The Fence Design Tool is currently in development. What is shown on the next page is the tab that would be used for any type of fencing for both wind and ice loading. The Fence Design Tool will have a tab specifically for chain link fencing that will calculate almost all of the variables so you won't have to spend time looking the values up in the various tables shown on FenceDesign.com.

Page 2 shows the C_f value calculator for evenly spaced fence posts. In this case, you're looking for the equivalent post C_f value for the worst case post you would use to size all the posts. Alternatively, on a long enough fence where it would be worth it, you can size the inner line posts to the lower Case A wind forces. Those post and footings can be smaller as the forces away from the ends and corners are lower.

There will eventually be a C_f tab for uneven post spacings where the spacings can be adjusted near ends and corners to keep all of the posts and footings sized to the lower Case A wind forces.

Page 3 shows the force calculations for the worst case post, and a post size that works. This uses the same starting values as the example 3 hand calculations, but resulting forces are slightly different due to rounding in the hand calcs.

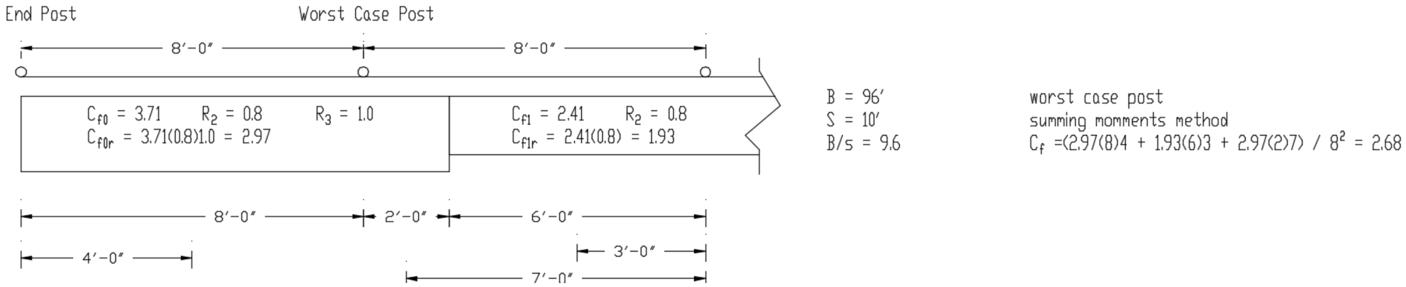
Page 4 shows the range of post types that can be analyzed. New types and sizes can be added if there is demand for them.

Page 5 shows 2 passes of the post footing calculations that match what was done on the example 3 hand calculations. With the Fence Calculations tool, you can quickly try a variety of depths and diameters to find the most economical footing size that minimizes the amount of soil that needs to be removed, and the volume of concrete required.

C_f values for solid & mostly solid fencing (ε or ε' > 0.7)

B =	96.000	ft	Length of Straight Fence Run Being Analyzed	Maximum Post Spacing		8.000	ft
L =	8.000	ft	Even Post Spacing - 13 Posts, 8' 0'' on Center	Even Post Spacings for Length, B		8.000	ft
h =	10.000	ft	Fence Height (3' minimum - 20' maximum)			7.385	ft
g =	0.000	ft	Gap between the ground and bottom of fencing			6.857	ft
s =	10.000	ft	Height of Fencing Materials, s = h - g			6.400	ft
s / h =	1.000	-	Clearance Ratio				
B / s =	9.600	-	Aspect Ratio				
R_2 =	0.800	-	Case C Reduction Factor	$R_2 = (1.8 - s/h) \leq 1.0$			
L_{rL} =	0.000	ft	Length of Left Return Corner (0 ft if no return)	Left and right ends of fence run when looking at the front face of the fencing			
L_{rR} =	0.000	ft	Length of Right Return Corner (0 ft if no return)				
L_{rL} / s =	0.000	-	Left Return Corner Length to Fencing Height Ratio				
L_{rR} / s =	0.000	-	Right Return Corner Length to Fencing Height Ratio				
R_{3L} =	1.000	-	Left Return Corner Reduction Factor	Per ASCE 7 §29 solid wall return corner table			
R_{3R} =	1.000	-	Right Return Corner Reduction Factor				
C_{fA} =	1.304	-	Force Coefficient - Case A Use C_{fA} for line posts away from ends and corners	Per ASCE 7 §29 solid wall Case A table			
$C_{fA\text{-}max}$ =		-	Highest C_{fA} value that controls elsewhere in fence	Put in the highest C_{fA} controling a fence run			
Raw Case C C_f Values							
C_{f0} =	3.710	-	Force Coefficient - Case C - 0 to s	Per ASCE 7 §29 solid wall Case C table Values in red are lower than the Case A C_f value			
C_{f1} =	2.410		Force Coefficient - Case C - s to 2s				
C_{f2} =	1.810	-	Force Coefficient - Case C - 2s to 3s				
C_{f3} =	0.970	-	Force Coefficient - Case C - > 3s				
C_{f4} =	0.000	-	N/A for B/s < 13				
C_{f5} =	0.000	-	N/A for B/s < 13				
C_{f6} =	0.000	-	N/A for B/s < 13				
Reduced Case C C_f values per Case C Reduction Factor, R_2 and Return Corner Reduction Factors, R_{3L} & R_{3R}							
C_{fr0L} =	2.968	-	Reduced Force Coefficient - Left Case C - 0 to s	$C_{fr0L} = R_2 R_{3L} C_{f0}$ Left end - 0 to s region			
C_{fr0R} =	2.968	-	Reduced Force Coefficient - Right Case C - 0 to s	$C_{fr0R} = R_2 R_{3R} C_{f0}$ Right end - 0 to s region			
C_{fr1} =	1.928	-	Reduced Force Coefficient - Case C - s to 2s	$C_{fr1} = R_2 C_{f1}$			
C_{fr2} =	1.448	-	Reduced Force Coefficient - Case C - 2s to 3s	$C_{fr2} = R_2 C_{f2}$			
C_{fr3} =	0.776	-	Reduced Force Coefficient - Case C - > 3s	$C_{fr3} = R_2 C_{f3}$			
C_{fr4} =	0.000	-	N/A for B/s < 13	$C_{fr4} = R_2 C_{f4}$			
C_{fr5} =	0.000	-	N/A for B/s < 13	$C_{fr5} = R_2 C_{f5}$			
C_{fr6} =	0.000	-	N/A for B/s < 13	$C_{fr6} = R_2 C_{f6}$			
Equivalent Post C_f values per Post Spacing, L							

C_{FE1} =	2.968	-	Left End		C_{FE1} =	2.968	-	Right End
C_{FE2} =	2.676	-	2nd Post	Use the highest C_f value for Case C posts	C_{FE2} =	2.676	-	2nd Post
C_{FE3} =	1.901	-	3rd Post		C_{FE3} =	1.901	-	3rd Post
C_{FE4} =	1.487	-	4th Post		C_{FE4} =	1.487	-	4th Post
C_{FE5} =	1.304	-	5th Post	Case A controls the center 5 post(s)	C_{FE5} =	1.304	-	5th Post



Wind & Ice Design for Any Fence Type per IBC / ASCE 7 and FenceDesign.com				
-	IBC 2018	-	Building Code	Per site location
-	I	-	Risk Category	Per client - Risk Category I is typical for fencing
-	C	-	Exposure Class	Per site location
Z_e =	44	ft	Site Elevation	
V_w =	105	mph	Basic Wind Speed	
t =	1.00	in	Nominal Ice Thickness	
V_i =	40	mph	Concurrent Gust Wind Speed for Ice Loading	
K_{zt} =	1.000	-	Topographic Factor	K_{zt} = 1.0 for flat ground. See ASCE 7 Fig. 26.8-1 for hilly regions
h =	10.000	ft	Fence Height	Per Fence Design
g =	0.000	ft	Gap at the Bottom of the Fencing	If there is no gap at the bottom, set to 0 ft
s =	10.000	ft	Height of Fencing Material	s = h - g
L =	8.000	ft	Post Spacing	L = Average of spacing on each side (Tributary Width)
K_d =	0.850	-	Wind Directionality Factor	Per ASCE 7-16, Table 26.6-1
G =	0.850	-	Gust Effect Factor	Per §26.11.1 Approximate natural frequency, $n_a > 1 H_z$
q_w =	12.235	psf	ASD Wind Pressure w/o Site Modifiers	$q_w = (0.6) 0.00256 K_d G V_w^2$
q_i =	2.072	psf	ASD Wind on Ice Pressure w/o Site Modifiers	$q_i = (0.7) 0.00256 K_d G V_i^2$
K_z =	0.849	-	Velocity Pressure Exposure Coefficient	Per Table 26.10-1, Note 1
K_e =	0.998	-	Ground Elevation Factor	$K_e = e^{-0.0000362Ze}$ per Note 2 of Table 26.9-1
ε =	0.160	-	Solidity Ratio	Per fence geometry
C_{fw} =	1.300	-	Wind Force Coefficient	Per ASCE 7 §29 Solid Wall or Open Frame tables
D_w =	1.000	psf	Weight of Fencing Materials	Per Fence Design
$\O_p$ =	2.875	in	Expected Post Diameter or Width	For solid or mostly solid fencing, leave these fields blank. For open fencing, leave rails blank if not applicable.
$\O_r$ =	1.625	in	Expected Top Rail Diameter or Width	
$\O_m$ =	1.625	in	Expected Mid Rail Diameter or Width	
A_p =	2.396	ft^2	Expected Post Wind Area	$A_p = (\O_p / 12) \times h$
A_r =	3.250	ft^2	Effective Rail Wind Area	$A_r = (\O_r / 12) \times 2 \times L + (\O_m / 12) \times L$
A_w =	18.446	ft^2	Wind Area Tributary to the Post	$A_w = \varepsilon s L + A_p + A_r$
R_{1w} =	1.000	-	Inverted Fence Opening Reduction Factor - Wind	Per FenceDesign.com Fence Post and Footing Design Guide
F_{hw} =	1.000	-	Force Height Adjustment Factor - Wind	
f_{min} =	177	lbs	Minimum Wind Force	Per §29.7 $f_{min} = (0.6) 16.0 A_w$
f_w =	249	lbs	Calculated Wind Force at Post Mid Height	$f_w = q_w k_z k_{zt} K_e R_{1w} F_{hw} C_{fw} A_w$
f_w' =	249	lbs	Maximum Wind Force at Post Mid Height	$f_w' = Max(f_{min}, f_w)$
p_w =	80	lbs	Maximum Axial Force for Wind Loading	$p_w = D_w s L$
ε' =	0.970	-	Iced Solidity Ratio	Per ASCE 7-16 §10 or FenceDesign.com Tables
C_{fi} =	2.760	-	Wind on Ice Force Coefficient	Per ASCE 7 §29 Solid Wall or Open Frame tables
D_i =	4.400	psf	Weight of Ice	Per ASCE 7 §10
A_i =	77.6	ft^2	Iced Area Tributary to the Post	$A_i = \varepsilon' s L$
R_{1i} =	1.005	-	Inverted Fence Opening Reduction Factor - Ice	Per FenceDesign.com Fence Post and Footing Design Guide
F_{hi} =	1.100	-	Force Height Adjustment Factor - Wind	
f_i =	416	lbs	Maximum Wind on Ice Force at Post Mid Height	$f_i = q_i k_z k_{zt} K_e R_{1i} F_{hi} C_{fi} A_i$
p_i =	432	lbs	Maximum Axial Force for Wind on Ice Loading	$p_i = (D_w + D_i) s L$

Post Strength Analysis

Post Type	Steel Circular Tube	Post Weight, D_p =	4.6	lbs / ft	$p_w' = p_w + D_p h + D_o$
O.D.	2-7/8"	Additional weight, D_o =	0	lbs (per post)	$p_i' = p_i + D_p h + D_o$
Thickness & Strength	40 Wt, 50 ksi (Group IC)	Slenderness Ratio, KL/r =	263		

Combined Bending & Axial Loading - Post Stress Ratios - Wind

$$\frac{f_w' = 249}{F_a = 547} = 0.45 \qquad \frac{p_w' = 126}{P_a = 2,818} = 0.04 \qquad \frac{f_w'}{F_a} + \frac{p_w'}{P_a} = 0.50$$

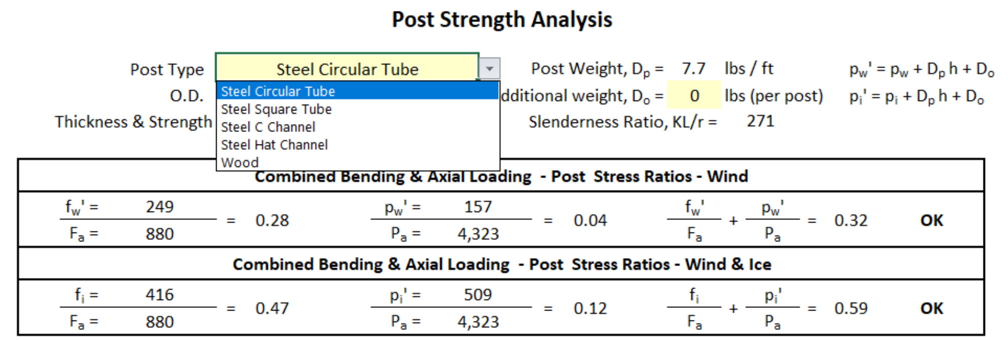
OK

Combined Bending & Axial Loading - Post Stress Ratios - Wind & Ice

$$\frac{f_i = 416}{F_a = 547} = 0.76 \qquad \frac{p_i' = 478}{P_a = 2,818} = 0.17 \qquad \frac{f_i}{F_a} + \frac{p_i'}{P_a} = 0.93$$

OK

With the Fence Design Tool, you can quickly check many different post sizes & types.



Post Strength Analysis

Post Type: Steel Circular Tube
O.D.
Thickness & Strength

Post Weight, D_p = 7.7 lbs / ft
dditional weight, D_o = 0 lbs (per post)
Slenderness Ratio, KL/r = 271

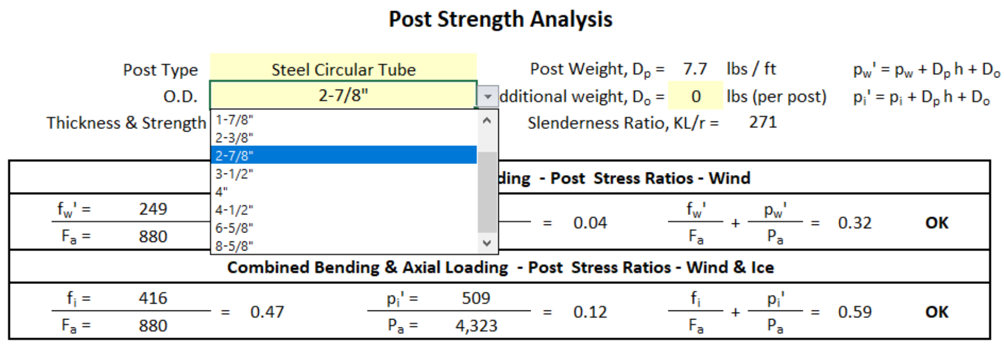
$p_w' = p_w + D_p\,h + D_o$
$p_i' = p_i + D_p\,h + D_o$

Combined Bending & Axial Loading - Post Stress Ratios - Wind

$\dfrac{f_w' = 249}{F_a = 880} = 0.28$ $\dfrac{p_w' = 157}{P_a = 4{,}323} = 0.04$ $\dfrac{f_w'}{F_a} + \dfrac{p_w'}{P_a} = 0.32$ **OK**

Combined Bending & Axial Loading - Post Stress Ratios - Wind & Ice

$\dfrac{f_i = 416}{F_a = 880} = 0.47$ $\dfrac{p_i' = 509}{P_a = 4{,}323} = 0.12$ $\dfrac{f_i}{F_a} + \dfrac{p_i'}{P_a} = 0.59$ **OK**



Post Strength Analysis

Post Type: Steel Circular Tube
O.D.: 2-7/8"
Thickness & Strength

Post Weight, D_p = 7.7 lbs / ft
dditional weight, D_o = 0 lbs (per post)
Slenderness Ratio, KL/r = 271

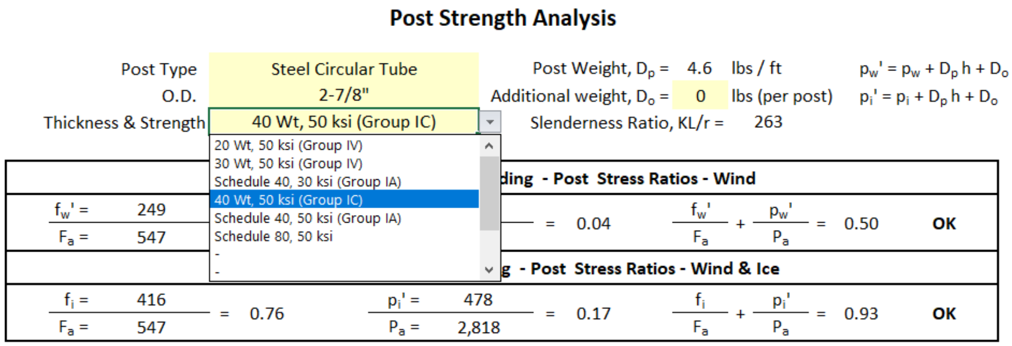
$p_w' = p_w + D_p\,h + D_o$
$p_i' = p_i + D_p\,h + D_o$

ding - Post Stress Ratios - Wind

f_w' = 249 F_a = 880 = 0.04 $\dfrac{f_w'}{F_a} + \dfrac{p_w'}{P_a} = 0.32$ **OK**

Combined Bending & Axial Loading - Post Stress Ratios - Wind & Ice

$\dfrac{f_i = 416}{F_a = 880} = 0.47$ $\dfrac{p_i' = 509}{P_a = 4{,}323} = 0.12$ $\dfrac{f_i}{F_a} + \dfrac{p_i'}{P_a} = 0.59$ **OK**



Post Strength Analysis

Post Type: Steel Circular Tube
O.D.: 2-7/8"
Thickness & Strength: 40 Wt, 50 ksi (Group IC)

Post Weight, D_p = 4.6 lbs / ft
Additional weight, D_o = 0 lbs (per post)
Slenderness Ratio, KL/r = 263

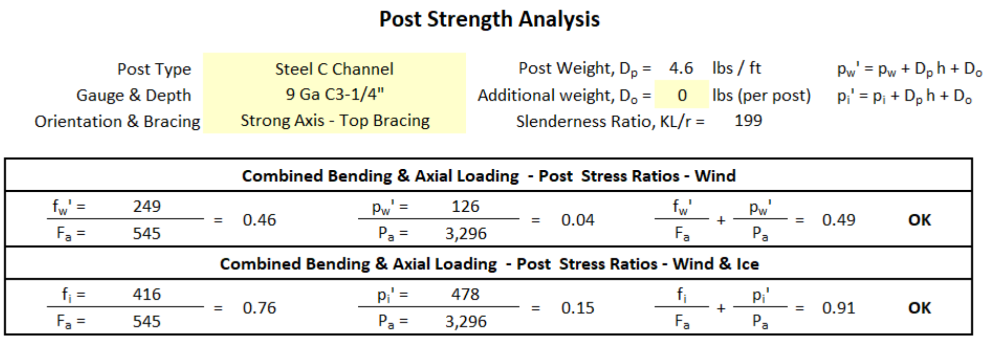
$p_w' = p_w + D_p\,h + D_o$
$p_i' = p_i + D_p\,h + D_o$

ding - Post Stress Ratios - Wind

f_w' = 249 F_a = 547 = 0.04 $\dfrac{f_w'}{F_a} + \dfrac{p_w'}{P_a} = 0.50$ **OK**

g - Post Stress Ratios - Wind & Ice

$\dfrac{f_i = 416}{F_a = 547} = 0.76$ $\dfrac{p_i' = 478}{P_a = 2{,}818} = 0.17$ $\dfrac{f_i}{F_a} + \dfrac{p_i'}{P_a} = 0.93$ **OK**



Post Strength Analysis

Post Type: Steel C Channel
Gauge & Depth: 9 Ga C3-1/4"
Orientation & Bracing: Strong Axis - Top Bracing

Post Weight, D_p = 4.6 lbs / ft
Additional weight, D_o = 0 lbs (per post)
Slenderness Ratio, KL/r = 199

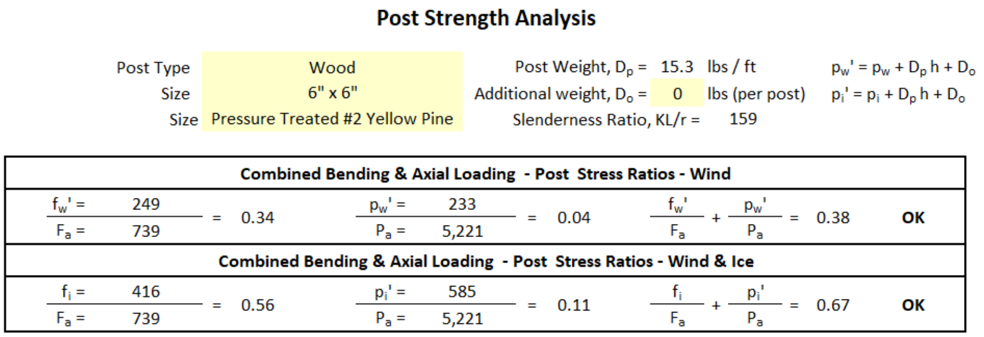
$p_w' = p_w + D_p\,h + D_o$
$p_i' = p_i + D_p\,h + D_o$

Combined Bending & Axial Loading - Post Stress Ratios - Wind

$\dfrac{f_w' = 249}{F_a = 545} = 0.46$ $\dfrac{p_w' = 126}{P_a = 3{,}296} = 0.04$ $\dfrac{f_w'}{F_a} + \dfrac{p_w'}{P_a} = 0.49$ **OK**

Combined Bending & Axial Loading - Post Stress Ratios - Wind & Ice

$\dfrac{f_i = 416}{F_a = 545} = 0.76$ $\dfrac{p_i' = 478}{P_a = 3{,}296} = 0.15$ $\dfrac{f_i}{F_a} + \dfrac{p_i'}{P_a} = 0.91$ **OK**



Post Strength Analysis

Post Type: Wood
Size: 6" x 6"
Size: Pressure Treated #2 Yellow Pine

Post Weight, D_p = 15.3 lbs / ft
Additional weight, D_o = 0 lbs (per post)
Slenderness Ratio, KL/r = 159

$p_w' = p_w + D_p\,h + D_o$
$p_i' = p_i + D_p\,h + D_o$

Combined Bending & Axial Loading - Post Stress Ratios - Wind

$\dfrac{f_w' = 249}{F_a = 739} = 0.34$ $\dfrac{p_w' = 233}{P_a = 5{,}221} = 0.04$ $\dfrac{f_w'}{F_a} + \dfrac{p_w'}{P_a} = 0.38$ **OK**

Combined Bending & Axial Loading - Post Stress Ratios - Wind & Ice

$\dfrac{f_i = 416}{F_a = 739} = 0.56$ $\dfrac{p_i' = 585}{P_a = 5{,}221} = 0.11$ $\dfrac{f_i}{F_a} + \dfrac{p_i'}{P_a} = 0.67$ **OK**

Example 3 - post footing calculations

Non-constrained Concrete Footing for Embedded Posts					
D_p =	2.875	in	Post Diameter / Largest Width / Largest Diagonal		
h =	120.000	in	Post Height		
b' =	6.875	in	Minimum Footing Diameter per IBC §1807.3.3(1)		$b' = D_p + 4$
b =	9.000	in	Footing Diameter	**OK**	b ≥ b' is OK
D =	60.000	in	Design Footing Depth	**OK**	12' ≥ D ≥ 2' is OK
V =	2.209	ft^3	Volume of Excavated Soil / Volume of Concrete		$V = \pi (\frac{1}{2}b)^2 D$
Lateral Load					
P =	416.000	lb	Lateral Force		$P= f_w$ or f_i
½h =	60.000	in	Height of Lateral Force Application		Modified for fencing - see Eq. 18-1 below
S =	150.000	psf / ft	Allowable Lateral Soil Bearing Pressure per ft		Per geotech or Table 1806.2
M =	2.000	-	Modifier for Isolated Poles		Per §1806.3.4
S_1 =	500.000	psf	Allowable Lateral Soil Bearing Pressure per Depth, D		Per §1807.3.2.1 $S_1 = \frac{1}{3}(D/12)\,S\,M$
A =	2.596	ft	Soil Bearing Factor		Per §1807.3.2.1 $A = 2.34P / (S_1(b/12))$
d =	63.322	in	Minimum Footing Depth modified for fencing	**BAD**	Eq. 18-1 ½h used in place of h
					$d = (\frac{1}{2}A(1 + (1 + 4.36\ \frac{1}{2}\,(h/12) / A)^{\frac{1}{2}}))12$
UC =	1.055	-	Unity Check		UC = d / D UC ≤ 1.0 is OK
Axial Load					
D_f =	331.340	lbs	Footing Weight		$D_f = V \times 150$ pcf
w_f =	463.000	lbs	Fencing, Post & Ice (if applicable) Weight		$w_f = p_i'$ or p_w'
D_{max} =	794.340	lbs	Axial Dead Load		$D_{max} = D_f + w_f$
A_f =	0.442	ft^2	Footing Area		$A_f = \pi (\frac{1}{2}(b/12))^2$
S_y =	2000.000	psf	Allowable Vertical Foundation Pressure		Per Geotech or Table 1806.2
s_y =	1798.018	psf	Maximum Vertical Pressure	**OK**	$p_a = D_{max} / A_f$
UC =	0.899	-	Unity Check		$UC = s_y / S_y$ UC ≤ 1.0 is OK

Try again with a deeper footing

Non-constrained Concrete Footing for Embedded Posts					
D_p =	2.875	in	Post Diameter / Largest Width / Largest Diagonal		
h =	120.000	in	Post Height		
b' =	6.875	in	Minimum Footing Diameter per IBC §1807.3.3(1)		$b' = D_p + 4$
D' =	42.000	in	Suggested Minimum Footing Depth per ASTM A567		D' = Max(24", 24 + (H - 48) / 4)
b =	9.000	in	Footing Diameter	**OK**	b ≥ b' is OK
D =	66.000	in	Design Footing Depth	**OK**	12' ≥ D ≥ 2' is OK
V =	2.430	ft^3	Volume of Excavated Soil / Volume of Concrete		$V = \pi (\frac{1}{2}b)^2 D$
Lateral Load					
P =	416.000	lb	Lateral Force		$P= f_w$ or f_i
½h =	60.000	in	Height of Lateral Force Application		Modified for fencing - see Eq. 18-1 below
S =	150.000	psf / ft	Allowable Lateral Soil Bearing Pressure per ft		Per geotech or Table 1806.2
M =	2.000	-	Modifier for Isolated Poles		Per §1806.3.4
S_1 =	550.000	psf	Allowable Lateral Soil Bearing Pressure per Depth, D		Per §1807.3.2.1 $S_1 = \frac{1}{3}(D/12)\,S\,M$
A =	2.360	ft	Soil Bearing Factor		Per §1807.3.2.1 $A = 2.34P / (S_1(b/12))$
d =	59.464	in	Minimum Footing Depth modified for fencing	**OK**	Eq. 18-1 ½h used in place of h
					$d = (\frac{1}{2}A(1 + (1 + 4.36\ \frac{1}{2}\,(h/12) / A)^{\frac{1}{2}}))12$
UC =	0.901	-	Unity Check		UC = d / D UC ≤ 1.0 is OK
Axial Load					
D_f =	364.474	lbs	Footing Weight		$D_f = V \times 150$ pcf
w_f =	463.000	lbs	Fencing, Post & Ice (if applicable) Weight		$w_f = p_i'$ or p_w'
D_{max} =	827.474	lbs	Axial Dead Load		$D_{max} = D_f + w_f$
A_f =	0.442	ft^2	Footing Area		$A_f = \pi (\frac{1}{2}(b/12))^2$
S_y =	2000.000	psf	Allowable Vertical Foundation Pressure		Per Geotech or Table 1806.2
s_y =	1873.018	psf	Maximum Vertical Pressure	**OK**	$p_a = D_{max} / A_f$
UC =	0.937	-	Unity Check		$UC = s_y / S_y$ UC ≤ 1.0 is OK