Worksheet – Open Fencing – Wind Loading

Site Location:

Customer:

Site and Geometrical Variables

IBC______ ASCE 7-______ Risk Category______ Frost Depth______ ft

Basic Wind Speed, V_w = _______ mph

Wind Pressure, q_w = _______ psf

Exposure Category _______ Topographical Factor, K_{zt} = _______

Site Elevation, Z_e = ________ ft Elevation Factor, K_e = _______

Height of fence, h = _______ ft Gap at bottom of fence, g = ______ ft (zero if no gap)

Height of fencing material, s = h - g = ______ ft

Velocity Pressure Exposure Coefficient, K_z = _______

Wind & Axial Loading

Fence Run #_____ Length of Fence, B = _____ ft Post spacing, L = _____ ft

Solidity Ratio, ε = _____ Inverted Fence Opening Reduction Factor, $R_{1w} = 1.0$

Force Height Adjustment Factor, $F_{hw} = 1.0$ Wind Force Coefficient, C_{fw} = _____

Expected Post Diameter or Width, $Ø_p$ = ______ in

Top Rail Diameter or Width, $Ø_r$ = ______ in Mid Rail Diameter or Width, $Ø_p$ = _____ in

($Ø_r$ & $Ø_m$ – set to Zero if not applicable for rails)

Wind Area of Post, $A_p = Ø_p / 12 \times h$ = ______ ÷ 12 × ______ = ______ ft²
(A_p = 0 for solid / mostly solid fencing) $Ø_p$ h A_p

Wind Area of Rails, $A_r = (Ø_r / 12) \times 2 \times L + (Ø_m /12) \times L$ ($A_r = 0$ if no rails)

A_r = (_______ ÷ 12 × 2 × _______) + (_______ ÷ 12 × _______) = _______ ft²
$Ø_r$ L $Ø_m$ L A_r

Wind area tributary to the post, $A_w = \varepsilon\, s\, L + A_p + A_r$ = ____ × ____ × ____ + ____ + _____ = _____ ft²
ε s L A_p A_r A_w

Dead Load of fencing materials, D_m ______ psf

Lateral and Axial Forces for Wind Loading

Minimum wind force to the post, $f_{min} = (0.6)\, 16.0\, A_w = 9.6 \times$ ______ = ________ lbs
A_w f_{min}

Calculated Wind Force to the post, $f_w = q_w K_z K_{zt} K_e R_{1w} F_{hw} C_{fw} A_w$

f_w = ______ × ______ × ______ × ______ × 1.0 × 1.0 × ______ × ______ = __________ lbs
q_w K_z K_{zt} K_e R_{1w} F_{hw} C_{fw} A_w f_w

Maximum wind force to the post, f_w' = maximum value of either f_{mim} or f_w = _________ lbs
f_w'

Axial force supported by the post, $p_a = D_w\, s\, L$

p_w = _______ × _______ × _______ = __________ lbs
D_m s L p_w

$5 \times p_w$ = ________ lbs (used for stability check)

Post Selection

Using the size of the desired post and the Fence Height, h, look through the post charts for post types that have an F_a value larger than the f_w value, and a P_a value larger than the p_w value. If the post has an * next to the P_a value, only use it if the P_a value is $\geq 5 \times p_w$ due to stability requirements.

Put in the O.D or size, post type, weight per foot, D_p and fence height, h and calculate p_w' to include the weight of the post. Add any additional weight if needed.

f_w' / F_a is the bending strength ratio for Wind

p_w' / P_a is the axial strength ratio for Wind

If the sum of the bending strength and axial strength ratios are ≤ 1.0, the post is acceptable.

O.D.	Post Type	D_p (lb/f)	h (ft)	$p_w' = p_w + (D_p \times h)$	
				p_w' =	
Wind					
$\frac{f_w'}{F_a} = \frac{\_\_\_\_}{} =$			$\frac{p_w'}{P_a} = \frac{\_\_\_\_}{} =$		$\frac{f_w'}{F_a} + \frac{p_w'}{P_a} =$

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Footing Sizing (non-constrained footings)

Design Footing Depth, D = _______ ft   Footing Diameter, b = _______ ft

Lateral Bearing Pressure per foot of depth, S = _____ psf / ft   per geotechnical analysis or table 1806.2

Maximum Wind Force, P = f_w' = ________ lbs   Post Height, h = _______ ft

Modifier for Isolated Posts, M = 2.0   per IBC §1086.3.4

Allowable Lateral Soil Bearing Pressure for non-constrained footings, $S_1 = \frac{1}{3} D\,S\,M$

$S_1 = \frac{1}{3} \times \underset{D}{\underline{\qquad}} \times \underset{S}{\underline{\qquad}} \times \underset{M}{2.0} = \underset{S_1}{\underline{\qquad}}$ psf   per IBC §1807.3.2.1

Soil Bearing Factor, $A = 2.34\,P / (S_1\,b)$ per IBC §1807.3.2.1

$A = 2.34 \times \underset{P}{\underline{\qquad}} \div (\underset{S_1}{\underline{\qquad}} \times \underset{b}{\underline{\qquad}}) = \underset{A}{\underline{\qquad}}$

Minimum Depth, $d = \frac{1}{2} A \left(1 + \sqrt{1 + \frac{4.36\ \frac{1}{2}h}{A}}\right)$ per Eq. 18-1, modified for fencing

$$d = \frac{1}{2} \times \underset{A}{\underline{\qquad}} \times \left(1 + \sqrt{1 + (4.36 \times \frac{1}{2} \times \underset{h}{\underline{\qquad}} \div \underset{A}{\underline{\qquad}})}\right) = \underset{d}{\underline{\qquad}} \text{ ft}$$

Area of the bottom of the footing, $A_f = \pi \left(\frac{1}{2} b\right)^2 = 3.14 \times \left(\frac{1}{2} \times \underset{b}{\underline{\qquad}}\right)^2 = \underset{A_f}{\underline{\qquad}}$ ft^2

Footing Volume, $V = A_f\,D = \underset{A_f}{\underline{\qquad}} \times \underset{D}{\underline{\qquad}} = \underset{V}{\underline{\qquad}}$ ft^3

Weight of footing, $D_f = 150\,V = 150 \times \underset{V}{\underline{\qquad}} = \underset{D_f}{\underline{\qquad}}$ lbs   (Typical Concrete weight is 150 lbs / ft^3)

Axial Dead Load, $D_{max} = D_f + p_w'$

$D_{max} = \underset{D_f}{\underline{\qquad}} + \underset{p_w'}{\underline{\qquad}} = \underset{D_{max}}{\underline{\qquad}}$ lbs

Maximum Vertical Foundation Pressure, S_y = _______ psf   per geotechnical analysis or table 1806.2

Maximum Axial Pressure on the soil, $s_y = D_{max} / A_f = \underset{D_{max}}{\underline{\qquad}} \div \underset{A_f}{\underline{\qquad}} = \underset{s_y}{\underline{\qquad}}$ psf

Actual to Allowable Soil Strength Ratio, $s_y / S_y = \underset{s_y}{\underline{\qquad}} \div \underset{S_y}{\underline{\qquad}} = \underline{\qquad} \leq 1.0$ is OK

s_y / S_y must be less than 1.0. If not, start over with a larger footing diameter, b