STRUCTURAL CALCULATIONS
100% CD

for

Chino Airport Fencing and Sign

7000 Merrill Ave
Chino, CA 91710

for

HMC Architects
3546 Concours Street
Ontario, CA 91764

by

MHP, Inc.
Structural Engineers
Long Beach, California

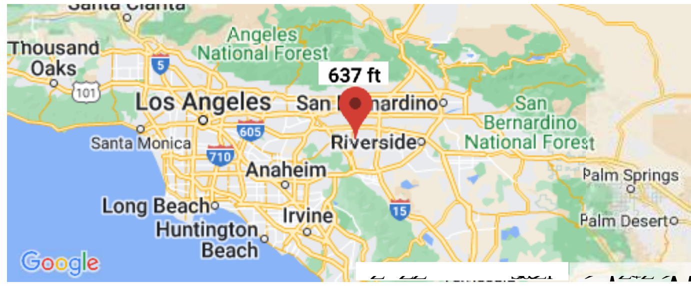
May 8, 2023
MHP JN: 23-0127-00

MHP
STRUCTURAL ENGINEERS

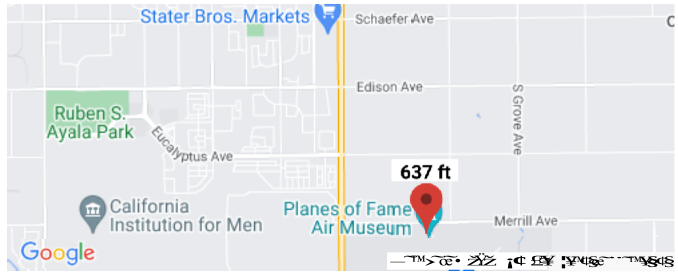
Table of Contents

Scope of Work

The project consists of a proposed perimeter fencing, and monument signature project at Chino Airport located in Chino, California. Project includes a new 9200-foot-long metal fencing along Euclid Ave. and Merrill Ave. and three 12'x16' monument signs.


Thousand Oaks
Angeles National Forest
637 ft
Los Angeles
San Bernardino
San Bernardino National Forest
Riverside
Santa Monica
Anaheim
Palm Springs
Long Beach
Irvine
Huntington Beach
Palm Desert
Google
5
101
605
710
15

1.3



Stater Bros. Markets
Schaefer Ave
Edison Ave
S Grove Ave
Ruben S. Ayala Park
Eucalyptus Ave
637 ft
California Institution for Men
Planes of Fame Air Museum
Merrill Ave
Google

SOLID FREESTANDING WALLS AND SIGNS

All references from ASCE 7-16 unless noted otherwise

Wall-Sign-Freestanding FENCE

Design Assumptions
Solid freestanding wall or sign is not attached to a building
Sign is not a double-faced wall

WIND DEMAND FOR FENCE AND SIGN

Building and Site Information

Structure Type = **Solid Freestanding Walls**

Building Risk Category = II

Horizontal dimension of sign, B = 8.0 ft
Vertical dimension of sign, s = 10.0 ft

B/s = 0.80
s/h = 1.00

A_s = 80 sq ft

Sign Height = 15.00 ft
B/2 = 4.0 ft
s/2 = 5.0 ft
h/2 = 5.0 ft
0.05h = 0.5 ft
Top of sign = 15.00 ft

Height of sign, h = 10.0 ft

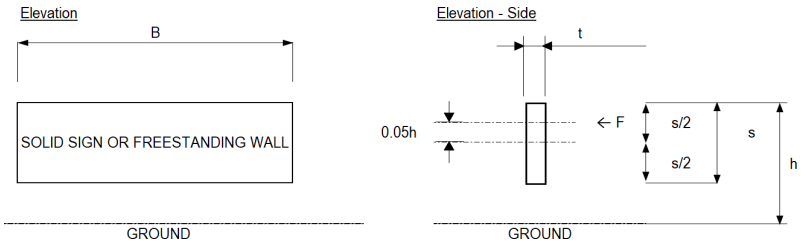
Thickness of sign, t = 0.2 ft

Sign classified as a solid sign. Openings comprise less than 30% of gross area.

Openings? No

Return Corner? No

Ground Elevation = 0 ft



Wind Load Parameters

Wind speed, V = 95 mph per ATC Hazards by Location Online Tool

Exposure category = C per §26.7 or AHJ

Wind directionality factor, K_d

Wind directionality factor, K_d = **0.85** calculated per §26.6, Tbl 26.6-1

Topographic factor, K_{zt}

Topographic factor, K_{zt} = 1.00 per §26.8.1, Fig 26.8-1

Ground elevation factor, K_e

Ground elevation factor, K_e = 1

Per Note 1 of Table 26.9-1, the conservation approximation Ke = 1.00 is permitted.

Gust-effect factor, G

Gust-effect factor, G or G_f = 0.85 calculated per §26.11.1

The gust-effect factor for a rigid building or other structure is permitted to be taken as 0.85.

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Sign Parameters

Opening Reduction Factor

Percent Open = 0%

ε = 100% calculated per §29.3.1, Fig 29.3-1, Footnote 2

Opening Reduction Factor = 1.00 calculated per §29.3.1, Fig 29.3-1, Footnote 2

Double-faced signs (not used in this spreadsheet)

R_{min} = 0.03

R_{max} = 0.03

s/h Reduction Factor for Case C

s/h = 1.00 > 0.8

s/h Reduction Factor = 0.80 calculated per §29.3.1, Fig 29.3-1, Footnote 4

Return corner reduction factor

L_r/s = 1.78

Return Corner Reduction Factor = 0.633 calculated per §29.3.1, Fig 29.3-1

Net force coefficient

$C_{f, A \text{ and } B}$ = 1.49 calculated per §29.3.1, Fig 29.3-1, Case A and Case B

$C_{f, C}$ = See further pages, calculated per §29.3.1, Fig 29.3-1, Case C

Velocity Pressure Exposure Coefficient and Velocity Pressure

$$q_z = 0.00256 K_z K_{zt} K_d K_e V^2$$ per §26.6, Tbl 26.6-1

Velocity Pressures at Height z Above Ground Level

z, Height above Ground Level (ft)	K_z or K_h	q_z or q_h
60		
50		
40		
30		
25		
20		
15	15 ft	0.85	17 psf

q_h = 17 psf at top of sign

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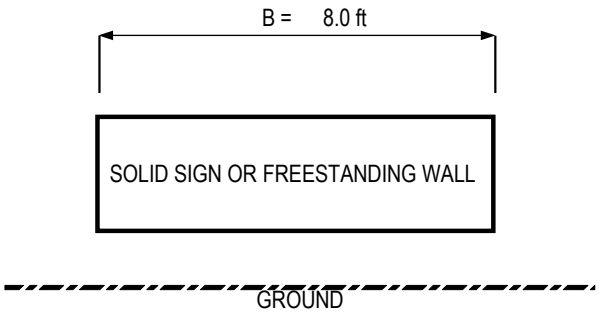
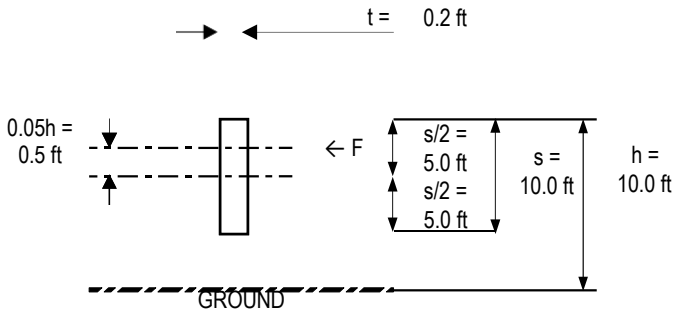
Normal and Oblique Wind Directions

Elevation



Elevation - Side



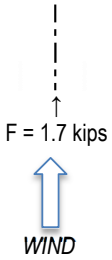
$F = q_h G C_f A_c$ = **1.7 kips** or **21.1 psf**

Case A

Resultant force acts normal to the face of the sign at geometric center of the sign

F = **1.7 kips** applied at 4.0 ft from either the left or right corner of the sign
and 5.5 ft from the bottom of the sign

Plan



LOAD CASE A WIND PRESSURE ON SIGN
21.1 psf
OVER ENTIRE SIGN

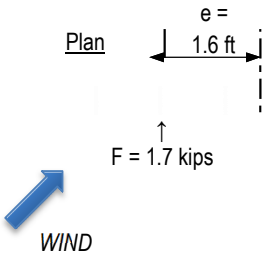
Case B

Resultant force acts normal to the face of the sign at a distance from the geometric center toward the windward edge equal to 0.2 times the average width of the sign

e = 0.2B = **1.6 ft**

F = **1.7 kips** applied at 2.4 ft from either the left or right corner of the sign
and 5.5 ft from the bottom of the sign
this is a 1.6 ft eccentricty from plan center of the sign

Plan



LOAD CASE B WIND PRESSURE ON SIGN
21.1 psf
OVER ENTIRE SIGN

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Case C

Resultant forces act normal to the face of the sign through the geometric centers of each region.

$$F = q_h G C_f A_c$$

Plan

s

2.6 kips
or
25.5 psf
@
-

-2.6 psf	-1.7 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf
-25.5 psf	-17.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf	0.0 psf
1	2	3	4	5	6	7	8	9	10	11

The Minimum Design Wind Pressure of 16 psf has been applied to this calculation, per §27.1.5.

Case C governs for Fence and Sign wind demand

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SOLID FREESTANDING WALLS AND SIGNS

All references from ASCE 7-16 unless noted otherwise

Wall-Sign-Freestanding Flagpole

WIND DEMAND FOR FLAG POLE

Design Assumptions
Solid freestanding wall or sign is not attached to a building
Sign is not a double-faced wall

Building and Site Information

Structure Type = **Solid Freestanding Walls**

Building Risk Category = II

Horizontal dimension of sign, B = 8.0 ft
Vertical dimension of sign, s = 5.0 ft

B/s = 1.60
s/h = 0.17

A_s = 40 sq ft

Sign Height = 30.00 ft
B/2 = 4.0 ft
s/2 = 2.5 ft
h/2 = 15.0 ft
0.05h = 0.0 ft
Top of sign = 30.00 ft

Height of sign, h = 30.0 ft

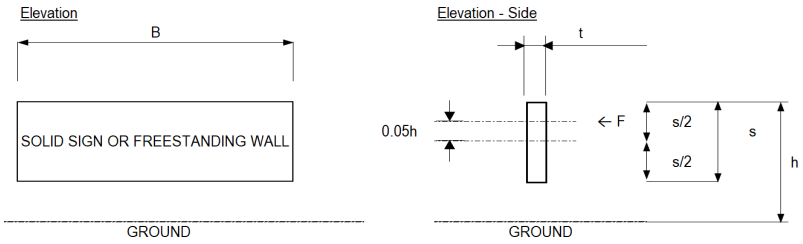
Thickness of sign, t = 0.1 ft

Sign classified as a solid sign. Openings comprise less than 30% of gross area.

Openings? No

Return Corner? No

Ground Elevation = 0 ft



Wind Load Parameters

Wind speed, V = 95 mph per ATC Hazards by Location Online Tool

Exposure category = C per §26.7 or AHJ

Wind directionality factor, K_d

Wind directionality factor, K_d = **0.85** calculated per §26.6, Tbl 26.6-1

Topographic factor, K_{zt}

Topographic factor, K_{zt} = 1.00 per §26.8.1, Fig 26.8-1

Ground elevation factor, K_e

Ground elevation factor, K_e = 1

Per Note 1 of Table 26.9-1, the conservation approximation Ke = 1.00 is permitted.

Gust-effect factor, G

Gust-effect factor, G or G_f = 0.85 calculated per §26.11.1

The gust-effect factor for a rigid building or other structure is permitted to be taken as 0.85.

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Sign Parameters

Opening Reduction Factor

Percent Open = 0%

ε = 100% calculated per §29.3.1, Fig 29.3-1, Footnote 2

Opening Reduction Factor = 1.00 calculated per §29.3.1, Fig 29.3-1, Footnote 2

Double-faced signs (not used in this spreadsheet)

R_{min} = 0.01

R_{max} = 0.01

s/h Reduction Factor for Case C

s/h = 0.17 ≤ 0.8

s/h Reduction Factor = 1.00 calculated per §29.3.1, Fig 29.3-1, Footnote 4

Return corner reduction factor

L_r/s = 3.56

Return Corner Reduction Factor = 0.600 calculated per §29.3.1, Fig 29.3-1

Net force coefficient

$C_{f,\ A\ and\ B}$ = 1.80 calculated per §29.3.1, Fig 29.3-1, Case A and Case B

$C_{f,\ C}$ = See further pages, calculated per §29.3.1, Fig 29.3-1, Case C

Velocity Pressure Exposure Coefficient and Velocity Pressure

$$q_z = 0.00256 K_z K_{zt} K_d K_e V^2$$ per §26.6, Tbl 26.6-1

Velocity Pressures at Height z Above Ground Level

	z, Height above Ground Level (ft)	K_z or K_h	q_z or q_h
60			
50			
40			
30	30 ft	0.98	19 psf
25	25 ft	0.95	19 psf
20	20 ft	0.90	18 psf
15	15 ft	0.85	17 psf

q_h = 19 psf at top of sign

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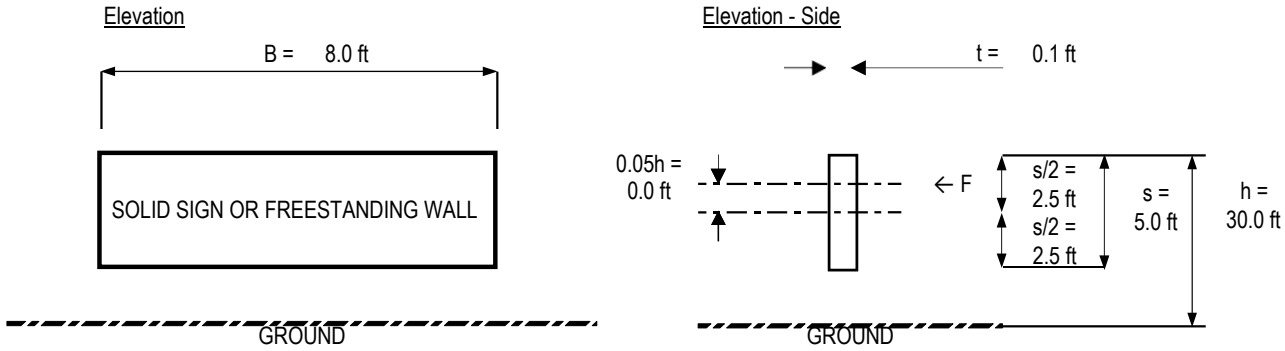
Normal and Oblique Wind Directions



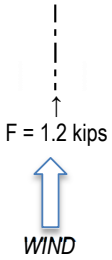
$F = q_h G C_f A_c$ = **1.2 kips** or **29.5 psf**

Case A

Resultant force acts normal to the face of the sign at geometric center of the sign

F = **1.2 kips** applied at 4.0 ft from either the left or right corner of the sign
and 2.5 ft from the bottom of the sign

Plan



LOAD CASE A WIND PRESSURE ON SIGN
29.5 psf
OVER ENTIRE SIGN

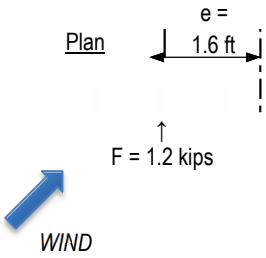
Case B

Resultant force acts normal to the face of the sign at a distance from the geometric center toward the windward edge equal to 0.2 times the average width of the sign

e = 0.2B = **1.6 ft**

F = **1.2 kips** applied at 2.4 ft from either the left or right corner of the sign
and 2.5 ft from the bottom of the sign
this is a 1.6 ft eccentricty from plan center of the sign

Plan



LOAD CASE B WIND PRESSURE ON SIGN
29.5 psf
OVER ENTIRE SIGN

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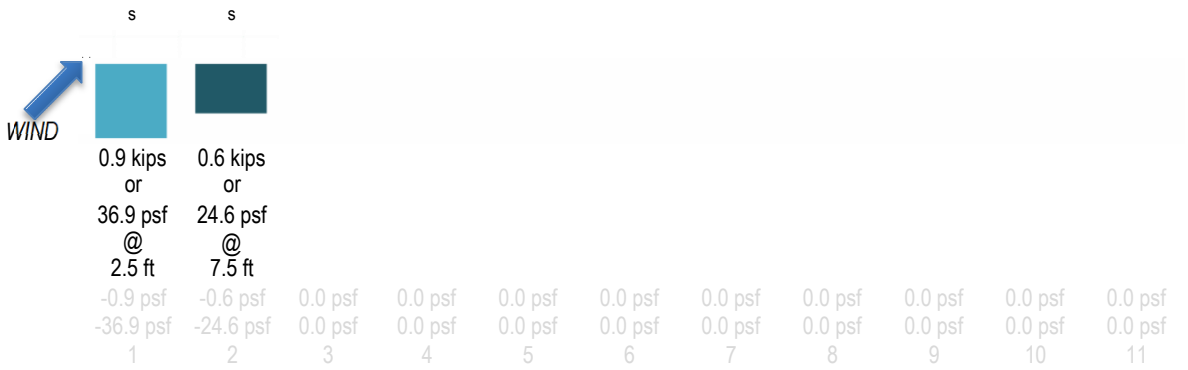
Case C

Resultant forces act normal to the face of the sign through the geometric centers of each region.

$$F = q_h G C_f A_c$$

Plan



The Minimum Design Wind Pressure of 16 psf has been applied to this calculation, per §27.1.5.

Case C governs for flag pole wind demand

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SEISMIC FACTORS FOR EQUIPMENT ANCHORAGE

Site: Chino Airport

Floor(Level): Ground

Equipment: Freestanding Sign

Seismic Design Force Factors:

a_p*	R_p*	Ω_o	I_p	z	h	S_{DS}**
amp factor	response mod factor	Omega (overstrength) Factor	importance factor	height of attach point	average roof height	design parameter at short periods
2.5	3	2	1.0	0	1	1.348

* ASCE 7-16, Table 13.5-1, 13.6-1

**See seismic coefficients on US Seismic Design Maps output

Seismic Design Force for Equipment Anchorage

$$F_p = \frac{0.4 a_p S_{DS} W_p}{R_p / I_p}\left(1 + 2\frac{z}{h}\right) = 0.45\ W_p$$ (ASCE 7-16, Equation 13.3-1)

$F_p(\max) = 1.6 S_{DS} I_p W_p =$ 2.16 W_p (ASCE 7-16, Equation 13.3-2)

$F_p(\min) = 0.3 S_{DS} I_p W_p =$ 0.40 W_p (ASCE 7-16, Equation 13.3-3)

Seismic Design Force

	LRFD	ASD (0.7 x LRFD)
$F_{p(H)}$ =	0.45 W_p	0.31 W_p
$F_{p(V)}$ = .2S_{DS}	0.27 W_p	0.19 W_p

(ASCE 7-16, Section 13.3.1.2)

Overstrength Forces (Anchorage into Concrete (LRFD))

	LRFD	ASD (0.7 x LRFD)
Ω_o*$F_{p(H)}$=	0.90 W_p	0.63 W_p

*No overstrength required for $F_{p(V)}$

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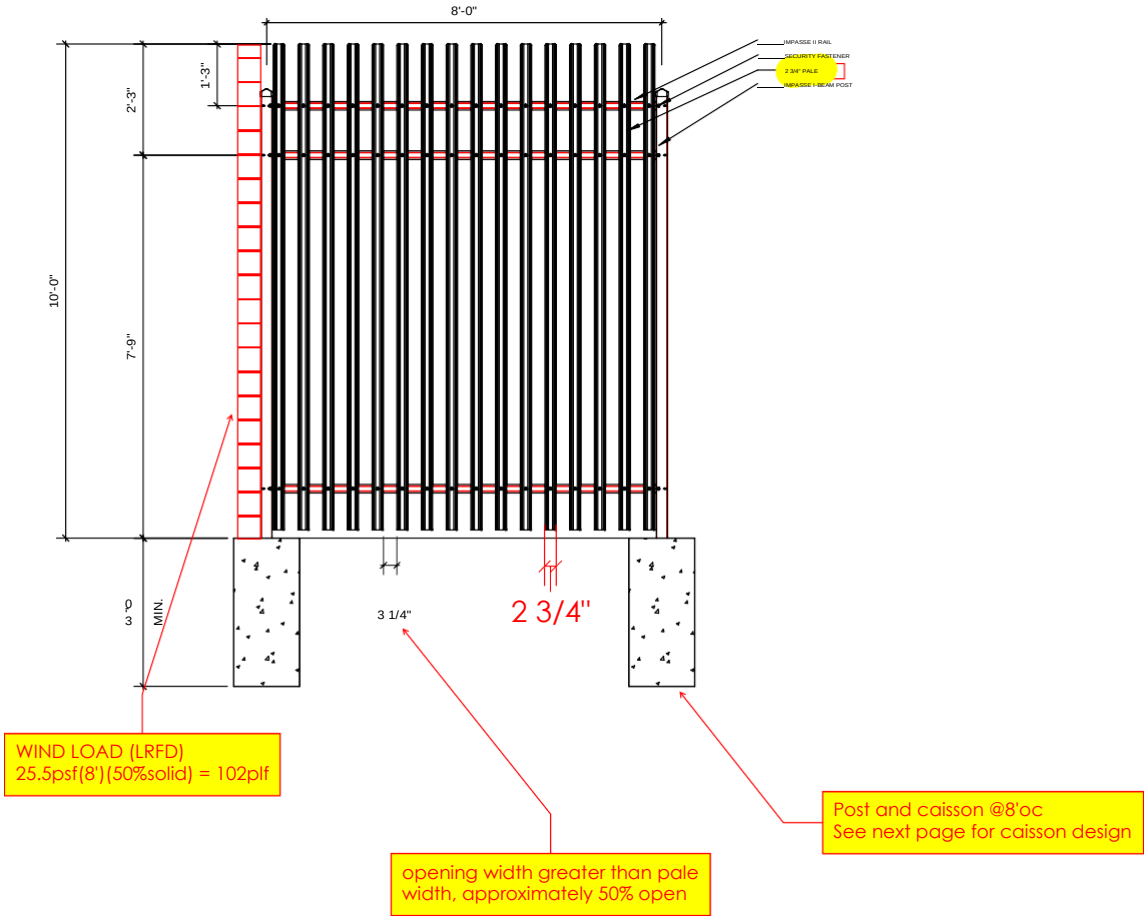
MHP STRUCTURAL ENGINEERS

SUBJECT: Typical Fence

DATE: 05/05/2023 JOB NO: 23-0127

BY: KH SHEET: 2.1



Pole Footing Embedded in Soil

Project File: Fence footing.ec6

DESCRIPTION: Fence Footing

Code References

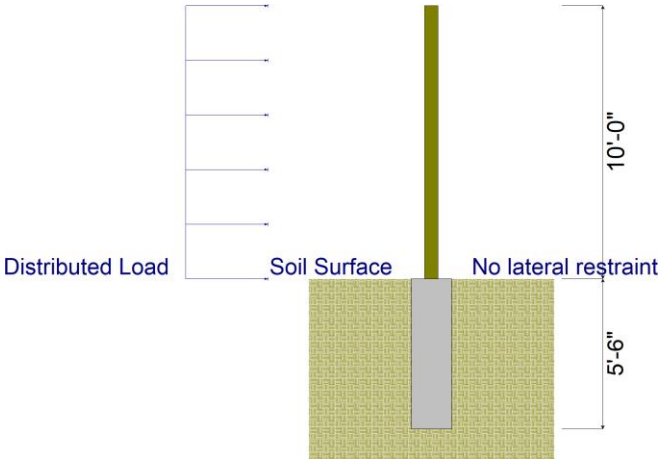
Calculations per IBC 2021 1807.3, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	18.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	200.0 pcf
Max Passive	1,500.0 psf

Controlling Values

Governing Load Combination	+0.60W
Lateral Load	0.6120 k
Moment	3.060 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	**357.467** psf
Allowable	**358.504** psf
Minimum Required Depth	**5.50 ft**
Footing Base Area	1.767 ft^2
Maximum Soil Pressure	0.0 ksf

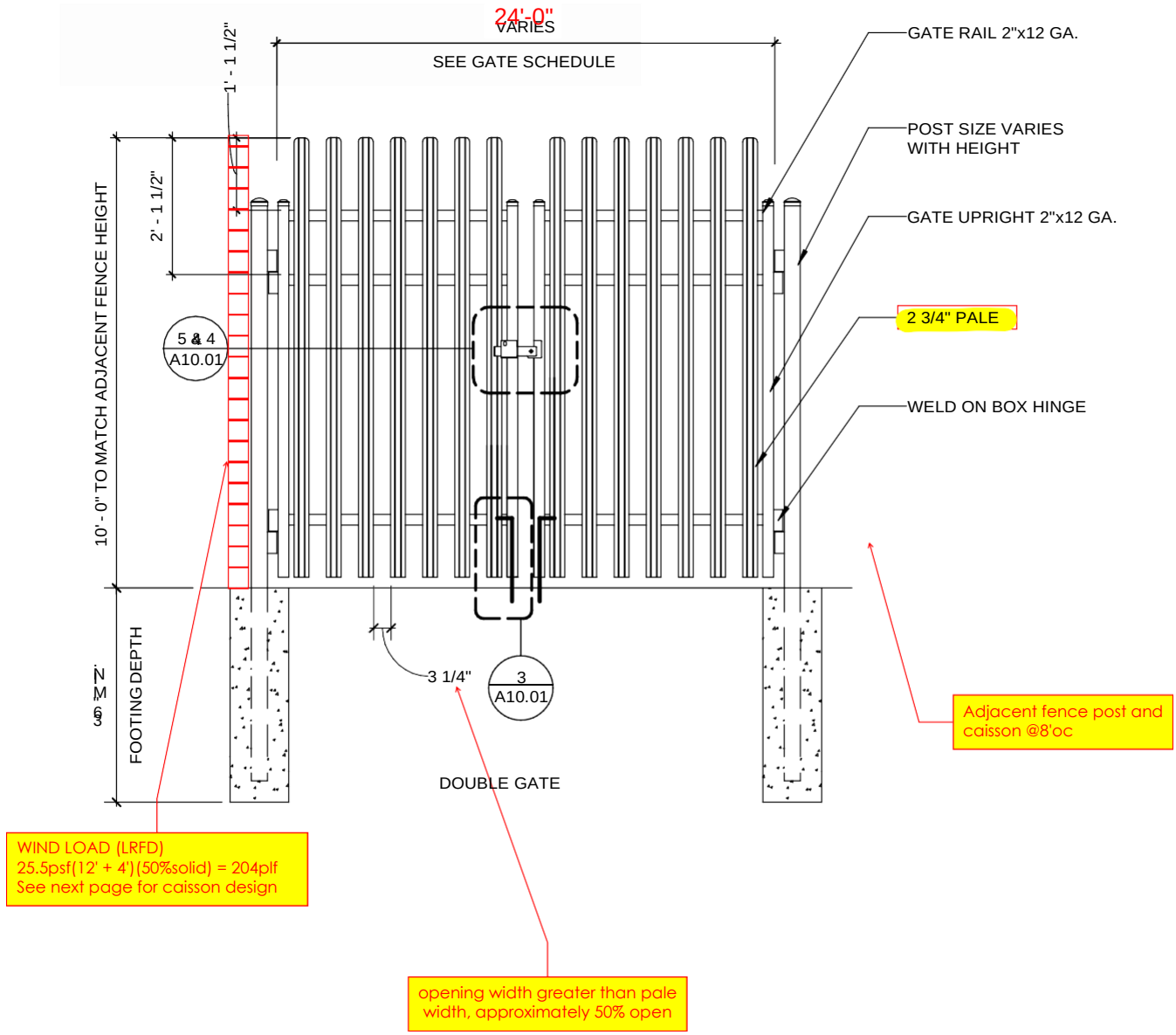


Applied Loads

	Lateral Concentrated Load (k)		Lateral Distributed Loads (k		Vertical Load (k)
D : Dead Load	k		k/ft		k
Lr : Roof Live	k		k/ft		k
L : Live	k		k/ft		k
S : Snow	k		k/ft		k
W : Wind	k	0.1020	k/ft		k
E : Earthquake	k		k/ft		k
H : Lateral Earth	k		k/ft		k
Load distance above ground surface	ft	TOP of Load above ground surface 10.0	ft		
		BOTTOM of Load above ground surface	ft		

Load Combination Results

Load Combination	Forces @ Ground Surface Loads - (k)	Moments - (ft-k)	Required Depth - (ft)	Pressure at 1/3 Depth Actual - (psf)	Allow - (psf)	Soil Increase Factor
	0.000	0.000	0.13	0.0	0.0	1.000
+0.60W	0.612	3.060	5.50	357.5	358.5	1.000
+0.450W	0.459	2.295	4.88	318.5	320.0	1.000


24'-0"
VARIES
SEE GATE SCHEDULE
1' - 1 1/2"
2' - 1 1/2"
10' - 0" TO MATCH ADJACENT FENCE HEIGHT
FOOTING DEPTH
5 & 4
A10.01
3 1/4"
3
A10.01
DOUBLE GATE
GATE RAIL 2"x12 GA.
POST SIZE VARIES WITH HEIGHT
GATE UPRIGHT 2"x12 GA.
2 3/4" PALE
WELD ON BOX HINGE
Adjacent fence post and caisson @8'oc
WIND LOAD (LRFD)
25.5psf(12' + 4')(50%solid) = 204plf
See next page for caisson design
opening width greater than pale width, approximately 50% open

Pole Footing Embedded in Soil

Project File: Fence footing.ec6

DESCRIPTION: Double Gate Footing

Code References

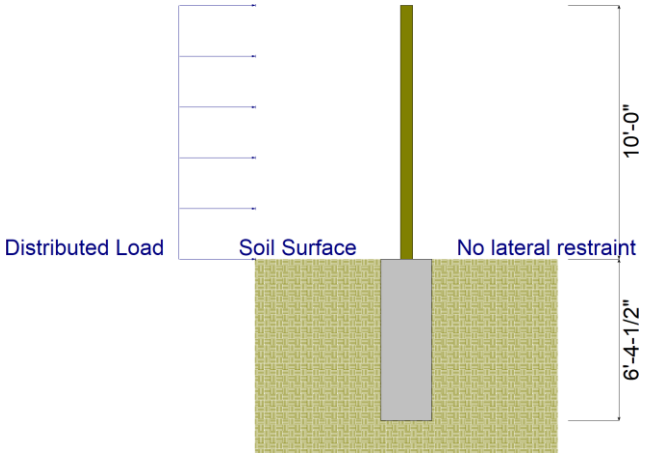
Calculations per IBC 2021 1807.3, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	24.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	200.0 pcf
Max Passive	1,500.0 psf

Controlling Values

Governing Load Combination	+0.60W
Lateral Load	1.224 k
Moment	6.120 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	**421.344** psf
Allowable	**421.780** psf
Minimum Required Depth	**6.375 ft**
Footing Base Area	3.142 ft^2
Maximum Soil Pressure	0.0 ksf

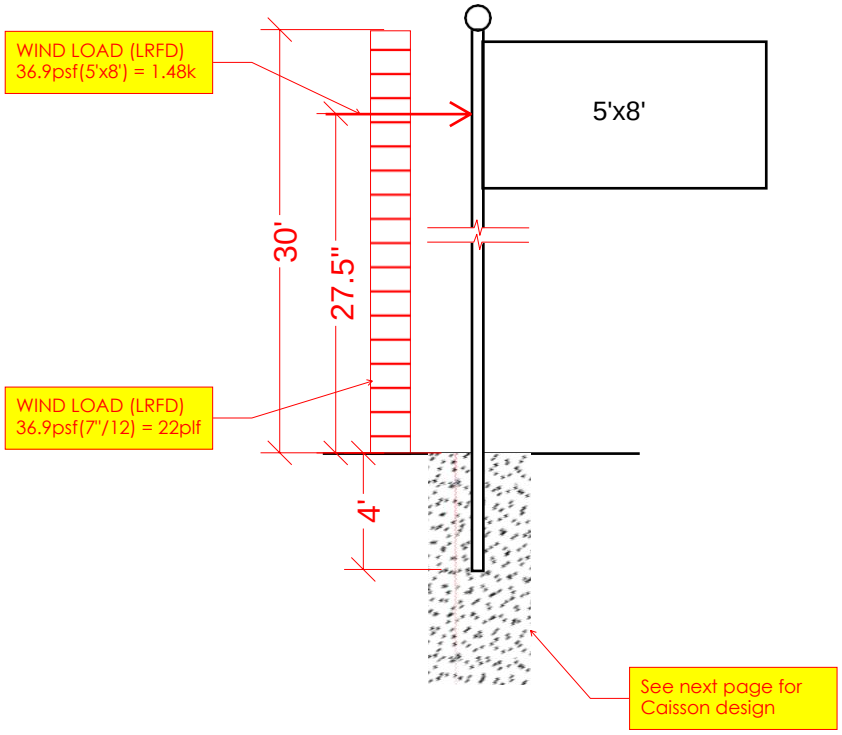


Applied Loads

	Lateral Concentrated Load (k)	Lateral Distributed Loads (k		Vertical Load (k)
D : Dead Load	k		k/ft	k
Lr : Roof Live	k		k/ft	k
L : Live	k		k/ft	k
S : Snow	k		k/ft	k
W : Wind	k	0.2040	k/ft	k
E : Earthquake	k		k/ft	k
H : Lateral Earth	k		k/ft	k
Load distance above ground surface	ft	TOP of Load above ground surface 10.0	ft	
		BOTTOM of Load above ground surface	ft	

Load Combination Results

Load Combination	Forces @ Ground Surface Loads - (k)	Moments - (ft-k)	Required Depth - (ft)	Pressure at 1/3 Depth Actual - (psf)	Allow - (psf)	Soil Increase Factor
	0.000	0.000	0.13	0.0	0.0	1.000
+0.60W	1.224	6.120	6.38	421.3	421.8	1.000
+0.450W	0.918	4.590	5.75	375.2	375.5	1.000

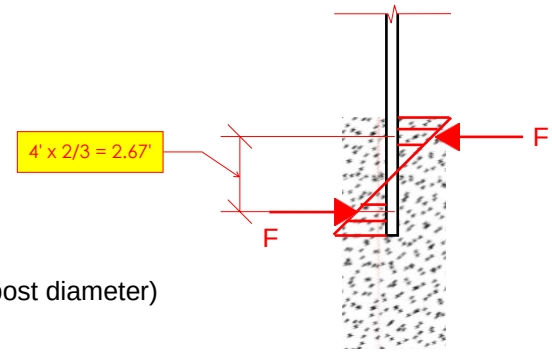


Pole Embedment:

M = 22plf x 32' x 32'/2 + 1.48k x 29.5' = 54.9k-ft (LRFD)

F = 54.9k-ft / 2.67' = 20,597 lb

V = 22plf*(32') + 1480lb = 2184 lb



Bearing Pressure due to moment:

B*L/2 = F

B = F*2/L = 20,597# *2/ (24")

B = 1716 #/in (LRFD)

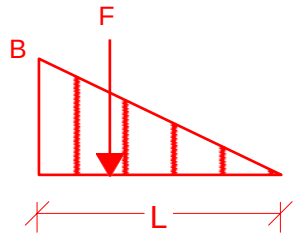
B = 1716 #/in / (7in *2/3) = 368 psi (assume bearing width = 2/3*post diameter)

Bearing Pressure due to shear:

B = V/L

B = 2184lb / 24" = 91 #/in

B = 91 #/in / (7in *2/3) = 20psi



Combined Bearing Pressure:

B = 368psi + 20 psi = 388psi

Bearing Capacity:

ϕ(0.85f'c) = 0.65* 0.85*(3,000psi) = 1657psi (LRFD)

1657psi > 388psi

4' embedment OK

Pole Footing Embedded in Soil

Project File: Fence footing.ec6

DESCRIPTION: Flag Pole Footing

Code References

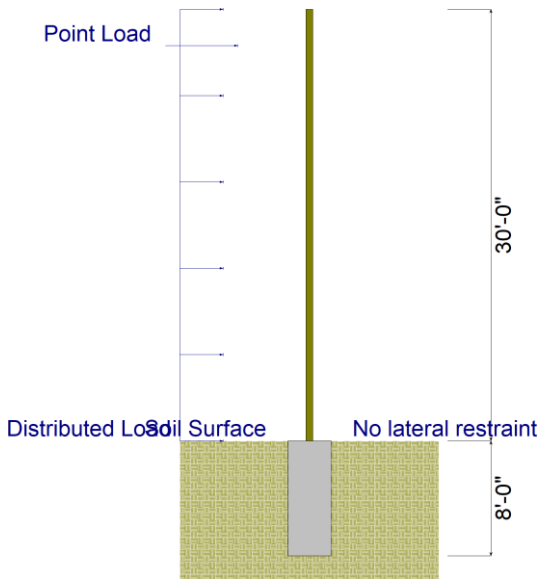
Calculations per IBC 2021 1807.3, ASCE 7-16
Load Combinations Used : IBC 2021

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	200.0 pcf
Max Passive	1,500.0 psf

Controlling Values

Governing Load Combination	+0.60W
Lateral Load	1.284 k
Moment	30.360 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	**530.98** psf
Allowable	**531.92** psf
Minimum Required Depth	**8.0 ft**
Footing Base Area	7.069 ft^2
Maximum Soil Pressure	0.0 ksf

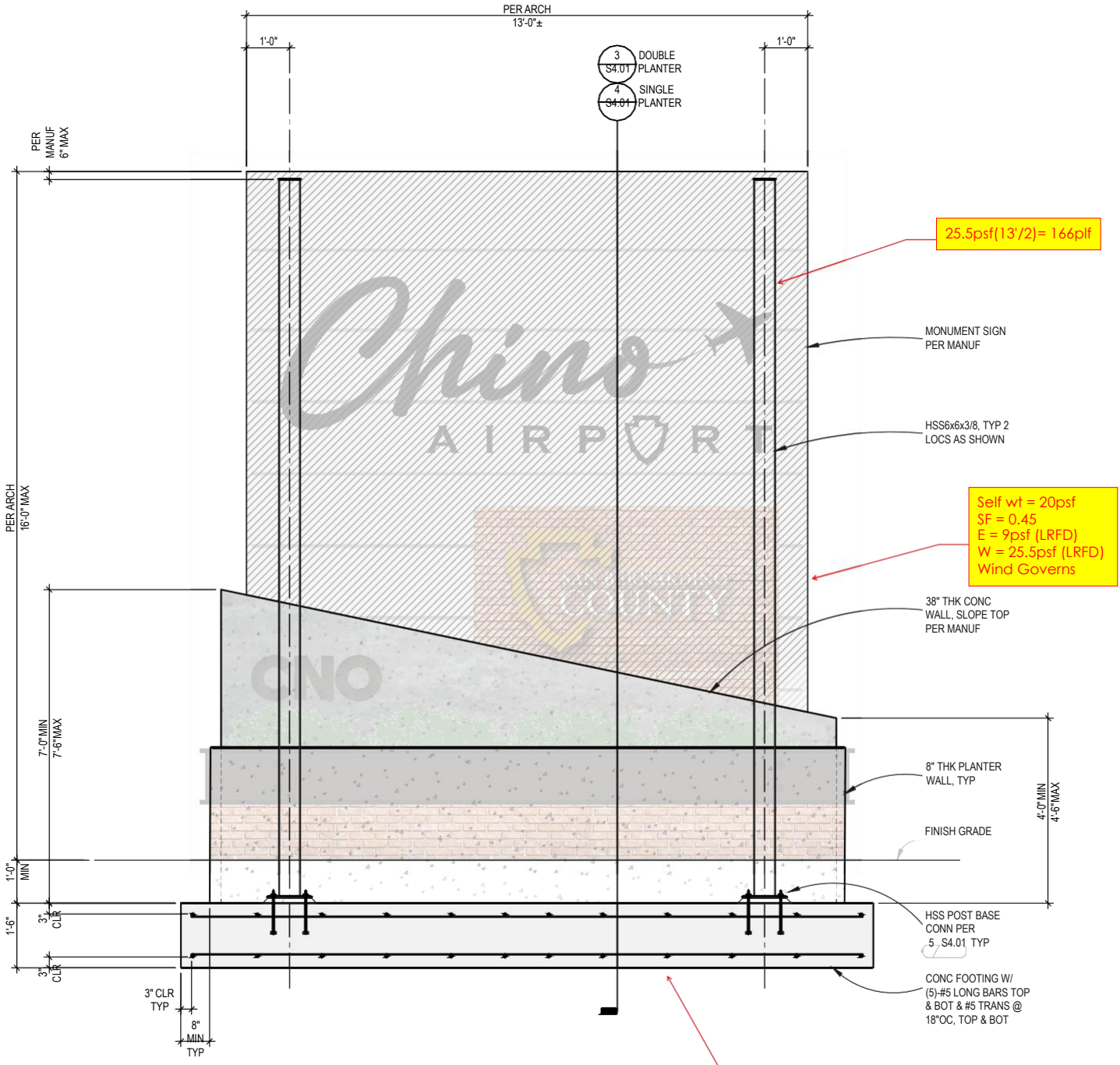


Applied Loads

	Lateral Concentrated Load (k)	Lateral Distributed Loads (k		Vertical Load (k)
D : Dead Load	k		k/ft	k
Lr : Roof Live	k		k/ft	k
L : Live	k		k/ft	k
S : Snow	k		k/ft	k
W : Wind	1.480 k	0.0220	k/ft	k
E : Earthquake	k		k/ft	k
H : Lateral Earth	k		k/ft	k
Load distance above ground surface	27.50 ft	TOP of Load above ground surface 30.0	ft	
		BOTTOM of Load above ground surface	ft	

Load Combination Results

Load Combination	Forces @ Ground Surface Loads - (k)	Moments - (ft-k)	Required Depth - (ft)	Pressure at 1/3 Depth Actual - (psf)	Allow - (psf)	Soil Increase Factor
	0.000	0.000	0.13	0.0	0.0	1.000
+0.60W	1.284	30.360	8.00	531.0	531.9	1.000
+0.450W	0.963	22.770	7.25	478.6	479.6	1.000



MONUMENT SIGN ELEVATION

SCALE: 1/2" = 1'-0"

A S4.01

Monument Sign Post Embedment:
M = 22.6 kft per Enercalc (LRFD)
F = 22.6k-ft / 2.67' = 8464lb
V = 166plf (17'-4.2') = 2125 lb

Bearing Pressure due to moment:
B*L/2 = F
B = F*2/L = 8464lb *2/ (24")
B = 705 lb/in (LRFD)
B = 705 lb/in / 4.3 in = 164 psi (bearing width as post workable flat)

Bearing Pressure due to shear:
B = V/L
B = 2125lb / 24" = 89 lb/in
B = 89 lb/in / 4.3 in = 21 psi

Combined Bearing Pressure:
B = 164psi + 21 psi = 185psi

Bearing Capacity:
ϕ(0.85f'c) = 0.65* 0.85*(3,000psi) = 1657psi (LRFD)
1657psi > 185psi OK

Steel Column

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Supporting Post

Code References

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

General Information

Steel Section Name : **HSS6x6x3/8**

Analysis Method :	Load Resistance Factor
Steel Stress Grade	, A500, Grade C, Fy = 50 ksi, Carbon Steel
Fy : Steel Yield	50.0 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height 17.0 ft
Top & Bottom Fixity Top Free, Bottom Fixed
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 17.0 ft, K = 2.1
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 17.0 ft, K = 2.1

Applied Loads

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

Column self weight included : 467.160 lbs * Dead Load Factor
AXIAL LOADS . . .
Sign Self Wt: Axial Load at 17.0 ft, D = 2.10 k
BENDING LOADS . . .
Wind from Sign: Lat. Uniform Load from 4.20-->17.0 ft creating Mx-x, W = 0.1660 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.4119** : 1

Load Combination	+1.20D+W
Location of max.above base	0.0 ft
At maximum location values are . . .	
Pu	3.081 k
0.9 * Pn	48.504 k
Mu-x	-22.523 k-ft
0.9 * Mn-x :	59.250 k-ft
Mu-y	0.0 k-ft
0.9 * Mn-y :	59.250 k-ft

PASS Maximum Shear Stress Rati **0.0** : 1

Load Combination	0.0
Location of max.above base	0.0 ft
At maximum location values are . . .	
Vu : Applied	0.0 k
Vn * Phi : Allowable	0.0 k

Maximum Load Reactions . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	0.0 k
Bottom along Y-Y	2.125 k

Maximum Load Deflections . . .

Along Y-Y 1.532 in at 17.0 ft above base
for load combination : +D+0.60W

Along X-X 0.0 in at 0.0 ft above base
for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Ry	KyLy/Rx	Maximum Shear Ratios: Stress Ratio	Status	Location
+1.40D	0.074	PASS	0.00 ft	2.25	1.00	187.89	187.89	0.000	PASS	0.00 ft
+1.20D	0.064	PASS	0.00 ft	2.25	1.00	187.89	187.89	0.000	PASS	0.00 ft
+1.20D+0.50W	0.222	PASS	0.00 ft	2.25	1.00	187.89	187.89	0.000	PASS	0.00 ft
+1.20D+W	0.412	PASS	0.00 ft	2.25	1.00	187.89	187.89	0.000	PASS	0.00 ft
+0.90D+W	0.404	PASS	0.00 ft	2.25	1.00	187.89	187.89	0.000	PASS	0.00 ft
+0.90D	0.048	PASS	0.00 ft	2.25	1.00	187.89	187.89	0.000	PASS	0.00 ft

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 k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
D Only	2.567								
+D+0.60W	2.567			1.275		-13.514			
+D+0.450W	2.567			0.956		-10.135			
+0.60D+0.60W	1.540			1.275		-13.514			
+0.60D	1.540								
W Only				2.125		-22.523			

Steel Column

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Supporting Post

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	@ Top	**k** Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments **k-ft** @ Base	@ Top	My - End Moments @ Base	@ Top
Axial @ Base	Maximum	2.567								
"	Minimum				2.125		-22.523			
Reaction, X-X Axis Base	Maximum	2.567								
"	Minimum	2.567								
Reaction, Y-Y Axis Base	Maximum				2.125		-22.523			
"	Minimum	2.567								
Reaction, X-X Axis Top	Maximum	2.567								
"	Minimum	2.567								
Reaction, Y-Y Axis Top	Maximum	2.567								
"	Minimum	2.567								
Moment, X-X Axis Base	Maximum	2.567								
"	Minimum		-22.523		2.125		-22.523			
Moment, Y-Y Axis Base	Maximum	2.567								
"	Minimum	2.567								
Moment, X-X Axis Top	Maximum	2.567								
"	Minimum	2.567								
Moment, Y-Y Axis Top	Maximum	2.567								
"	Minimum	2.567								

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+0.60W	0.0000 in	0.000 ft	1.532 in	17.000 ft
+D+0.450W	0.0000 in	0.000 ft	1.149 in	17.000 ft
+0.60D+0.60W	0.0000 in	0.000 ft	1.532 in	17.000 ft
+0.60D	0.0000 in	0.000 ft	0.000 in	0.000 ft

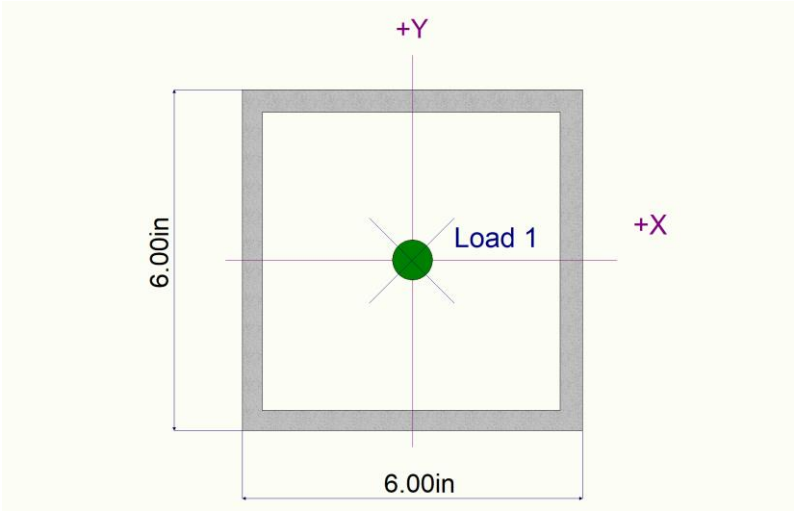
Steel Section Properties : HSS6x6x3/8

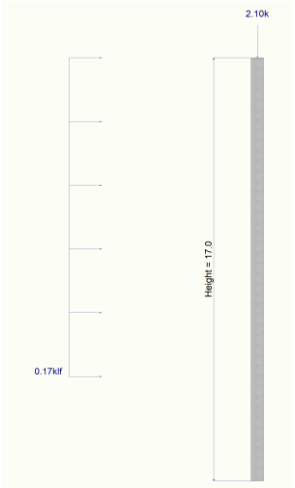
Depth	=	6.000 in	I xx	=	39.50 in^4	J	=	64.600 in^4
Design Thick	=	0.349 in	S xx	=	13.20 in^3			
Width	=	6.000 in	R xx	=	2.280 in			
Wall Thick	=	0.375 in	Zx	=	15.800 in^3			
Area	=	7.580 in^2	I yy	=	39.500 in^4	C	=	22.100 in^3
Weight	=	27.480 plf	S yy	=	13.200 in^3			
			R yy	=	2.280 in			
Ycg	=	0.000 in						

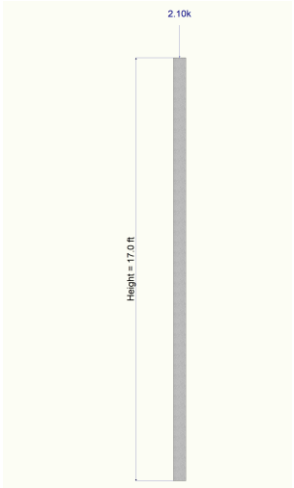
Steel Column

DESCRIPTION: Monument Sign Supporting Post

Sketches







Wall Footing

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Footing (planter wall both side)

Code References

Calculations per ACI 318-19, IBC 2021, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	150.0 pcf
M Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00090
Min. Overturning Safety Factor	=	1.10 : 1
Min. Sliding Safety Factor	=	1.10 : 1
AutoCalc Footing Weight as DL :		Yes

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	100.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

Increases based on footing Depth

Reference Depth below Surface	=	2.50 ft
Allow. Pressure Increase per foot of depth	=	ksf
when base footing is below	=	ft

Increases based on footing Width

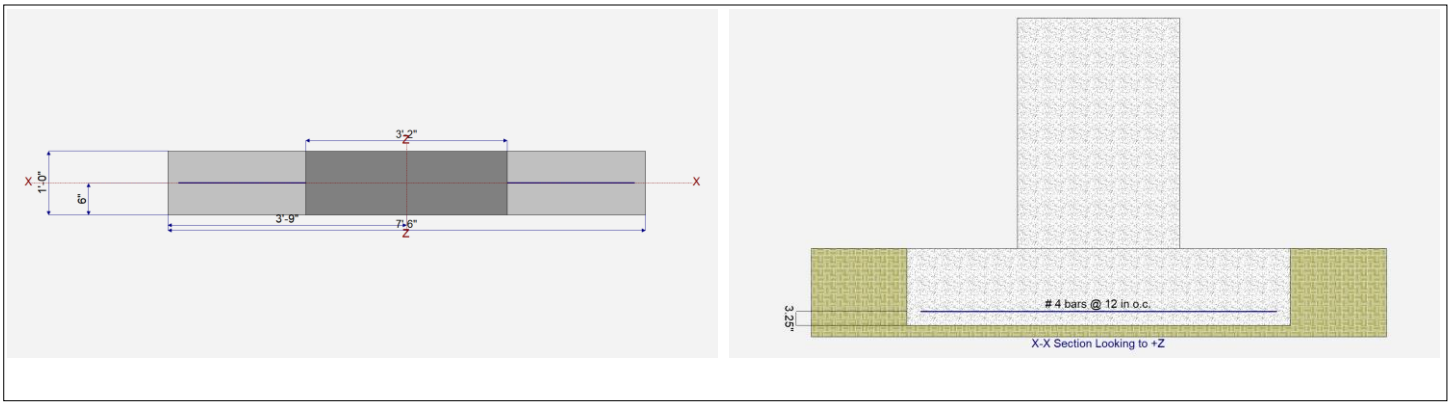
Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft

Adjusted Allowable Bearing Pressure = 2.0 ksf

Dimensions

Footing Width	=	7.50 ft	Footing Thickness	=	18.0 in	Bars along X-X Axis	
Wall Thickness	=	38.0 in	Rebar Centerline to Edge of Concrete...			Bar spacing	= 12.00
Wall center offset from center of footing	=	0 in	at Bottom of footing	=	3.250 in	Reinforcing Bar Size	= # 4

Reinforcing



Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	3.752							k
OB : Overburden	=								ksf
V-x	=								k
M-zz	=					3.70			k-ft
Vx applied	=	in above top of footing							

Wall Footing

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Footing (planter wall both side)

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	5.513	Overturning - Z-Z	2.220 k-ft	12.239 k-ft	+0.60D+0.60W
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.4810	Soil Bearing	0.9619 ksf	2.0 ksf	+D+0.60W
PASS	0.2131	Z Flexure (+X)	2.791 k-ft	13.099 k-ft	+1.20D+W
PASS	0.1170	Z Flexure (-X)	1.532 k-ft	13.099 k-ft	+0.90D
PASS	0.06284	1-way Shear (+X)	5.163 psi	82.158 psi	+1.40D
PASS	0.06284	1-way Shear (-X)	5.163 psi	82.158 psi	+1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio
, D Only	2.0 ksf	0.0 in	0.7253 ksf	0.7253 ksf	0.363
, +D+0.60W	2.0 ksf	4.898 in	0.4886 ksf	0.9619 ksf	0.481
, +D+0.450W	2.0 ksf	3.673 in	0.5478 ksf	0.9027 ksf	0.451
, +0.60D+0.60W	2.0 ksf	8.163 in	0.1985 ksf	0.6718 ksf	0.336
, +0.60D	2.0 ksf	0.0 in	0.4352 ksf	0.4352 ksf	0.218

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
, D Only	None	0.0 k-ft	Infinity	OK
, +D+0.60W	2.220 k-ft	20.398 k-ft	9.188	OK
, +D+0.450W	1.665 k-ft	20.398 k-ft	12.251	OK
, +0.60D+0.60W	2.220 k-ft	12.239 k-ft	5.513	OK
, +0.60D	None	0.0 k-ft	Infinity	OK

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Tension @ Bot. Side ?	or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
, +1.40D	2.383	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.40D	2.383	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D	2.043	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D	2.043	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D+0.50W	1.669	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D+0.50W	2.417	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D+W	1.295	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D+W	2.791	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +0.90D+W	0.7842	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +0.90D+W	2.28	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +0.90D	1.532	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +0.90D	1.532	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK

One Way Shear

Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	5.163 psi	5.163 psi	5.163 psi	82.158 psi	0.06284	OK
+1.20D	4.425 psi	4.425 psi	4.425 psi	82.158 psi	0.05386	OK
+1.20D+0.50W	4.425 psi	4.425 psi	4.425 psi	82.158 psi	0.05386	OK
+1.20D+W	4.425 psi	4.425 psi	4.425 psi	82.158 psi	0.05386	OK
+0.90D+W	3.319 psi	3.319 psi	3.319 psi	82.158 psi	0.0404	OK
+0.90D	3.319 psi	3.319 psi	3.319 psi	82.158 psi	0.0404	OK

Wall Footing

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Footing (planter wall one side)

Code References

Calculations per ACI 318-19, IBC 2021, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	150.0 pcf
M Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00090
Min. Overturning Safety Factor	=	1.10 : 1
Min. Sliding Safety Factor	=	1.10 : 1
AutoCalc Footing Weight as DL :		Yes

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	100.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

Increases based on footing Depth

Reference Depth below Surface	=	2.50 ft
Allow. Pressure Increase per foot of depth	=	ksf
when base footing is below	=	ft

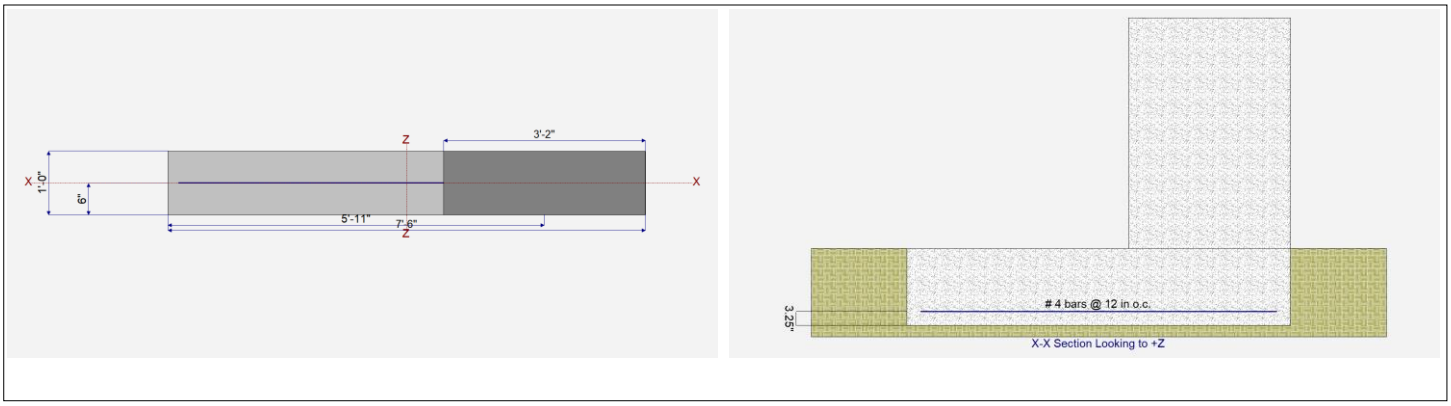
Increases based on footing Width

Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft
Adjusted Allowable Bearing Pressure	=	2.0 ksf

Dimensions

Footing Width	=	7.50 ft	Footing Thickness	=	18.0 in	Bars along X-X Axis	
Wall Thickness	=	38.0 in	Rebar Centerline to Edge of Concrete...			Bar spacing	= 12.00
Wall center offset from center of footing	=	26 in	at Bottom of footing	=	3.250 in	Reinforcing Bar Size	= # 4

Reinforcing



Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	3.752							k
OB : Overburden	=	0.0							ksf
V-x	=								k
M-zz	=					3.70			k-ft
Vx applied	=	in above top of footing							

Wall Footing

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Footing (planter wall one side)

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	3.316	Overturning - Z-Z	2.220 k-ft	7.361 k-ft	+0.60D+0.60W
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9810	Soil Bearing	1.962 ksf	2.0 ksf	+D+0.60W
PASS	0.0	Z Flexure (+X)	0.0 k-ft	0.0 k-ft	No Moment
PASS	0.1269	Z Flexure (-X)	1.663 k-ft	13.099 k-ft	+0.90D
PASS	n/a	1-way Shear (+X)	0.0 psi	82.158 psi	n/a
PASS	0.2199	1-way Shear (-X)	18.070 psi	82.158 psi	+1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio
, D Only	2.0 ksf	17.934 in	0.0 ksf	1.607 ksf	0.804
, +D+0.60W	2.0 ksf	22.832 in	0.0 ksf	1.962 ksf	0.981
, +D+0.450W	2.0 ksf	21.607 in	0.0 ksf	1.859 ksf	0.930
, +0.60D+0.60W	2.0 ksf	26.097 in	0.0 ksf	1.380 ksf	0.690
, +0.60D	2.0 ksf	17.934 in	0.0 ksf	0.9643 ksf	0.482

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
, D Only	None	12.269 k-ft	Infinity	OK
, +D+0.60W	2.220 k-ft	12.269 k-ft	5.526	OK
, +D+0.450W	1.665 k-ft	12.269 k-ft	7.369	OK
, +0.60D+0.60W	2.220 k-ft	7.361 k-ft	3.316	OK
, +0.60D	None	7.361 k-ft	Infinity	OK

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
, +1.40D	2.586	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.40D	0	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D	2.217	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D	0	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D+0.50W	1.292	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D+0.50W	0	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D+W	0.5809	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +1.20D+W	0	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +0.90D+W	0.1907	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +0.90D+W	0	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +0.90D	1.663	-X	Bottom	0.1944	Min Temp %	0.2	13.099	OK
, +0.90D	0	+X	Bottom	0.1944	Min Temp %	0.2	13.099	OK

One Way Shear

Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	18.07 psi	0 psi	18.07 ps	82.158 psi	0.2199	OK
+1.20D	15.489 psi	0 psi	15.489 ps	82.158 psi	0.1885	OK
+1.20D+0.50W	15.489 psi	0 psi	15.489 ps	82.158 psi	0.1885	OK
+1.20D+W	15.489 psi	0 psi	15.489 ps	82.158 psi	0.1885	OK
+0.90D+W	11.617 psi	0 psi	11.617 ps	82.158 psi	0.1414	OK
+0.90D	11.617 psi	0 psi	11.617 ps	82.158 psi	0.1414	OK

Concrete Slender Wall

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Wall

Code References

Calculations per ACI 318-19 Sec 11.8, IBC 2021, ASCE 7-16
Load Combinations Used : IBC 2021

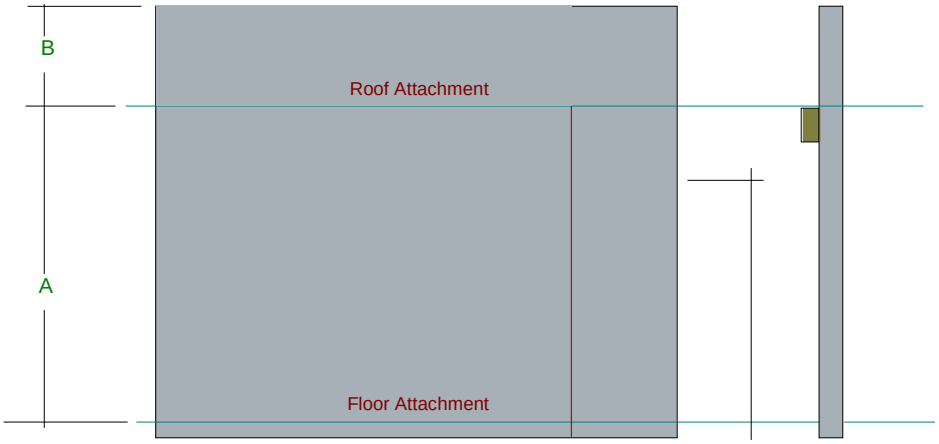
General Information

f'c : Concrete 28 day streng	=	3.0 ksi	Wall Thickness		38 in	Temp Diff across thickness	=	deg F
Fy : Rebar Yield	=	60.0 ksi	Rebar at each face			Min Allow Out-of-Plane Defl Ratio	=	0.0
Ec : Concrete Elastic Modu	=	3,122.02 ksi	Rebar "d" distance		36.0 in			/2 for Cantilever
Z : Lt Wt Conc Fact	=	1.0	Lower Level Rebar . . .			Min allow As/bd	=	0.0020
Fr : Rupture Modulus	=	410.792 psi	Bar Size	#	5	Using Stiff. Reduction Factor per ACI 318-14		
Max Allow As/bd	=	0.01355	Bar Spacing		10 in			Section 11.8.3
Max Pu/Ag = f'c *	=	0.060						
Concrete Density	=	150 pcf						
Width of Design Strip	=	12.0 in						

One-Story Wall Dimensions

A Clear Height = 6.5 ft
B Parapet height = ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :
Full area WIND load 25.5 psf

Seismic Loads :
Wall Weight Seismic Load Input Method : ASCE seismic factors entered

SDS Value per ASCE 12.11.1 S_{DS} * I = 1.348

Fp = Wall Wt. * 0.5392 = 256.120 psf

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Rat	0.08907		
	+1.20D+E	Max Mu	-5.411 k-ft	Phi * Mn	60.747 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	#####	Allowable Defl. Ratio	150.0
	E Only	Max. Deflection	0.000751 in		/2 for Cantilever
PASS	Axial Load Check	Max Pu / Ag	0.6319 psi	Max. Allow. Defl.	1.040 in
	+1.20D+E	Location	0.1083 ft	0.06 * f'c	180.0 psi
PASS	Reinforcing Limit Check				
	OK per ACI 318 Section 22.2	Actual As/bd	0.000861	Max Allow As/bd	0.01355

Maximum Reactions *for Load Combination...*

Top Horizontal		0.0 k
Base Horizontal	E Only	1.665 k
Vertical Reaction	+D+0.60W	3.088 k

Concrete Slender Wall

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Wall

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.06*f'c*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 0.22	0.000	82.080	98.86	0.27	0.90	60.75	0.372	0.0009	0.0135	36.00
+1.20D+W at 0.00 to 0.22	0.000	82.080	98.86	0.54	0.90	60.75	0.372	0.0009	0.0135	36.00
+1.20D+E at 0.00 to 0.22	0.000	82.080	98.86	5.41	0.90	60.75	0.372	0.0009	0.0135	36.00
+0.90D+W at 0.00 to 0.22	0.000	82.080	98.86	0.54	0.90	60.75	0.372	0.0009	0.0135	36.00
+0.90D+E at 0.00 to 0.22	0.000	82.080	98.86	5.41	0.90	60.75	0.372	0.0009	0.0135	36.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+0.60W at 6.28 to 6.50	0.000	98.86	0.00	54,872.00	3,935.25	####.###	0.000	######.#
+D+0.70E at 6.28 to 6.50	0.000	98.86	0.00	54,872.00	3,935.25	####.###	0.001	296587.8
+D+0.450W at 6.28 to 6.50	0.000	98.86	0.00	54,872.00	3,935.25	####.###	0.000	######.#
+D+0.5250E at 6.28 to 6.50	0.000	98.86	0.00	54,872.00	3,935.25	####.###	0.000	395450.4
+0.60D+0.60W at 6.28 to 6.50	0.000	98.86	0.00	54,872.00	3,935.25	####.###	0.000	######.#
+0.60D+0.70E at 6.28 to 6.50	0.000	98.86	0.00	54,872.00	3,935.25	####.###	0.001	296589.8
W Only at 6.28 to 6.50	0.000	98.86	0.00	54,872.00	3,935.25	####.###	0.000	######.#
E Only at 6.28 to 6.50	0.000	98.86	0.00	54,872.00	3,935.25	####.###	0.001	207614.9

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	3.087 k
+D+0.60W	0.1 k	0.00 k	3.088 k
+D+0.70E	1.2 k	0.00 k	3.087 k
+D+0.450W	0.1 k	0.00 k	3.088 k
+D+0.5250E	0.9 k	0.00 k	3.087 k
+0.60D+0.60W	0.1 k	0.00 k	1.853 k
+0.60D+0.70E	1.2 k	0.00 k	1.853 k
W Only	0.2 k	0.00 k	0.000 k
E Only	1.7 k	0.00 k	0.000 k

Concrete Slender Wall

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Planter Wall

Code References

Calculations per ACI 318-19 Sec 11.8, IBC 2021, ASCE 7-16
Load Combinations Used : IBC 2021

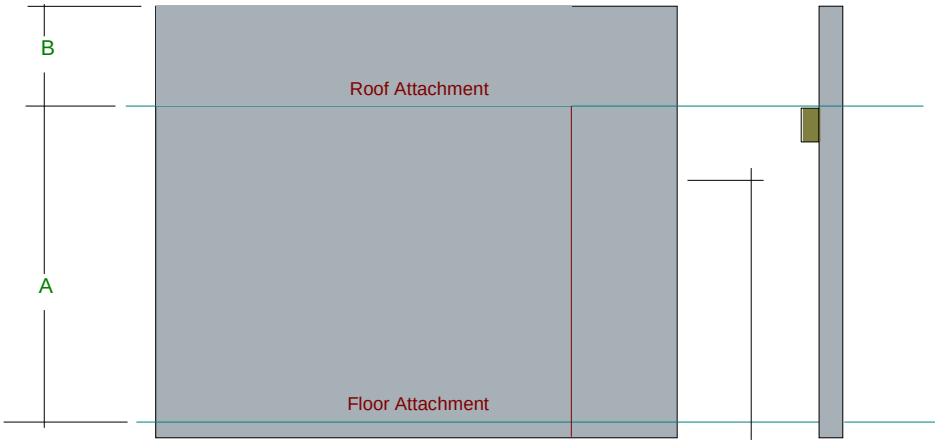
General Information

f'c : Concrete 28 day streng	=	3.0 ksi	Wall Thickness		8.0 in	Temp Diff across thickness	=	deg F
Fy : Rebar Yield	=	60.0 ksi	Rebar at wall center			Min Allow Out-of-Plane Defl Ratio	=	0.0
Ec : Concrete Elastic Modu	=	3,122.02 ksi	Rebar "d" distance		4.0 in			/2 for Cantilever
Z : Lt Wt Conc Fact	=	1.0	Lower Level Rebar . . .			Min allow As/bd	=	0.0020
Fr : Rupture Modulus	=	410.792 psi	Bar Size	#	5	Using Stiff. Reduction Factor per ACI 318-14		
Max Allow As/bd	=	0.01355	Bar Spacing		18.0 in			Section 11.8.3
Max Pu/Ag = f'c *	=	0.060						
Concrete Density	=	150.0 pcf						
Width of Design Strip	=	12.0 in						

One-Story Wall Dimensions

A Clear Height = 4.0 ft
B Parapet height = ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :
Full area WIND load 25.50 psf

Seismic Loads :
Wall Weight Seismic Load Input Method : ASCE seismic factors entered

SDS Value per ASCE 12.11.1 S_{DS} * I = 1.348
Fp = Wall Wt. * 0.5392 = 53.920 psf

	D	Lr	L	E	W	Height	*(Applied to full "STRIP Width")*
Point Lateral Load			0.20		k	4.0 ft	

Concrete Slender Wall

Project File: Fence footing.ec6

DESCRIPTION: Monument Sign Planter Wall

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .	Allowable Values . . .
PASS	Moment Capacity Check +1.20D+1.60L	Maximum Bending Stress Rat **0.3625** Max Mu -1.280 k-ft	Phi * Mn 3.532 k-ft
PASS	Service Deflection Check +D+L	Actual Defl. Ratio L/ 16009 Max. Deflection 0.005997 in	Allowable Defl. Ratio 150.0 /2 for Cantilever
PASS	Axial Load Check +1.20D+1.60L	Max Pu / Ag 0.3889 psi Location 0.06667 ft	Max. Allow. Defl. 0.640 in 0.06 * f'c 180.0 psi
PASS	Reinforcing Limit Check OK per ACI 318 Section 22.2	Actual As/bd 0.004306	Max Allow As/bd 0.01355

Maximum Reactions *for Load Combination...*

Top Horizontal		0.0 k
Base Horizontal	+D+0.750L+0.5250E	0.2632 k
Vertical Reaction	+D+L	0.40 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Axial Load 0.06*f'c*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+1.60L at 0.00 to 0.13	0.000	17.280	4.38	1.28	0.90	3.53	0.207	0.0043	0.0135	4.00
+1.20D+0.50L at 0.00 to 0.13	0.000	17.280	4.38	0.40	0.90	3.53	0.207	0.0043	0.0135	4.00
+1.20D+0.50W at 0.00 to 0.13	0.000	17.280	4.38	0.10	0.90	3.53	0.207	0.0043	0.0135	4.00
+1.20D+0.50L+W at 0.00 to 0.13	0.000	17.280	4.38	0.60	0.90	3.53	0.207	0.0043	0.0135	4.00
+1.20D+0.50L+E at 0.00 to 0.13	0.000	17.280	4.38	0.83	0.90	3.53	0.207	0.0043	0.0135	4.00
+0.90D+W at 0.00 to 0.13	0.000	17.280	4.38	0.20	0.90	3.53	0.207	0.0043	0.0135	4.00
+0.90D+E at 0.00 to 0.13	0.000	17.280	4.38	0.43	0.90	3.53	0.207	0.0043	0.0135	4.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+L at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.006	16,008.8
+D+0.750L at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.004	21,345.0
+D+0.60W at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.001	139140.1
+D+0.70E at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.002	56,402.2
+D+0.750L+0.450W at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.005	19,142.6
+D+0.750L+0.5250E at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.006	16,626.0
+0.60D+0.60W at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.001	139145.2
+0.60D+0.70E at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.002	56,404.3
L Only at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.006	16,010.2
W Only at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.001	83,491.7
E Only at 3.87 to 4.00	0.000	4.38	0.00	512.00	22.90	384.000	0.002	39,485.2

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	0.400 k
+D+L	0.2 k	0.00 k	0.400 k
+D+0.750L	0.1 k	0.00 k	0.400 k
+D+0.60W	0.1 k	0.00 k	0.400 k

Concrete Slender Wall

DESCRIPTION: Monument Sign Planter Wall

+D+0.70E	0.2 k	0.00 k	0.400 k
+D+0.750L+0.450W	0.2 k	0.00 k	0.400 k
+D+0.750L+0.5250E	0.3 k	0.00 k	0.400 k
+0.60D+0.60W	0.1 k	0.00 k	0.240 k
+0.60D+0.70E	0.2 k	0.00 k	0.240 k
L Only	0.2 k	0.00 k	0.000 k
W Only	0.1 k	0.00 k	0.000 k
E Only	0.2 k	0.00 k	0.000 k

SEISMIC FACTORS FOR EQUIPMENT ANCHORAGE

Site: Chino Airport

Floor (Level): Ground

Equipment: Electrical Panel

Seismic Design Force Factors:

a_p*	R_p*	fi_o	I_p	z	h	S_{DS}**
amp factor	response mod factor	Omega (overstrength) Factor	importance factor	height of attach point	average roof height	design parameter at short periods
2.5	6	2	1.0	0	1	1.348

* ASCE 7-16, Table 13.5-1, 13.6-1

**See seismic coefficients on US Seismic Design Maps output

Seismic Design Force for Equipment Anchorage

$$F_p = \frac{0.4 a_p S_{DS} W_p}{R_p / I_p}\left(1 + 2\frac{z}{h}\right) =$$ 0.22 W_p (ASCE 7-16, Equation 13.3-1)

$$F_p(\max) = 1.6 S_{DS} I_p W_p =$$ 2.16 W_p (ASCE 7-16, Equation 13.3-2)

$$F_p(\min) = 0.3 S_{DS} I_p W_p =$$ 0.40 W_p (ASCE 7-16, Equation 13.3-3)

Seismic Design Force

	LRFD	ASD (0.7 x LRFD)
$F_{p(H)}$ =	**0.40 W_p**	**0.28 W_p**
$F_{p(V)} = .2S_{DS}$	**0.27 W_p**	**0.19 W_p**

(ASCE 7-16, Section 13.3.1.2)

Overstrength Forces (Anchorage into Concrete (LRFD))

	LRFD	ASD (0.7 x LRFD)
$fi_o * F_{p(H)}$ =	**0.81 W_p**	**0.57 W_p**

*No overstrength required for $F_{p(V)}$

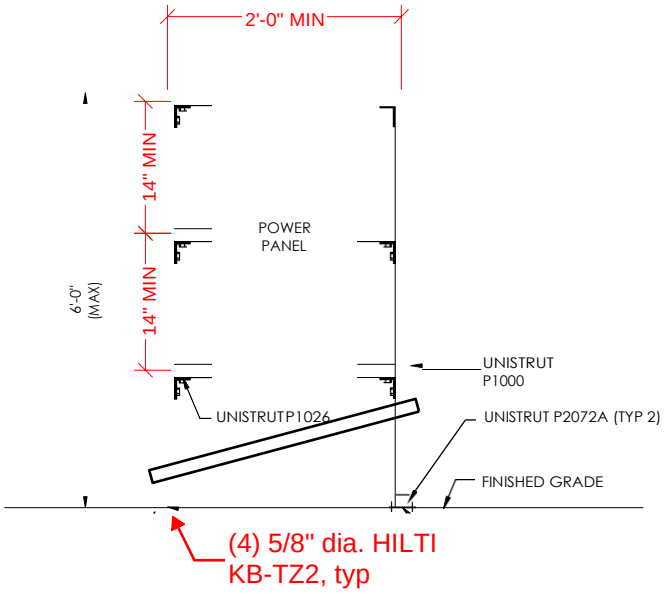
Electrical Panel Frame

Wp = 50#

Seismic Loads:
Fph = 0.81*Wp = 0.81*50# = 41# (LRFD w/ Ω)
Fpv = 0.27*Wp = 0.27*50# = 14# (LRFD)

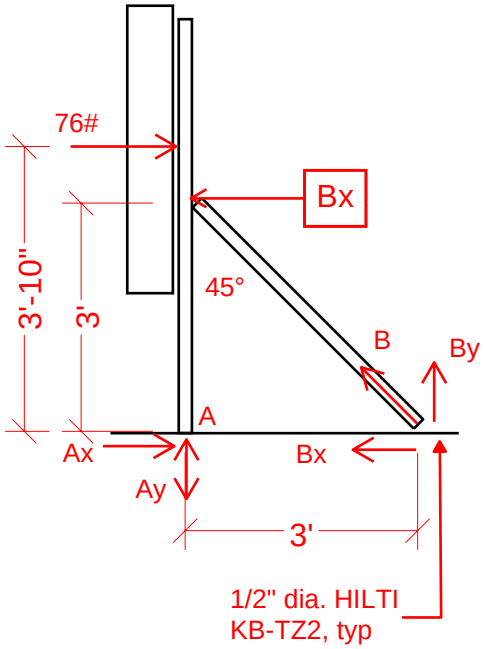
Wind Loads:
25.5psf x 15.25" x 28" / 144 = 76# (LRFD)

***Wind Governs**



Anchorage:
$\Sigma M_A = 0 = 76\#*(3.83') - Bx(3')$
Bx = 97# / 2 braces = 49#
Ax = 76# - 97# = -21 / 2 posts = 11#
Ay = By = 49#
(4) 5/8" dia. HILTI KB-TZ2 (3 1/4" embed) at vert P1000
OK by inspection

1/2" dia. HILTI KB-TZ2 (2" embed) at brace
By = 49#
Bx = 49#
OK by inspection



Brace Check:
Fbrace,x = 49# per brace (LRFD)
Fbrace = √(49^2 + 49^2) = 69# (LRFD)
Fbrace = 0.6*69# = 41# (ASD)
Lbrace = √(36^2 + 36^2) = 60in

Unistrut P1000:
r = 0.577in
KL/r = 1.0*60in/0.577in = 104 < 200 OK
Pall = 2,380# > 69# OK