1.20D+0.50S	0.59 psi	0.59 psi	0.59 psi	31.61 psi	0.02	OK
+1.20D+0.50W	0.09 psi	0.09 psi	0.09 psi	31.61 psi	0.00	OK
+1.20D+1.60S	1.60 psi	1.60 psi	1.60 psi	31.61 psi	0.05	OK
+1.20D+1.60S+0.50W	1.39 psi	1.39 psi	1.39 psi	31.61 psi	0.04	OK
+1.20D+W	0.30 psi	0.30 psi	0.30 psi	31.61 psi	0.01	OK
+1.20D+0.50S+W	0.17 psi	0.17 psi	0.17 psi	31.61 psi	0.01	OK
+0.90D+W	0.33 psi	0.33 psi	0.33 psi	31.61 psi	0.01	OK
+1.20D+0.20S+E	0.31 psi	0.31 psi	0.31 psi	31.61 psi	0.01	OK
+0.90D+E	0.09 psi	0.09 psi	0.09 psi	31.61 psi	0.00	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.66 psi	150.00psi	0.004398	OK
+1.20D	0.57 psi	150.00psi	0.00377	OK
+1.20D+0.50S	2.66 psi	150.00psi	0.01775	OK
+1.20D+0.50W	0.39 psi	150.00psi	0.002607	OK
+1.20D+1.60S	7.28 psi	150.00psi	0.04851	OK
+1.20D+1.60S+0.50W	6.32 psi	150.00psi	0.04213	OK
+1.20D+W	1.35 psi	150.00psi	0.008984	OK
+1.20D+0.50S+W	0.75 psi	150.00psi	0.004997	OK
+0.90D+W	2.91 psi	150.00psi	0.01937	OK
+1.20D+0.20S+E	1.43 psi	150.00psi	0.009511	OK
+0.90D+E	0.77 psi	150.00psi	0.005129	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

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DESCRIPTION: LONG SPAN ALTERNATE FOOTING FOR 9'-0" POST

Code References

Calculations per ACI 318-19, IBC 2021

Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00090
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	150.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

Increases based on footing Depth

Footing base depth below soil surface	=	2.0 ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

Increases based on footing plan dimension

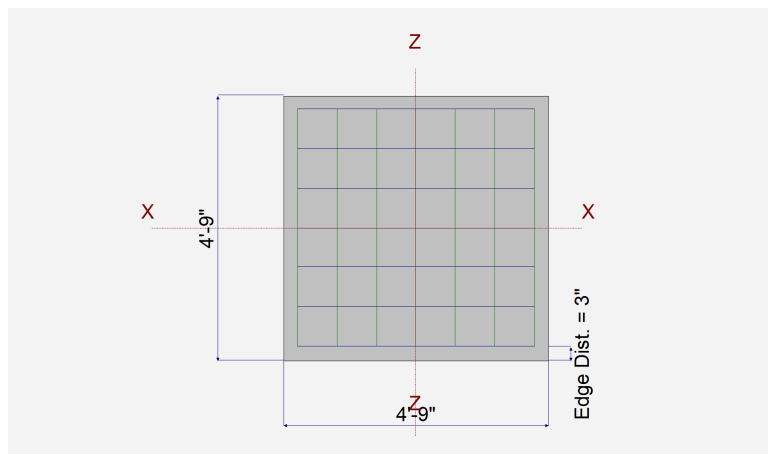
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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Dimensions

Width parallel to X-X Axis	=	4.750 ft
Length parallel to Z-Z Axis	=	4.750 ft
Footing Thickness	=	24.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



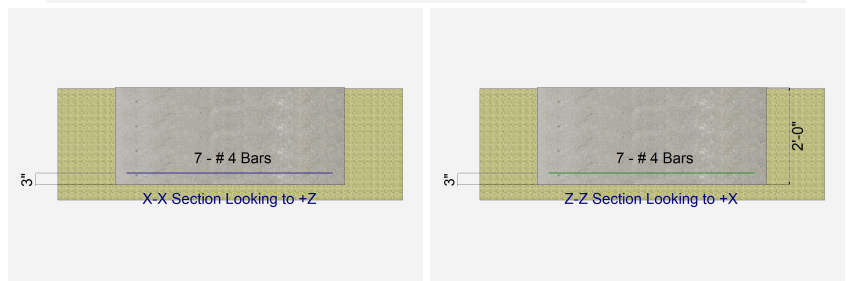
Reinforcing

Bars parallel to X-X Axis	=	7.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis	=	7.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	# 4

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.9550		8.50	-3.877		k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=				6.158	9.887	k-ft
V-x	=				0.6840	1.099	k
V-z	=						k

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: LONG SPAN ALTERNATE FOOTING FOR 9'-0" POST

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.4722	Soil Bearing	1.256 ksf	2.660 ksf	+0.60D+0.70E about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	1.064	Overturning - Z-Z	10.040 k-ft	10.685 k-ft	+0.60D+0.60W
PASS	3.314	Sliding - X-X	0.7693 k	2.550 k	+0.60D+0.70E
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	1.934	Uplift	-2.326 k	4.499 k	+0.60D+0.60W
PASS	0.07290	Z Flexure (+X)	1.997 k-ft/ft	27.393 k-ft/ft	+1.20D+1.60S+0.50W
PASS	0.06729	Z Flexure (-X)	1.843 k-ft/ft	27.393 k-ft/ft	+1.20D+1.60S
PASS	0.06729	X Flexure (+Z)	1.843 k-ft/ft	27.393 k-ft/ft	+1.20D+1.60S
PASS	0.06729	X Flexure (-Z)	1.843 k-ft/ft	27.393 k-ft/ft	+1.20D+1.60S
PASS	0.08331	1-way Shear (+X)	2.633 psi	31.608 psi	+0.90D+E
PASS	0.05067	1-way Shear (-X)	1.601 psi	31.608 psi	+1.20D+1.60S
PASS	0.05067	1-way Shear (+Z)	1.601 psi	31.608 psi	+1.20D+1.60S
PASS	0.05067	1-way Shear (-Z)	1.601 psi	31.608 psi	+1.20D+1.60S
PASS	0.04851	2-way Punching	7.276 psi	150.0 psi	+1.20D+1.60S



Top reinforcing mat required (see 'Bending' tab).

Hand check required for anchor pullout.

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	2.0	n/a	0.0	0.3323	0.3323	n/a	n/a	0.166
X-X, +D+S	2.0	n/a	0.0	0.7091	0.7091	n/a	n/a	0.355
X-X, +D+0.750S	2.0	n/a	0.0	0.6149	0.6149	n/a	n/a	0.308
X-X, +D+0.60W	2.660	n/a	0.0	0.2292	0.2292	n/a	n/a	0.086
X-X, +D+0.450W	2.660	n/a	0.0	0.2550	0.2550	n/a	n/a	0.096
X-X, +D+0.750S+0.450W	2.660	n/a	0.0	0.5376	0.5376	n/a	n/a	0.202
X-X, +0.60D+0.60W	2.660	n/a	0.0	0.09630	0.09630	n/a	n/a	0.036
X-X, +D+0.70E	2.660	n/a	0.0	0.3323	0.3323	n/a	n/a	0.125
X-X, +D+0.750S+0.5250E	2.660	n/a	0.0	0.6149	0.6149	n/a	n/a	0.231
X-X, +0.60D+0.70E	2.660	n/a	0.0	0.1994	0.1994	n/a	n/a	0.075
Z-Z, D Only	2.0	0.0	n/a	n/a	n/a	0.3323	0.3323	0.166
Z-Z, +D+S	2.0	0.0	n/a	n/a	n/a	0.7091	0.7091	0.355
Z-Z, +D+0.750S	2.0	0.0	n/a	n/a	n/a	0.6149	0.6149	0.308
Z-Z, +D+0.60W	2.660	10.477	n/a	n/a	n/a	0.0	0.4808	0.181
Z-Z, +D+0.450W	2.660	7.064	n/a	n/a	n/a	0.06729	0.4427	0.166
Z-Z, +D+0.750S+0.450W	2.660	3.351	n/a	n/a	n/a	0.3498	0.7253	0.273
Z-Z, +0.60D+0.60W	2.660	24.940	n/a	n/a	n/a	0.0	1.001	0.376
Z-Z, +D+0.70E	2.660	13.539	n/a	n/a	n/a	0.0	0.8387	0.315
Z-Z, +D+0.750S+0.5250E	2.660	5.488	n/a	n/a	n/a	0.2632	0.9665	0.363
Z-Z, +0.60D+0.70E	2.660	22.564	n/a	n/a	n/a	0.0	1.256	0.472

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, D Only	None	0.0 k-ft	Infinity	OK
X-X, +D+S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.70E	None	0.0 k-ft	Infinity	OK
Z-Z, D Only	None	0.0 k-ft	Infinity	OK
Z-Z, +D+S	None	0.0 k-ft	Infinity	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC#: KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: LONG SPAN ALTERNATE FOOTING FOR 9'-0" POST

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Z-Z, +D+0.750S	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.60W	10.040 k-ft	17.808 k-ft	1.774	OK
Z-Z, +D+0.450W	7.530 k-ft	17.808 k-ft	2.365	OK
Z-Z, +D+0.750S+0.450W	7.530 k-ft	32.949 k-ft	4.376	OK
Z-Z, +0.60D+0.60W	10.040 k-ft	10.685 k-ft	1.064	OK
Z-Z, +D+0.70E	8.460 k-ft	17.808 k-ft	2.105	OK
Z-Z, +D+0.750S+0.5250E	6.345 k-ft	32.949 k-ft	5.193	OK
Z-Z, +0.60D+0.70E	8.460 k-ft	10.685 k-ft	1.263	OK

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, D Only	0.0 k	3.30 k	No Sliding	OK
X-X, +D+S	0.0 k	5.425 k	No Sliding	OK
X-X, +D+0.750S	0.0 k	4.893 k	No Sliding	OK
X-X, +D+0.60W	0.4104 k	2.718 k	6.623	OK
X-X, +D+0.450W	0.3078 k	2.863 k	9.303	OK
X-X, +D+0.750S+0.450W	0.3078 k	4.457 k	14.481	OK
X-X, +0.60D+0.60W	0.4104 k	1.968 k	4.796	OK
X-X, +D+0.70E	0.7693 k	3.30 k	4.289	OK
X-X, +D+0.750S+0.5250E	0.5770 k	4.893 k	8.481	OK
X-X, +0.60D+0.70E	0.7693 k	2.550 k	3.314	OK
Z-Z, D Only	0.0 k	3.30 k	No Sliding	OK
Z-Z, +D+S	0.0 k	5.425 k	No Sliding	OK
Z-Z, +D+0.750S	0.0 k	4.893 k	No Sliding	OK
Z-Z, +D+0.60W	0.0 k	2.718 k	No Sliding	OK
Z-Z, +D+0.70E	0.0 k	3.30 k	No Sliding	OK
Z-Z, +D+0.750S+0.5250E	0.0 k	4.893 k	No Sliding	OK
Z-Z, +0.60D+0.70E	0.0 k	2.550 k	No Sliding	OK
Z-Z, +D+0.450W	0.0 k	2.863 k	No Sliding	OK
Z-Z, +D+0.750S+0.450W	0.0 k	4.457 k	No Sliding	OK
Z-Z, +0.60D+0.60W	0.0 k	1.968 k	No Sliding	OK

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.1671	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.40D	0.1671	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D	0.1433	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D	0.1433	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50S	0.6745	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50S	0.6745	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50W	0.09906	+Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50W	0.09906	-Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+1.60S	1.843	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+1.60S	1.843	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+1.60S+0.50W	1.601	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+1.60S+0.50W	1.601	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+W	0.3414	+Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+W	0.3414	-Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50S+W	0.1899	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.50S+W	0.1899	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +0.90D+W	0.3772	+Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +0.90D+W	0.3772	-Z	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.20S+E	0.3558	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +1.20D+0.20S+E	0.3558	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +0.90D+E	0.1074	+Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
X-X, +0.90D+E	0.1074	-Z	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.40D	0.1671	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.40D	0.1671	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D	0.1433	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D	0.1433	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK

General Footing

Project File: 20822 ENERCALC.ec6

LIC# : KW-06014086, Build:20.24.10.30

SITTS & HILL ENGINEERING, INC.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: LONG SPAN ALTERNATE FOOTING FOR 9'-0" POST

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in ²	Gvrn. As in ²	Actual As in ²	Phi*Mn k-ft	Status
Z-Z, +1.20D+0.50S	0.6745	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50S	0.6745	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50W	0.4951	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50W	0.2970	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+1.60S	1.843	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+1.60S	1.843	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+1.60S+0.50W	1.205	-X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+1.60S+0.50W	1.997	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+W	0.9795	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+W	0.6048	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50S+W	0.6022	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.50S+W	0.9821	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +0.90D+W	0.7361	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +0.90D+W	0.7361	+X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.20S+E	0.8459	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +1.20D+0.20S+E	1.698	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +0.90D+E	0.7361	-X	Top	0.2592	ACI 7.6.1.1	0.2947	27.393	OK
Z-Z, +0.90D+E	1.808	+X	Bottom	0.2592	ACI 7.6.1.1	0.2947	27.393	OK

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.15 psi	0.15 psi	0.15 psi	31.61 psi	0.00	OK
+1.20D	0.12 psi	0.12 psi	0.12 psi	31.61 psi	0.00	OK
+1.20D+0.50S	0.59 psi	0.59 psi	0.59 psi	31.61 psi	0.02	OK
+1.20D+0.50W	0.54 psi	0.36 psi	0.54 psi	31.61 psi	0.02	OK
+1.20D+1.60S	1.60 psi	1.60 psi	1.60 psi	31.61 psi	0.05	OK
+1.20D+1.60S+0.50W	0.94 psi	1.84 psi	1.84 psi	31.61 psi	0.06	OK
+1.20D+W	0.85 psi	0.87 psi	0.87 psi	31.61 psi	0.03	OK
+1.20D+0.50S+W	0.73 psi	1.06 psi	1.06 psi	31.61 psi	0.03	OK
+0.90D+W	0.64 psi	0.64 psi	0.64 psi	31.61 psi	0.02	OK
+1.20D+0.20S+E	0.85 psi	1.86 psi	1.86 psi	31.61 psi	0.06	OK
+0.90D+E	0.64 psi	2.63 psi	2.63 psi	31.61 psi	0.08	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.15 psi	0.15 psi	0.15 psi	31.61 psi	0.00	OK
+1.20D	0.12 psi	0.12 psi	0.12 psi	31.61 psi	0.00	OK
+1.20D+0.50S	0.59 psi	0.59 psi	0.59 psi	31.61 psi	0.02	OK
+1.20D+0.50W	0.09 psi	0.09 psi	0.09 psi	31.61 psi	0.00	OK
+1.20D+1.60S	1.60 psi	1.60 psi	1.60 psi	31.61 psi	0.05	OK
+1.20D+1.60S+0.50W	1.39 psi	1.39 psi	1.39 psi	31.61 psi	0.04	OK
+1.20D+W	0.30 psi	0.30 psi	0.30 psi	31.61 psi	0.01	OK
+1.20D+0.50S+W	0.17 psi	0.17 psi	0.17 psi	31.61 psi	0.01	OK
+0.90D+W	0.33 psi	0.33 psi	0.33 psi	31.61 psi	0.01	OK
+1.20D+0.20S+E	0.31 psi	0.31 psi	0.31 psi	31.61 psi	0.01	OK
+0.90D+E	0.09 psi	0.09 psi	0.09 psi	31.61 psi	0.00	OK

Two-Way "Punching" Shear

All units k

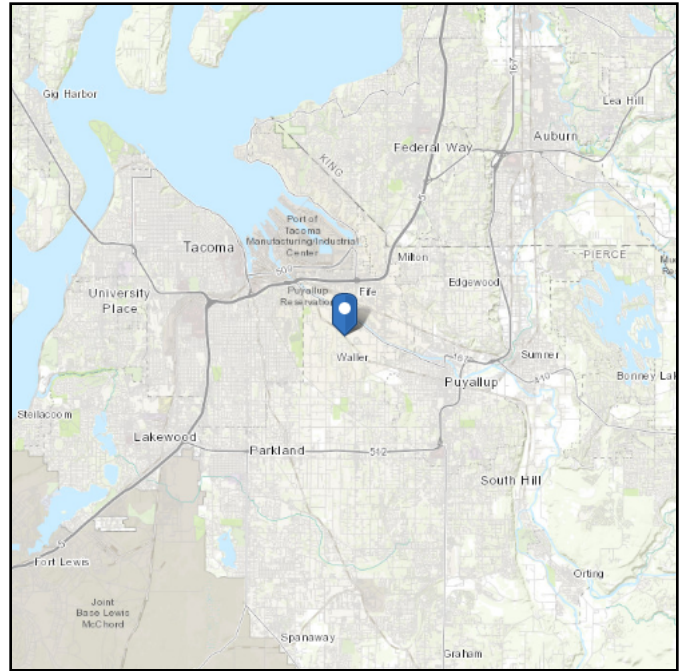
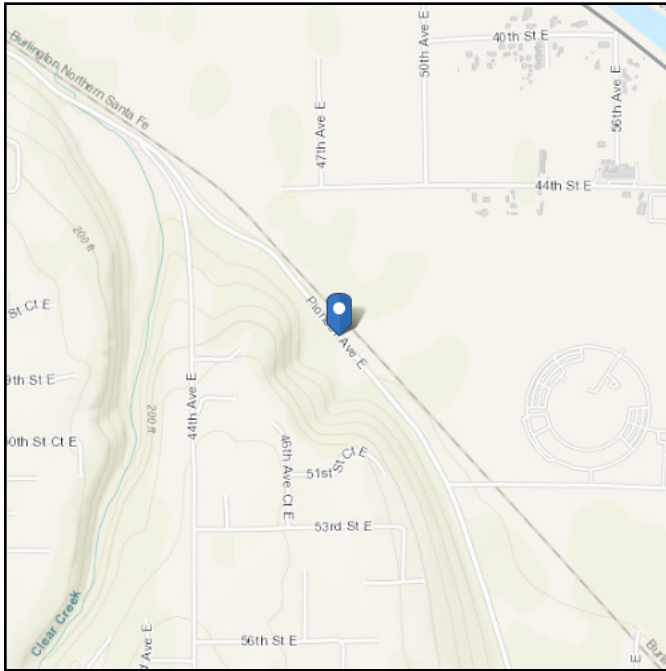
Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.66 psi	150.00psi	0.004398	OK
+1.20D	0.57 psi	150.00psi	0.00377	OK
+1.20D+0.50S	2.66 psi	150.00psi	0.01775	OK
+1.20D+0.50W	0.39 psi	150.00psi	0.002607	OK
+1.20D+1.60S	7.28 psi	150.00psi	0.04851	OK
+1.20D+1.60S+0.50W	6.32 psi	150.00psi	0.04213	OK
+1.20D+W	1.35 psi	150.00psi	0.008984	OK
+1.20D+0.50S+W	0.75 psi	150.00psi	0.004997	OK
+0.90D+W	2.91 psi	150.00psi	0.01937	OK
+1.20D+0.20S+E	1.46 psi	150.00psi	0.009747	OK
+0.90D+E	0.90 psi	150.00psi	0.005971	OK

ASCE Hazards Report

Address:
Pioneer Way E
Puyallup, Washington
98371

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Default (see
Section 11.4.3)

Latitude: 47.213645
Longitude: -122.365315
Elevation: 24.3694552253606 ft (NAVD
88)



Wind

Results:

Wind Speed	97 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: Tue Feb 04 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.

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	1.308	S_{D1} :	N/A
S_1 :	0.451	T_L :	6
F_a :	1.2	PGA :	0.5
F_v :	N/A	PGA _M :	0.6
S_{MS} :	1.57	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.047	C_v :	1.362

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Tue Feb 04 2025

Date Source: [USGS Seismic Design Maps](#)

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Residential Design Criteria

For 2021 International Codes & [PCC 17C.20.170](#)

This bulletin establishes the design criteria used in designing buildings using the current International Residential Code (IRC).

It is the responsibility of the property owner to verify all design criteria for their specific site.

Ground Snow Load	Wind Design		Seismic Design Category	Subject to Damage From			Winter Design Temp	Ice Barrier UnderLayment Required	Flood Hazard	Air Freezing Index	Mean Annual Temp
	Speed (mph)	Topographic Effects		Weathering	Frostline Depth	Termite					
See below	110 Mph Ult	No	D1 / D2	Moderate	See below	Slight to Moderate	26	No	Ask Engineering	50	50

Table items above in **bold** vary depending on your location. Read below for more information.

Ground Snow Loads

- All structural tables in the International Residential Code (IRC) have a minimum ground snow load of 30 pounds per square foot (psf). Projects designed to the IRC must be designed to a minimum of 30 psf.
- If plans are designed by engineer using the International Building Code (IBC) then a **minimum ground snow load of 25psf** may be used.
- Higher elevations (above 700 feet) may have a higher snow load.
- Ground snow loads greater than 70psf require structural calculations prepared by a WA state registered engineer (2021 IRC section R301.2.3).

Wind Design Criteria

- **110 mph Ultimate** with a 3-second gust
- Exposure B (assumed unless the site meets the definition of another type)

Exposure A: Not used for residential construction.

Exposure B: Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Exposure C: Open terrain with scattered obstructions, including hills or other landscape features less than 30 feet extending more than 1,500 feet from the building site in any direction.

Exposure D: Flat, unobstructed areas exposed to wind flowing over open water for a horizontal distance of at least 5000 feet.

Seismic Design Categories

The majority of Pierce County is Category D1. The area of Pierce County abutting Kitsap County (Gig Harbor area) is designated as D2 on the IRC map.

Soil Site Class

All of Pierce County will be assumed to be soil **Site Class D**, unless a geotechnical evaluation is required from Development Engineering. In this case, the findings of the professional evaluation will set the soil site class and related seismic information. This report must be turned in with the building application.

Soil Load-Bearing Values

Assume **1,500 pounds per square foot (PSF)** unless a soils report from a licensed geotechnical engineer is provided.

Frost Depth

All low-land areas have a **frost depth of 12 inches below grade**. Higher elevations will have a deeper frost depth. Visit PierceCountyWa.gov/AboutMyProperty or check with Building technical support for your specific project.

****Site specific snow loads do not apply to your minimum required design criteria.**

****This website provides approximate information only and does not guarantee validity.**