



STRUCTURAL CALCULATIONS

Olive Bowl Kaku Park

Site Structures

150 N. Mirage Avenue

Lindsay, CA

Prepared for:

MIG

109 W. Union Ave.

Fullerton, CA 92832

Prepared by:

Innovative Structural Engineering, Inc.

27369 Via Industria

Temecula, CA 92590



February 13, 2023

ISE Project # 21-6937



STRUCTURAL DESIGN CRITERIA

Project: Olive Bowl Kaku Park

Engineer of Record (SEOR): Shawn Lothrop, SE

Project Manager: Tony Serna, SE

Engineer: Hunter Burseth

General

Governing Building Code(s):

2019 California Building Code, ASCE 7-16

Building Risk Category:

I

(CBC Table 1604.5)

Project Description:

Pole Footings, Fencepost Footings & Monument Sign Footing

Seismic Design Criteria

(ASCE 7-16, Chapter 11 & 12)

Site Factors:

Spectral acceleration for short period buildings (S_s):	0.535	g
Spectral acceleration for 1-sec period buildings (S_1):	0.214	g
Soil Site Class:	D	
Seismic Importance Factor: (I_E)	1.00	



STRUCTURAL DESIGN CRITERIA

Wind Design Criteria

(ASCE 7-16, Chapter 26)

Design Wind Speed:	89	mph	(ASCE 26.5)
Special Wind Region	No	Source: ASCE 7 Hazard Tool	
Surface Roughness Category:	C		(ASCE 26.7.2)
Exposure Category:	C		(ASCE 26.7.3)
Enclosure Classification	Open		(ASCE 26.10)

Design procedure for Main Wind Force Resisting System (MWFRS):	Directional Procedure, Ch. 27
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Design procedure for Component & Cladding Wind Loads (C&C):	Component & Cladding, Ch. 30
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Geotechnical Design Criteria & Foundation Type

Geotechnical Report:

Prepared by:	BSK Associates
Report Number:	G21-320-11F
Date:	October 25, 2021

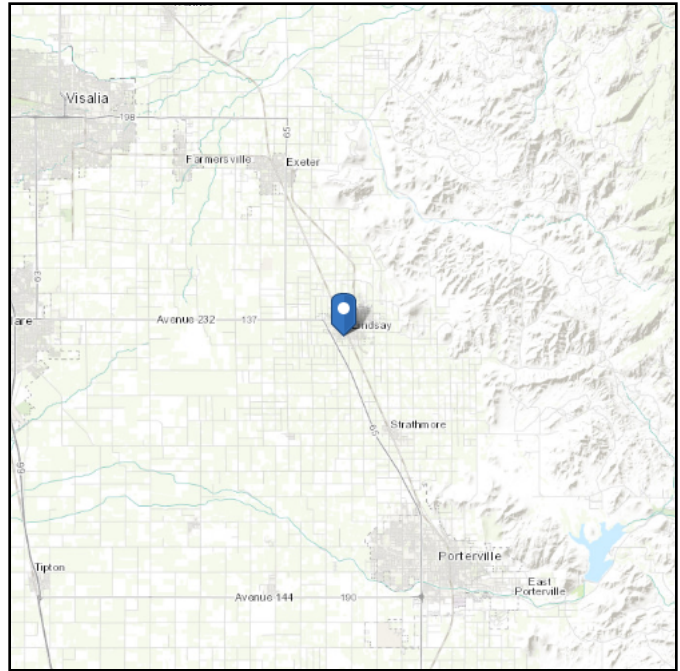
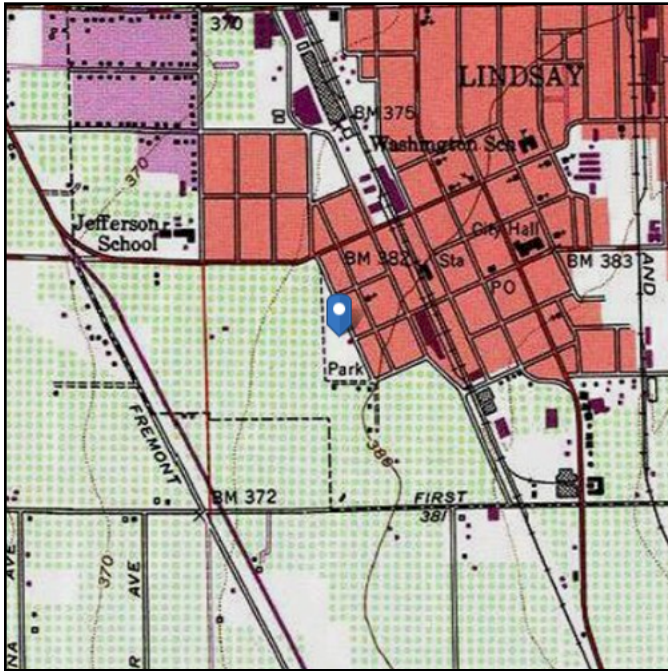
Allowable Soil Bearing Pressure:	N/A	psf
Allowable Passive Pressure:	300	psf / ft

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: I
Soil Class: D - Stiff Soil

Elevation: 380.74 ft (NAVD 88)
Latitude: 36.200953
Longitude: -119.09525



Wind

Results:

Wind Speed:	89 Vmph
10-year MRI	66 Vmph
25-year MRI	72 Vmph
50-year MRI	76 Vmph
100-year MRI	81 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1A and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Fri Nov 12 2021

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 15% probability of exceedance in 50 years (annual exceedance probability = 0.00333, MRI = 300 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

Site Soil Class: D - Stiff Soil

Results:

S_s :	0.535	S_{D1} :	N/A
S_1 :	0.214	T_L :	12
F_a :	1.372	PGA :	0.232
F_v :	N/A	PGA _M :	0.317
S_{MS} :	0.734	F_{PGA} :	1.368
S_{M1} :	N/A	I_e :	1
S_{DS} :	0.489	C_v :	1.057

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

Data Accessed: Fri Nov 12 2021

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

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SECURITY CAMERA POLE FOOTING

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Security Camera Pole

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	24.00 ft	
Pole Size =	5.00 in.	
Additional height from base of footing =	0.50 ft	
Weight of Structure, W_p =	300 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.22 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	1.43	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W =$	0.49	W	(12.8-1)
Design Weight of Light Pole =	300	lbs	
Base Shear at bottom of pole, V =	0.147	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	16	ft.	

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Security Camera

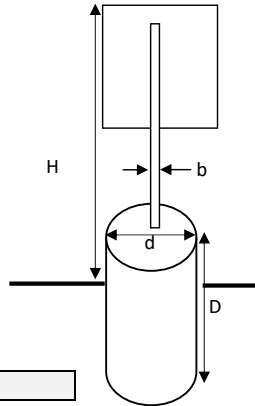
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S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
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Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Fixture, z =	24.00 ft	
Additional height from base of footing =	0.50 ft	
Weight of Structure, W_p =	100 lbs	Assumed Weight of Camera & Power Supply
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.22 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
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$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	1.43	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W =$	0.49	W	(12.8-1)
Design Weight of Light Pole =	100	lbs	
Base Shear at bottom of pole, V =	0.049	kips	15.4.1
Seismic Load Height Acting at Top =	24	ft.	
Moment at Base =	1.17	kip-ft	

ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

Risk Category Factor	=	I
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust -effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	0.85
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	52.8



ASCE Table 1.5-1
 ASCE Hazard Tool
 ASCE Hazard Tool
 ASCE 26.7.2
 ASCE 26.7.3
 ASCE 26.9.5

ASCE Table 26.10-1
 ASCE Table 26.6-1
 Table 26.9-1
 ASCE (26.8.2)
 Figures 29.4-1 through 29.4-4

Velocity Pressure: $q_n = .00256 K_z K_{zt} K_d K_e V^2$	=	16.37 (psf)
Elevation of applied load from ground level	=	11 ft.
Total Height of Pole From Base Plate	H =	22 ft.

ASCE (26.10-1)

Design Wind Force, $F = q_z G C_f A_f$ ASD = 10.02 psf	=	16.70 A_f (psf)
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ASCE 29.4-1

A_f projected area normal to applied wind force	=	17.700 ft. ² (EPA Per Manufacturer)
M_w	=	1.68 kip-ft
b, diameter of round post or diagonal dimension of square post	=	5.00 in.
d, diameter of footing	=	24 in.
Pole Type	=	square
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	6.96 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_f$	=	295.6 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	3.3 kip-ft

ASCE 29.5-1

Assumed

ASCE (29.4-1)

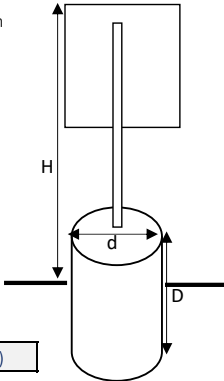
Anchor Bolt Load Determination

Moment at Base	=	3.25 kip-ft
Total Moment (Pole & Fixture)	=	4.408 kip-ft
Moment Demand at each Anchor Bolt	=	2.20 kip-ft + fixture
# of bolts ea side of pole	=	2
Moment Arm Between Bolts	=	8.00 in
T/C ea side	=	6612.7 lbs
T/C ea bolt	=	3306.4 lbs
Resisting Dead Load	D =	150.0 lbs
Resisting Dead Load	.9D =	135.0 lbs

Sht:	W-2
Date:	12/7/2021
#:	--
Δ :	--

ASCE 7-Chapter 29.5 Wind Loading on Light Fixture

Risk Category Factor	=	1			ASCE Table 1.5-1
Basic Wind Speed (3s Gust), V	=	89 mph			ASCE Hazard Tool
Z_g ground elevation above sea level	=	1005 ft.			ASCE Hazard Tool
Surface Roughness	=	C			ASCE 26.7.2
Exposure Category	=	C			ASCE 26.7.3
G_f Gust -effect factor	=	0.85			ASCE 26.9.5
Wind Load Parameters:					
K_z Velocity pressure exposure coefficient	=	0.924			ASCE Table 26.10-1
K_d Wind load directionality factor	=	1			ASCE Table 26.6-1
K_e Ground Elevation Factor	=	0.964			Table 26.9-1
K_{zt} Topographic Factor	=	1			ASCE (26.8.2)
C_f	=	1.2			Figures 29.4-1 through 29.4-4
Velocity Pressure:	$q_h = .00256 K_z K_{zt} K_d K_e V^2$	=	18.07 (psf)		ASCE (26.10-1)
Elevation of applied load		=	23 ft.		
H, Total Height to Fixture		=	23 ft.		
Design Wind Force, $F = q_z G C_f A_f$	ASD = 11.06 psf	=	18.43 A_f (psf)		ASCE 29.4-1
A_f projected area normal to wind pressure		=	2.73 ft. ²	(EPA Per Manufacturer)	ASCE 29.5-1
M_w		=	1.0314 kip-ft		
Equiv. Lateral Concentrated Load applied at center of fixture	$F = q_z G C_f A_f$	=	50.31 lbs	At Fixture	ASCE (29.4-1)
Moment Applied at Bottom of Pole	$F \times H$	=	1.2 kip-ft		



Pole Footing Embedded in Soil

Lic. #: KW-06008078

DESCRIPTION: 24' Tall Security Camera Pole Footing

Code References

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

General Information

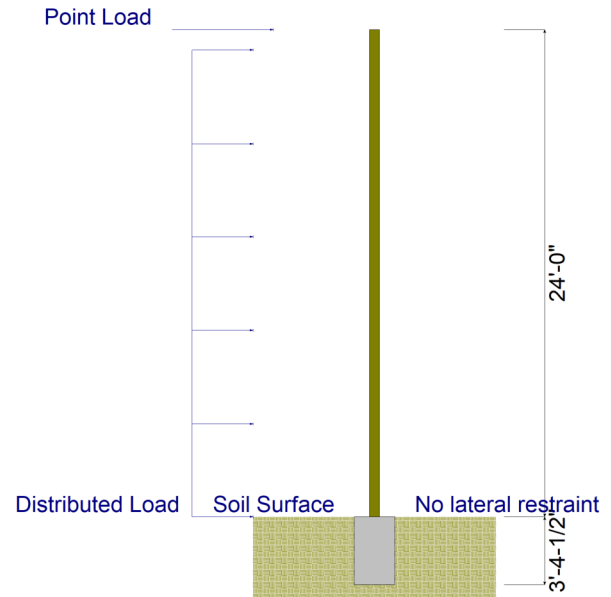
Pole Footing Shape	Circular
Pole Footing Diameter	24.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	300.0 pcf
Max Passive	1,000.0 pcf

Controlling Values

Governing Load Combination : +1.068D+0.70E	
Lateral Load	0.1029 k
Moment	2.470 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	328.190 psf
Allowable	328.667 psf

Minimum Required Depth **3.375 ft**

Footing Base Area	3.142 ft ²
Maximum Soil Pressure	0.1360 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load k		0.40 k
Lr : Roof Live k		k
L : Live k		k
S : Snow k		k
W : Wind 0.05031 k	0.006960	k
E : Earthquake 0.1470 k		k
H : Lateral Earth k		k
Load distance above ground surface 24.0 ft	TOP of Load above ground surface 23.0 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+0.60W	0.126	1.829	3.13	301.7	303.6	1.000
+D-0.60W	0.126	1.829	3.13	301.7	303.6	1.000
+D+0.450W	0.095	1.372	2.75	273.1	274.2	1.000
+D-0.450W	0.095	1.372	2.75	273.1	274.2	1.000
+0.60D+0.60W	0.126	1.829	3.13	301.7	303.6	1.000
+0.60D-0.60W	0.126	1.829	3.13	301.7	303.6	1.000
+1.068D+0.70E	0.103	2.470	3.38	328.2	328.7	1.000
+1.068D-0.70E	0.103	2.470	3.38	328.2	328.7	1.000

Pole Footing Embedded in Soil

File: 01-3_FOUNDATION_POLE FOOTING.ec6
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Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 24' Tall Security Camera Pole Footing

+1.051D+0.5250E	0.077	1.852	3.00	296.2	298.1	1.000
+1.051D-0.5250E	0.077	1.852	3.00	296.2	298.1	1.000
+0.5315D+0.70E	0.103	2.470	3.38	328.2	328.7	1.000
+0.5315D-0.70E	0.103	2.470	3.38	328.2	328.7	1.000



27369 Via Industria
 Temecula, CA 92590
 (951)600-0032, (951)600-0036 Fax

Sht:	Pier Renf_22'H
Date:	-
#:	-
Δ :	-

**Cast In Place Deep Foundation Element Analysis & Design in Seismic Design Category D, E & F Per 2019
 CBC 1810.1-1810.4**

Pier Design Parameters

Diameter, D	=	24	in.	
Seismic Design Category	=	D		
Depth, H	=	5.50	ft.	
f'_c	=	2500	psi	
f_y	=	60	psi	
Clear spacing from outside edge of transverse reinforcement	=	3	in	
$A_{g, Pier}$	=	452.39	in ²	
A_{ch}	=	254.47	in ²	
Factored (ASD) Vertical Axial Load	=	400	lbs	
Allowable vertical foundation pressure at base	=	3200	psf	CBC 1806.2.0
Neglect self-weight of concrete pole footing ?	=	No		
Foundation Pressure	=	952	psf	< 3200 psf OK

Seismic Longitudinal Reinforcement

A minimum of four longitudinal bars

Longitudinal Reinforcement Size	=	#5	bars		CBC 1810.3.9.4.2
# of bars	=	8	≥ 4 Min	OK	CBC 1810.3.9.4.2
Bar Dia.	=	0.6250	in.		
$A_s, provided$	=	2.4544	in ²		
$P_s, long, min$	=	0.0050			CBC 1810.3.9.4.2
$P_s, long, provided$	=	0.0054	> 0.005	OK	CBC 1810.3.9.4.2

Seismic Transverse Reinforcement

Shall consist of closed ties or spirals

Transverse Reinforcement Size (#3 for D ≤ 20", #4 for larger)	=	#4	bars		CBC 1810.3.9.4.2
Bar Dia.	=	0.5	in.		
$A_s, provided$ (per closed tie / spiral)	=	0.39	in ²		
l_o Length of l_o shall be at least the greatest of:					ACI 318-14 18.7.5
(a) Pier Diameter or where flexural yielding is likely to occur	=	24	in.		
(b) 1/6 pier depth	=	11	in.		
(c) 18 inches	=	18	in.		
Transverse Confinement Reinforcement within 3D from top of element or point of fixity	=	72	in.		CBC 1810.3.9.4.2.1
$P_s, (min)$ for spiral or circular hoop greater of					ACI 318-14 Table 18.10.6.4(f)
(a) $.45 (A_g/A_{ch} - 1) (f'_c/f_{yt})$	=	0.015			CBC 1810.3.9.4.2.1
(b) $.12(f'_c/f_{yt}) \times (1/2)$ per 2019 CBC	=	0.003			CBC 1810.3.9.4.2.1
$P_s, (provided)$	=	0.042	> 0.015 in.	OK	
Spacing of transverse reinforcement within confinement range shall not exceed the least of:	S =	3	in.	< 3.75 in.	ACI 318-14 18.7.5.3 OK
(a) D/2	=	12	in.		
(b) $6d_{b, long}$	=	3.75	in.		
(c) 6 in.	=	6	in.		

Remainder of Transverse Bar

Spacing of transverse reinforcement shall not exceed the least of	S =	7	in.	< 7.50 in.	CBC 1810.3.9.4.2 OK
1. 12 longitudinal bar diameters	=	7.5	in.		
2. 1/2 least dimension of element	=	12	in.		
3. 12 inches	=	12	in.		

WALKWAY LIGHT POLE FOOTING

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Light Pole

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	12.00 ft	
Pole Size =	4.00 in.	
Additional height from base of footing =	0.50 ft	
Weight of Structure, W_p =	66 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.13 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	2.40	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W$ =	0.49	W	(12.8-1)
Design Weight of Light Pole =	66	lbs	
Base Shear at bottom of pole, V =	0.032	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	8	ft.	

**Design of Non-Building Structures per ASCE 7-16
Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Light Fixture

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Fixture, z =	13.00 ft	
Additional height from base of footing =	0.50 ft	
Weight of Structure, W_p =	36 lbs	From Manufacturer (Mounting Arm + Fixture)
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.14 sec	12.8-7

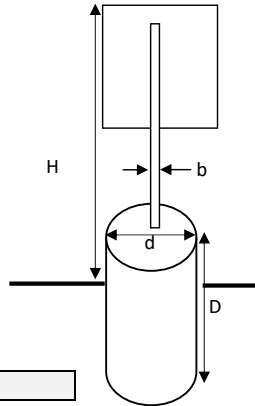
Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	2.26	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W =$	0.49	W	(12.8-1)
Design Weight of Light Pole =	36	lbs	
Base Shear at bottom of pole, V =	0.018	kips	15.4.1
Seismic Load Height Acting at Top =	13	ft.	
Moment at Base =	0.23	kip-ft	

Sht:	W-1
Date:	12/7/2021
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Δ :	--

ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

Risk Category Factor	=	I
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust -effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	0.85
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	36.0



ASCE Table 1.5-1
 ASCE Hazard Tool
 ASCE Hazard Tool
 ASCE 26.7.2
 ASCE 26.7.3
 ASCE 26.9.5

ASCE Table 26.10-1
 ASCE Table 26.6-1
 Table 26.9-1
 ASCE (26.8.2)
 Figures 29.4-1 through 29.4-4

Velocity Pressure: $q_n = .00256 K_z K_{zt} K_d K_e V^2$	=	16.37 (psf)
Elevation of applied load from ground level	=	6 ft.
Total Height of Pole From Base Plate	H =	12 ft.

ASCE (26.10-1)

Design Wind Force, $F = q_z G C_f A_f$ ASD = 10.02 psf	=	16.70 A_f (psf)
--	---	-------------------

ASCE 29.4-1

A_f projected area normal to applied wind force	=	16.900 ft. ² (EPA Per Manufacturer)
M_w	=	0.40 kip-ft
b, diameter of round post or diagonal dimension of square post	=	4.00 in.
d, diameter of footing	=	24 in.
Pole Type	=	round
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	5.57 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_f$	=	282.2 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	1.7 kip-ft

ASCE 29.5-1

Assumed

ASCE (29.4-1)

Anchor Bolt Load Determination

Moment at Base	=	1.69 kip-ft
Total Moment (Pole & Fixture)	=	2.218 kip-ft
Moment Demand at each Anchor Bolt	=	1.11 kip-ft + fixture
# of bolts ea side of pole	=	2
Moment Arm Between Bolts	=	10.00 in
T/C ea side	=	2661.4 lbs
T/C ea bolt	=	1330.7 lbs
Resisting Dead Load	D =	150.0 lbs
Resisting Dead Load	.9D =	135.0 lbs

Sht:	W-2
Date:	12/7/2021
#:	--
Δ :	--

ASCE 7-Chapter 29.5 Wind Loading on Light Fixture

<p>Risk Category Factor = 1</p> <p>Basic Wind Speed (3s Gust), V = 89 mph</p> <p>Z_g ground elevation above sea level = 1005 ft.</p> <p>Surface Roughness = C</p> <p>Exposure Category = C</p> <p>G_r Gust -effect factor = 0.85</p> <p>Wind Load Parameters:</p> <p>K_z Velocity pressure exposure coefficient = 0.85</p> <p>K_d Wind load directionality factor = 1</p> <p>K_e Ground Elevation Factor = 0.964</p> <p>K_{zt} Topographic Factor = 1</p> <p>C_f = 1.2</p>		<p>ASCE Table 1.5-1</p> <p>ASCE Hazard Tool</p> <p>ASCE Hazard Tool</p> <p>ASCE 26.7.2</p> <p>ASCE 26.7.3</p> <p>ASCE 26.9.5</p> <p>ASCE Table 26.10-1</p> <p>ASCE Table 26.6-1</p> <p>Table 26.9-1</p> <p>ASCE (26.8.2)</p> <p>Figures 29.4-1 through 29.4-4</p> <p>ASCE (26.10-1)</p> <p>ASCE 29.4-1</p>
<p>Velocity Pressure: $q_h = .00256 K_z K_{zt} K_d K_e V^2$ = 16.62 (psf)</p>		
<p>Elevation of applied load = 14 ft.</p> <p>H, Total Height to Fixture = 14 ft.</p>		
<p>Design Wind Force, $F = q_z G C_f A_f$ ASD = 10.17 psf = 16.95 A_f (psf)</p>		
<p>A_f projected area normal to wind pressure = 2.21 ft.² (EPA Per Manufacturer)</p>		ASCE 29.5-1
<p>M_w = 0.4309 kip-ft</p>		
<p>Equiv. Lateral Concentrated Load applied at center of fixture $F = q_z G C_f A_f$ = 37.47 lbs At Fixture</p>		ASCE (29.4-1)
<p>Moment Applied at Bottom of Pole $F \times H$ = 0.5 kip-ft</p>		

Pole Footing Embedded in Soil

Lic. #: KW-06008078

DESCRIPTION: 12' Tall Light Pole Foundation

Code References

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

General Information

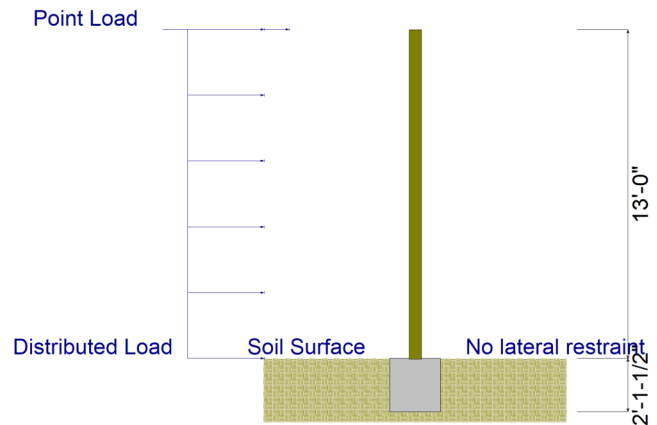
Pole Footing Shape Circular
 Pole Footing Diameter 24.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive 300.0 pcf
 Max Passive 1,000.0 psf

Controlling Values

Governing Load Combination : +D+0.60W
 Lateral Load 0.06625 k
 Moment 0.5788 k-ft
NO Ground Surface Restraint
 Pressures at 1/3 Depth
 Actual 207.575 psf
 Allowable 208.166 psf

Minimum Required Depth 2.125 ft

Footing Base Area 3.142 ft²
 Maximum Soil Pressure 0.03741 ksf



Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (klf)		Vertical Load (k)	
D : Dead Load	k		k/ft	0.110 k	
Lr : Roof Live	k		k/ft	k	
L : Live	k		k/ft	k	
S : Snow	k		k/ft	k	
W : Wind	0.0380 k	0.005570	k/ft	k	
E : Earthquake	0.050 k		k/ft	k	
H : Lateral Earth	k		k/ft	k	
Load distance above ground surface	13.0 ft	TOP of Load above ground surface	13.0 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+0.60W	0.066	0.579	2.13	207.6	208.2	1.000
+D-0.60W	0.066	0.579	2.13	207.6	208.2	1.000
+D+0.450W	0.050	0.434	2.00	186.6	188.5	1.000
+D-0.450W	0.050	0.434	2.00	186.6	188.5	1.000
+0.60D+0.60W	0.066	0.579	2.13	207.6	208.2	1.000
+0.60D-0.60W	0.066	0.579	2.13	207.6	208.2	1.000
+1.068D+0.70E	0.035	0.455	2.00	186.2	187.9	1.000
+1.068D-0.70E	0.035	0.455	2.00	186.2	187.9	1.000

Pole Footing Embedded in Soil

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Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 12' Tall Light Pole Foundation

+1.051D+0.5250E	0.026	0.341	1.75	169.2	169.7	1.000
+1.051D-0.5250E	0.026	0.341	1.75	169.2	169.7	1.000
+0.5315D+0.70E	0.035	0.455	2.00	186.2	187.9	1.000
+0.5315D-0.70E	0.035	0.455	2.00	186.2	187.9	1.000



27369 Via Industria
 Temecula, CA 92590
 (951)600-0032, (951)600-0036 Fax

Sht:	Pier Renf_12'H
Date:	-
#:	-
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**Cast In Place Deep Foundation Element Analysis & Design in Seismic Design Category D, E & F Per 2019
 CBC 1810.1-1810.4**

Pier Design Parameters

Diameter, D	=	24	in.	
Seismic Design Category	=	D		
Depth, H	=	4.25	ft.	
f'_c	=	4500	psi	
f_y	=	60	psi	
Clear spacing from outside edge of transverse reinforcement	=	3	in	
$A_{g, Pier}$	=	452.39	in ²	
A_{ch}	=	254.47	in ²	
Factored (ASD) Vertical Axial Load	=	110	lbs	
Allowable vertical foundation pressure at base	=	1915	psf	CBC 1806.2.0
Neglect self-weight of concrete pole footing ?	=	No		
Foundation Pressure	=	673	psf	< 1915 psf OK

Seismic Longitudinal Reinforcement

A minimum of four longitudinal bars

Longitudinal Reinforcement Size	=	#5	bars		CBC 1810.3.9.4.2
# of bars	=	8	≥ 4 Min	OK	CBC 1810.3.9.4.2
Bar Dia.	=	0.6250	in.		
$A_s, provided$	=	2.4544	in ²		
$P_s, long, min$	=	0.0050			CBC 1810.3.9.4.2
$P_s, long, provided$	=	0.0054	> 0.005	OK	CBC 1810.3.9.4.2

Seismic Transverse Reinforcement

Shall consist of closed ties or spirals

Transverse Reinforcement Size (#3 for D ≤ 20", #4 for larger)	=	#4	bars		CBC 1810.3.9.4.2
Bar Dia.	=	0.5	in.		
$A_s, provided$ (per closed tie / spiral)	=	0.39	in ²		
l_o Length of l_o shall be at least the greatest of:					ACI 318-14 18.7.5
(a) Pier Diameter or where flexural yielding is likely to occur	=	24	in.		
(b) 1/6 pier depth	=	8.5	in.		
(c) 18 inches	=	18	in.		
Transverse Confinement Reinforcement within 3D from top of element or point of fixity	=	72	in.		CBC 1810.3.9.4.2.1
$P_s, (min)$ for spiral or circular hoop greater of					ACI 318-14 Table 18.10.6.4(f)
(a) $.45 (A_g/A_{ch} - 1) (f'_c/f_{yt})$	=	0.026			CBC 1810.3.9.4.2.1
(b) $.12(f'_c/f_{yt}) \times (1/2)$ per 2019 CBC	=	0.005			CBC 1810.3.9.4.2.1
$P_s, (provided)$	=	0.036	> 0.026 in.	OK	
Spacing of transverse reinforcement within confinement range shall not exceed the least of:	S =	3.5	in.	< 3.75 in.	ACI 318-14 18.7.5.3 OK
(a) D/2	=	12	in.		
(b) $6d_{b, long}$	=	3.75	in.		
(c) 6 in.	=	6	in.		

Remainder of Transverse Bar

Spacing of transverse reinforcement shall not exceed the least of	S =	7	in.	< 7.50 in.	CBC 1810.3.9.4.2 OK
1. 12 longitudinal bar diameters	=	7.5	in.		
2. 1/2 least dimension of element	=	12	in.		
3. 12 inches	=	12	in.		

PARKING AREA LIGHT POLE FOOTING

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Light Pole

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	22.00 ft	
Pole Size =	5.00 in.	
Additional height from base of footing =	3.00 ft	
Weight of Structure, W_p =	135 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.20 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	1.53	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W$ =	0.49	W	(12.8-1)
Design Weight of Light Pole =	135	lbs	
Base Shear at bottom of pole, V =	0.066	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	14.66667	ft.	

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Light Fixture

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Fixture, z =	13.00 ft	
Additional height from base of footing =	0.50 ft	
Weight of Structure, W_p =	36 lbs	From Manufacturer (Mounting Arm + Fixture)
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.14 sec	12.8-7

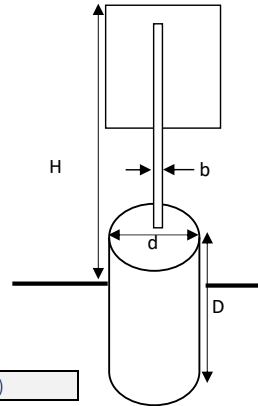
Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	2.26	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W =$	0.49	W	(12.8-1)
Design Weight of Light Pole =	36	lbs	
Base Shear at bottom of pole, V =	0.018	kips	15.4.1
Seismic Load Height Acting at Top =	23	ft.	
Moment at Base =	0.41	kip-ft	

Sht:	W-1
Date:	12/7/2021
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ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

Risk Category Factor	=	I
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust -effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	0.85
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	52.8



ASCE Table 1.5-1
 ASCE Hazard Tool
 ASCE Hazard Tool
 ASCE 26.7.2
 ASCE 26.7.3
 ASCE 26.9.5

ASCE Table 26.10-1
 ASCE Table 26.6-1
 Table 26.9-1
 ASCE (26.8.2)
 Figures 29.4-1 through 29.4-4

Velocity Pressure: $q_n = .00256 K_z K_{zt} K_d K_e V^2$	=	16.37 (psf)
Elevation of applied load from ground level	=	11 ft.
Total Height of Pole From Base Plate	H =	22 ft.

ASCE (26.10-1)

Design Wind Force, $F = q_z G C_f A_f$ ASD = 10.02 psf	=	16.70 A_f (psf)
--	---	-------------------

ASCE 29.4-1

A_f projected area normal to applied wind force	=	15.900 ft. ² (EPA Per Manufacturer)
M_w	=	1.68 kip-ft
b, diameter of round post or diagonal dimension of square post	=	5.00 in.
d, diameter of footing	=	30 in.
Pole Type	=	round
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	6.96 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_f$	=	265.5 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	2.9 kip-ft

ASCE 29.5-1

Assumed

ASCE (29.4-1)

Anchor Bolt Load Determination

Moment at Base	=	2.92 kip-ft
Total Moment (Pole & Fixture)	=	4.078 kip-ft
Moment Demand at each Anchor Bolt	=	2.04 kip-ft + fixture
# of bolts ea side of pole	=	2
Moment Arm Between Bolts	=	10.00 in
T/C ea side	=	4893.4 lbs
T/C ea bolt	=	2446.7 lbs
Resisting Dead Load	D =	150.0 lbs
Resisting Dead Load	.9D =	135.0 lbs

Sht:	W-2
Date:	12/7/2021
#:	--
Δ :	--

ASCE 7-Chapter 29.5 Wind Loading on Light Fixture

<p>Risk Category Factor = 1</p> <p>Basic Wind Speed (3s Gust), V = 89 mph</p> <p>Z_g ground elevation above sea level = 1005 ft.</p> <p>Surface Roughness = C</p> <p>Exposure Category = C</p> <p>G_r Gust -effect factor = 0.85</p> <p>Wind Load Parameters:</p> <p>K_z Velocity pressure exposure coefficient = 0.924</p> <p>K_d Wind load directionality factor = 1</p> <p>K_e Ground Elevation Factor = 0.964</p> <p>K_{zt} Topographic Factor = 1</p> <p>C_f = 1.2</p>		<p>ASCE Table 1.5-1</p> <p>ASCE Hazard Tool</p> <p>ASCE Hazard Tool</p> <p>ASCE 26.7.2</p> <p>ASCE 26.7.3</p> <p>ASCE 26.9.5</p> <p>ASCE Table 26.10-1</p> <p>ASCE Table 26.6-1</p> <p>Table 26.9-1</p> <p>ASCE (26.8.2)</p> <p>Figures 29.4-1 through 29.4-4</p> <p>ASCE (26.10-1)</p> <p>ASCE 29.4-1</p>
<p>Velocity Pressure: $q_h = .00256 K_z K_{zt} K_d K_e V^2$ = 18.07 (psf)</p>		
<p>Elevation of applied load = 23 ft.</p> <p>H, Total Height to Fixture = 23 ft.</p>		
<p>Design Wind Force, $F = q_z G C_f A_f$ ASD = 11.06 psf = 18.43 A_f (psf)</p>		
<p>A_f projected area normal to wind pressure = 2.73 ft.² (EPA Per Manufacturer)</p>		ASCE 29.5-1
<p>M_w = 1.0314 kip-ft</p>		
<p>Equiv. Lateral Concentrated Load applied at center of fixture $F = q_z G C_f A_f$ = 50.31 lbs At Fixture</p>		ASCE (29.4-1)
<p>Moment Applied at Bottom of Pole $F \times H$ = 1.2 kip-ft</p>		

Pole Footing Embedded in Soil

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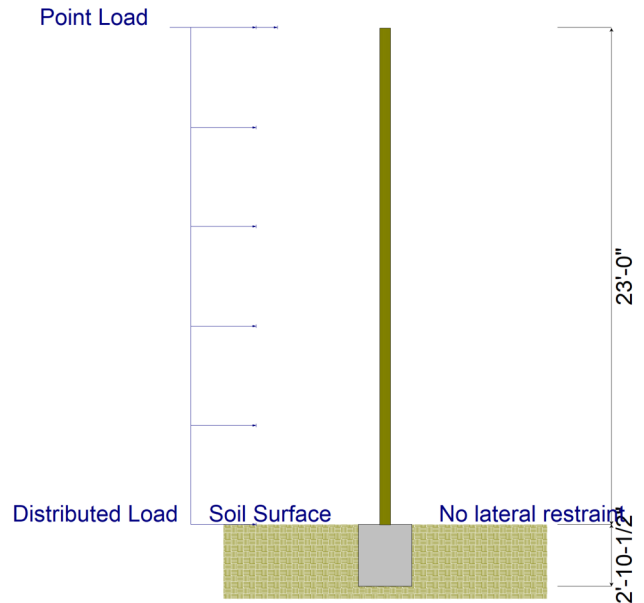
DESCRIPTION: 22' Tall Light Pole Foundation

Code References

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

General Information

Pole Footing Shape Circular
 Pole Footing Diameter 30.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive 300.0 pcf
 Max Passive 1,000.0 pcf



Controlling Values

Governing Load Combination : +D+0.60W
 Lateral Load 0.1262 k
 Moment 1.799 k-ft
NO Ground Surface Restraint
 Pressures at 1/3 Depth
 Actual **278.467** psf
 Allowable **278.810** psf

Minimum Required Depth 2.875 ft

Footing Base Area 4.909 ft²
 Maximum Soil Pressure 0.03809 ksf

Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (klf)		Vertical Load (k)	
D : Dead Load	k		k/ft	0.1750	k
Lr : Roof Live	k		k/ft		k
L : Live	k		k/ft		k
S : Snow	k		k/ft		k
W : Wind	0.05031 k	0.006960	k/ft		k
E : Earthquake	0.0840 k		k/ft		k
H : Lateral Earth	k		k/ft		k
Load distance above ground surface	23.0 ft	TOP of Load above ground surface	23.0 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+0.60W	0.126	1.799	2.88	278.5	278.8	1.000
+D-0.60W	0.126	1.799	2.88	278.5	278.8	1.000
+D+0.450W	0.095	1.349	2.63	251.1	252.4	1.000
+D-0.450W	0.095	1.349	2.63	251.1	252.4	1.000
+0.60D+0.60W	0.126	1.799	2.88	278.5	278.8	1.000
+0.60D-0.60W	0.126	1.799	2.88	278.5	278.8	1.000
+1.068D+0.70E	0.059	1.352	2.50	246.2	248.2	1.000
+1.068D-0.70E	0.059	1.352	2.50	246.2	248.2	1.000

Pole Footing Embedded in Soil

File: 03-3_FOUNDATION_POLE FOOTING.ec6
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Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 22' Tall Light Pole Foundation

+1.051D+0.5250E	0.044	1.014	2.25	223.1	224.8	1.000
+1.051D-0.5250E	0.044	1.014	2.25	223.1	224.8	1.000
+0.5315D+0.70E	0.059	1.352	2.50	246.2	248.2	1.000
+0.5315D-0.70E	0.059	1.352	2.50	246.2	248.2	1.000



27369 Via Industria
 Temecula, CA 92590
 (951)600-0032, (951)600-0036 Fax

Sht:	Pier Renf_22'H
Date:	-
#:	-
Δ :	-

**Cast In Place Deep Foundation Element Analysis & Design in Seismic Design Category D, E & F Per 2019
 CBC 1810.1-1810.4**

Pier Design Parameters

Diameter, D	=	30	in.	
Seismic Design Category	=	D		
Depth, H	=	6.00	ft.	
f'_c	=	4500	psi	
f_y	=	60	psi	
Clear spacing from outside edge of transverse reinforcement	=	3	in	
$A_{g, Pier}$	=	706.86	in ²	
A_{ch}	=	452.39	in ²	
Factored (ASD) Vertical Axial Load	=	175	lbs	
Allowable vertical foundation pressure at base	=	4770	psf	CBC 1806.2.0
Neglect self-weight of concrete pole footing ?	=	No		
Foundation Pressure	=	936	psf	< 4770 psf OK

Seismic Longitudinal Reinforcement

A minimum of four longitudinal bars

Longitudinal Reinforcement Size	=	#6	bars	
# of bars	=	9	≥ 4 Min	OK
Bar Dia.	=	0.7500	in.	
$A_s, provided$	=	3.9761	in ²	
$P_s, long, min$	=	0.0050		CBC 1810.3.9.4.2
$P_s, long, provided$	=	0.0056	> 0.005	OK

Seismic Transverse Reinforcement

Shall consist of closed ties or spirals

Transverse Reinforcement Size (#3 for D ≤ 20", #4 for larger)	=	#4	bars	
Bar Dia.	=	0.5	in.	
$A_s, provided$ (per closed tie / spiral)	=	0.39	in ²	
l_o Length of l_o shall be at least the greatest of:				ACI 318-14 18.7.5
(a) Pier Diameter or where flexural yielding is likely to occur	=	30	in.	
(b) 1/6 pier depth	=	12	in.	
(c) 18 inches	=	18	in.	
Transverse Confinement Reinforcement within 3D from top of element or point of fixity	=	90	in.	CBC 1810.3.9.4.2.1
$P_s, (min)$ for spiral or circular hoop greater of				ACI 318-14 Table 18.10.6.4(f)
(a) $.45 (A_g/A_{ch} - 1) (f'_c/f_{yt})$	=	0.019		CBC 1810.3.9.4.2.1
(b) $.12(f'_c/f_{yt}) \times (1/2)$ per 2019 CBC	=	0.005		CBC 1810.3.9.4.2.1
$P_s, (provided)$	=	0.022	> 0.019 in.	OK
Spacing of transverse reinforcement within confinement range shall not exceed the least of:	S =	4.5	in.	< 4.50 in. OK
(a) D/2	=	15	in.	
(b) $6d_{b, long}$	=	4.5	in.	
(c) 6 in.	=	6	in.	

Remainder of Transverse Bar

Spacing of transverse reinforcement shall not exceed the least of	S =	8.99	in.	< 9.00 in. OK	CBC 1810.3.9.4.2
1. 12 longitudinal bar diameters	=	9	in.		
2. 1/2 least dimension of element	=	15	in.		
3. 12 inches	=	12	in.		

CHAINLINK FENCE POLE FOOTING

**Design of Non-Building Structures per ASCE 7-16
Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Chainlink Fence Post Footing (3.5')

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	3.50 ft	
Pole Size =	1.50 in.	
Additional height from base of footing =	0.00 ft	
Weight of Structure, W_p =	75 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.05 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

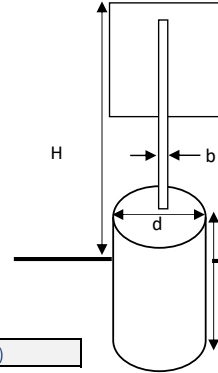
$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	6.06	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W =$	0.49	W	(12.8-1)
Design Weight of Light Pole =	75	lbs	
Base Shear at bottom of pole, V =	0.037	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	2.333333	ft.	

Sht:	W-1
Date:	12/9/2021
#:	--
Δ :	--

ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

3.5' POLE w/o WINDSCREEN

Risk Category Factor	=	1
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust-effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	0.85
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	28.0



ASCE Table 1.5-1
ASCE Hazard Tool
ASCE Hazard Tool
ASCE 26.7.2
ASCE 26.7.3
ASCE 26.9.5

ASCE Table 26.10-1
ASCE Table 26.6-1
Table 26.9-1
ASCE (26.8.2)

Figures 29.4-1 through 29.4-4

Velocity Pressure: $q_h = .00256 K_z K_{zt} K_d K_e V^2$	=	16.37 (psf)
Elevation of applied load from ground level	=	3.5 ft.
Total Height of Pole From Base Plate H	=	3.5 ft.

ASCE (26.10-1)

Design Wind Force, $F = q_z G C_f A_r$ ASD = 10.02 psf	=	16.70 A_r (psf)
--	---	-------------------

ASCE 29.4-1

A_r projected area normal to applied wind force	=	0.438 ft. ²
M_w	=	0.01 kip-ft
b , diameter of round post or diagonal dimension of square post	=	1.50 in.
d , diameter of footing	=	12 in.
Pole Type	=	round
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	2.09 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_r$	=	7.3 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	0.0 kip-ft

ASCE 29.5-1

Assumed

ASCE (29.4-1)

SOLID FREE STANDING WALLS AND SIGNS (ASCE 7-16 SECTION 29.4.1)

WIND ON CHAINLINK FENCE (w/ WIND SCREEN) (8' TALL)

	i	Risk / Occupancy Category	Table 1.5-1
	C	Exposure Category	Figure 26.5
h	= 3.5 ft.	Height above ground surface	
s	= 3.5 ft.	Vertical dimension of wall or sign	
B	= 8 ft.	Horizontal dimension of wall or sign	
L _r	= 0 ft.	Horizontal dimension of return corner	Figure 29.3-1
s/h	= 1	Clearance ratio	Figure 29.3-1
B/s	= 2.29	Aspect ratio	Figure 29.3-1
L _r /s	= 0	Return corner aspect ratio	Figure 29.3-1
	0	L _r /s reduction factor	
A _s	= 28 ft ²	Gross area of solid free standing wall or sign	Figure 29.3-1
V	= 89 mph	Basic wind speed	Figure 26.5-1A
K _z	= 0.85	velocity exposure coefficient	Table 29.3-1
K _{zt}	= 1 = (1 + K ₁ K ₂ K ₃) _z	directionality Factor	(26.8-1)
K _d	= 0.85		Table 26.6-1
G	= 0.85	gust-effect factor	
h'	= 1.93 ft.	Resultant location of load above ground surface	
q _h	= 14.65 psf	pressure at height h	$q_h = .00256K_zK_{zt}K_dV^2$

LOAD CASES

CASE A RESULTANT FORCE THROUGH THE GEOMETRIC CENTER

Figure 29.4-1

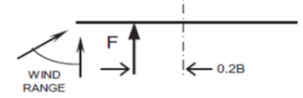
C _f	= 1.45	net force coefficient	(pg. 323)
q _h	= 14.65 psf	velocity pressure at height, h	
P	= 18.1 psf	= q _h G C _f	pressure at height h



CASE B RESULTANT FORCE at 0.2B FROM GEOMETRIC CENTER

Figure 29.4-1

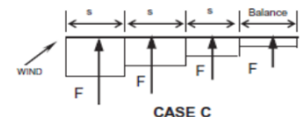
C _f	= 1.45	net force coefficient	
q _h	= 14.65 psf	velocity pressure at height, h	
P	= 18.1 psf	pressure at height h	



CASE C RESULTANT FORCE AT GEMETRIC CENTER OF REGIONS ALONG WALL OR SIGN

Figure 29.4-1

RF ₁	= 0.96	Reduction Factor for Case C for C _f >3.0
RF ₂	= 0.80	Reduction Factor for Case C



L _r /s	Reduction Factor
0.3	0.9
1	0.75
≥2	0.6

B/s = 2.29 Case C must be considered

FOR B/s > 2 CASE C MUST BE CONSIDERED

Aspect Ratio B/s ≤ 10 (2.286)							Aspect Ratio B/s > 10 (2.286)						
Region	Dist	A ₁	C _F	P _i (psf)	F (lbs)	M (kip-ft)	Region	Dist	A ₁	C _F	P _i (psf)	F (lbs)	M (kip-ft)
0 to s	3.5	12.25	0	0	0	0.00	0 to s	3.5	12.25	0	0.0	0	0
s to 2s	7	12.25	0	0	0	0.00	s to 2s	7	12.25	0	0.0	0	0
2s to 3s	10.5	12.25	0	0	0	0.00	2s to 3s	12.25	12.25	0	0.0	0	0
3s to 10s	14	12.25	0	0	0	0.00	3s to 4s	12.25	12.25	0	0.0	0	0
max	= 0.0	psf		Σ	0	0.00	4s to 5s	12.25	12.25	0	0.0	0	0
							5s to 6s	12.25	12.25	0	0.0	0	0
							>10s	8	12.25	0	0.0	0	0
							max	= 0.0	psf		Σ	0	0

DESIGN SUMMARY RESULTS

Design Summary:

	Strength	ASD
Max horizontal wind pressure	= 18.1 psf	10.8 psf
Max horizontal force at centroid	= 0.51 kips	0.3 kps
Max overturning moment	= 1.0 kip-ft	0.6 kip-ft
Max torsion at centroid	= -0.8 kip-ft	-0.5 kip-ft

Pole Footing Embedded in Soil

File: 04-3_FOUNDATION_CHAINLINK FENCE.ec6
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 Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 3.5' Tall Chainlink Fence Post (w/o Windscreen)

Code References

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

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	12.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	300.0 pcf
Max Passive	1,000.0 pcf

Controlling Values

Governing Load Combination : +1.068D+0.70E	
Lateral Load	0.02590 k
Moment	0.04533 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	123.390 psf
Allowable	124.420 psf

Minimum Required Depth	1.250 ft
------------------------	----------

Footing Base Area	0.7854 ft ²
Maximum Soil Pressure	0.2381 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load		0.1750 k
Lr : Roof Live		k
L : Live		k
S : Snow		k
W : Wind	0.002090	k
E : Earthquake		k
H : Lateral Earth		k
Load distance above ground surface	TOP of Load above ground surface	
1.750 ft	3.50	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+0.60W	0.004	0.008	0.75	63.2	64.4	1.000
+D-0.60W	0.004	0.008	0.75	63.2	64.4	1.000
+D+0.450W	0.003	0.006	0.63	57.5	57.7	1.000
+D-0.450W	0.003	0.006	0.63	57.5	57.7	1.000
+0.60D+0.60W	0.004	0.008	0.75	63.2	64.4	1.000
+0.60D-0.60W	0.004	0.008	0.75	63.2	64.4	1.000
+1.068D+0.70E	0.026	0.045	1.25	123.4	124.4	1.000
+1.068D-0.70E	0.026	0.045	1.25	123.4	124.4	1.000

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

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Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 3.5' Tall Chainlink Fence Post (w/o Windscreen)

+1.051D+0.5250E	0.019	0.034	1.13	110.6	111.4	1.000
+1.051D-0.5250E	0.019	0.034	1.13	110.6	111.4	1.000
+0.5315D+0.70E	0.026	0.045	1.25	123.4	124.4	1.000
+0.5315D-0.70E	0.026	0.045	1.25	123.4	124.4	1.000

Pole Footing Embedded in Soil

Lic. #: KW-06008078

DESCRIPTION: 3.5' Tall Chainlink Fence Post (w/ Windscreen)

Code References

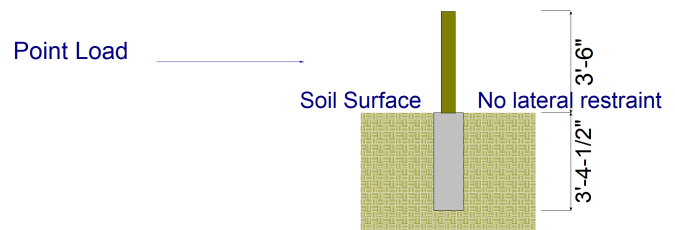
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	12.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	300.0 pcf
Max Passive	1,000.0 pcf

Controlling Values	
Governing Load Combination	: +D+0.60W
Lateral Load	0.3060 k
Moment	0.5355 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	334.429 psf
Allowable	335.750 psf
Minimum Required Depth 3.375 ft	
Footing Base Area	0.7854 ft ²
Maximum Soil Pressure	0.2381 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load		0.1750 k
Lr : Roof Live		k
L : Live		k
S : Snow		k
W : Wind	0.0	k
E : Earthquake		k
H : Lateral Earth		k
Load distance above ground surface	TOP of Load above ground surface	
	3.50	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+0.60W	0.306	0.536	3.38	334.4	335.7	1.000
+D-0.60W	0.306	0.536	3.38	334.4	335.7	1.000
+D+0.450W	0.230	0.402	3.00	295.8	297.8	1.000
+D-0.450W	0.230	0.402	3.00	295.8	297.8	1.000
+0.60D+0.60W	0.306	0.536	3.38	334.4	335.7	1.000
+0.60D-0.60W	0.306	0.536	3.38	334.4	335.7	1.000
+1.068D+0.70E	0.026	0.045	1.25	123.4	124.4	1.000
+1.068D-0.70E	0.026	0.045	1.25	123.4	124.4	1.000

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

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Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 3.5' Tall Chainlink Fence Post (w/ Windscreen)

+1.051D+0.5250E	0.019	0.034	1.13	110.6	111.4	1.000
+1.051D-0.5250E	0.019	0.034	1.13	110.6	111.4	1.000
+0.5315D+0.70E	0.026	0.045	1.25	123.4	124.4	1.000
+0.5315D-0.70E	0.026	0.045	1.25	123.4	124.4	1.000

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Chainlink Fence Post Footing (6')

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	6.00 ft	
Pole Size =	2.00 in.	
Additional height from base of footing =	0.00 ft	
Weight of Structure, W_p =	125 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.08 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

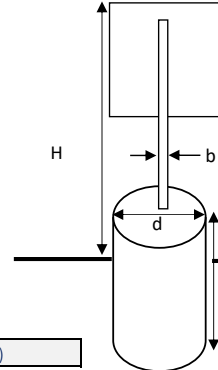
$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	4.04	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W$ =	0.49	W	(12.8-1)
Design Weight of Light Pole =	125	lbs	
Base Shear at bottom of pole, V =	0.061	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	4	ft.	

Sht:	W-1
Date:	12/9/2021
#:	--
Δ :	--

ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

6' POLE w/o WINDSCREEN

Risk Category Factor	=	1
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust-effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	0.85
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	36.0



ASCE Table 1.5-1
ASCE Hazard Tool
ASCE Hazard Tool
ASCE 26.7.2
ASCE 26.7.3
ASCE 26.9.5

ASCE Table 26.10-1
ASCE Table 26.6-1
Table 26.9-1
ASCE (26.8.2)

Figures 29.4-1 through 29.4-4

Velocity Pressure: $q_h = .00256 K_z K_{zt} K_d K_e V^2$	=	16.37 (psf)
Elevation of applied load from ground level	=	6 ft.
Total Height of Pole From Base Plate H	=	6 ft.

ASCE (26.10-1)

Design Wind Force, $F = q_z G C_f A_r$ ASD = 10.02 psf	=	16.70 A_r (psf)
--	---	-------------------

ASCE 29.4-1

A_r projected area normal to applied wind force	=	1.000 ft. ²
M_w	=	0.05 kip-ft
b , diameter of round post or diagonal dimension of square post	=	2.00 in.
d , diameter of footing	=	12 in.
Pole Type	=	round
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	2.78 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_r$	=	16.7 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	0.1 kip-ft

ASCE 29.5-1

Assumed

ASCE (29.4-1)

SOLID FREE STANDING WALLS AND SIGNS (ASCE 7-16 SECTION 29.4.1)

WIND ON CHAINLINK FENCE (w/ WIND SCREEN) (8' TALL)

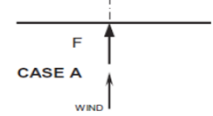
	i	Risk / Occupancy Category	Table 1.5-1
	C	Exposure Category	Figure 26.5
h	= 6	ft. Height above ground surface	
s	= 6	ft. Vertical dimension of wall or sign	
B	= 8	ft. Horizontal dimension of wall or sign	
L _r	= 0	ft. Horizontal dimension of return corner	Figure 29.3-1
s/h	= 1	Clearance ratio	Figure 29.3-1
B/s	= 1.33	Aspect ratio	Figure 29.3-1
L _r /s	= 0	Return corner aspect ratio	Figure 29.3-1
	0	L _r /s reduction factor	
A _s	= 48	ft ² Gross area of solid free standing wall or sign	Figure 29.3-1
V	= 89	mph Basic wind speed	Figure 26.5-1A
K _z	= 0.85	velocity exposure coefficient	Table 29.3-1
K _{zt}	= 1	= (1 + K ₁ K ₂ K ₃) _z directionality Factor	(26.8-1)
K _d	= 0.85		Table 26.6-1
G	= 0.85	gust-effect factor	
h'	= 3.30	ft. Resultant location of load above ground surface	
q _h	= 14.65	psf pressure at height h	$q_h = .00256K_zK_{zt}K_dV^2$

LOAD CASES

CASE A RESULTANT FORCE THROUGH THE GEOMETRIC CENTER

Figure 29.4-1

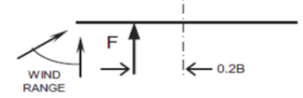
C _f	= 1.45	net force coefficient	(pg. 323)
q _h	= 14.65	psf velocity pressure at height, h	
P	= 18.1	psf = q _h G C _f pressure at height h	



CASE B RESULTANT FORCE at 0.2B FROM GEOMETRIC CENTER

Figure 29.4-1

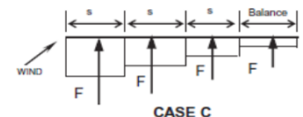
C _f	= 1.45	net force coefficient	
q _h	= 14.65	psf velocity pressure at height, h	
P	= 18.1	psf pressure at height h	



CASE C RESULTANT FORCE AT GEMETRIC CENTER OF REGIONS ALONG WALL OR SIGN

Figure 29.4-1

RF ₁	= 0.96	Reduction Factor for Case C for C _f >3.0
RF ₂	= 0.80	Reduction Factor for Case C



L _r /s	Reduction Factor
0.3	0.9
1	0.75
≥2	0.6

B/s = 1.33 Case C need not be considered

FOR B/s > 2 CASE C MUST BE CONSIDERED

Aspect Ratio B/s ≤ 10 (1.334)							Aspect Ratio B/s > 10 (1.334)						
Region	Dist	A _i	C _f	P _i (psf)	F (lbs)	M (kip-ft)	Region	Dist	A _i	C _f	P _i (psf)	F (lbs)	M (kip-ft)
0 to s	6	36	0	0	0	0.00	0 to s	6	36	0	0.0	0	0
s to 2s	12	36	0	0	0	0.00	s to 2s	36	36	0	0.0	0	0
2s to 3s	18	36	0	0	0	0.00	2s to 3s	36	36	0	0.0	0	0
3s to 10s	24	36	0	0	0	0.00	3s to 4s	36	36	0	0.0	0	0
max =	0.0	psf		∑	0	0.00	4s to 5s	36	36	0	0.0	0	0
							5s to 6s	36	36	0	0.0	0	0
							>10s	8	36	0	0.0	0	0
							max =	0.0	psf		∑	0	0

DESIGN SUMMARY RESULTS

Design Summary:

	Strength	ASD
Max horizontal wind pressure	= 18.1 psf	10.8 psf
Max horizontal force at centroid	= 0.87 kips	0.5 kps
Max overturning moment	= 2.9 kip-ft	1.7 kip-ft
Max torsion at centroid	= -1.4 kip-ft	-0.8 kip-ft

Pole Footing Embedded in Soil

File: 04-3_FOUNDATION_CHAINLINK FENCE.ec6
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.17
 Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 6' Tall Chainlink Fence Post (w/o Windscreen)

Code References

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

Load Combinations Used : ASCE 7-16

General Information

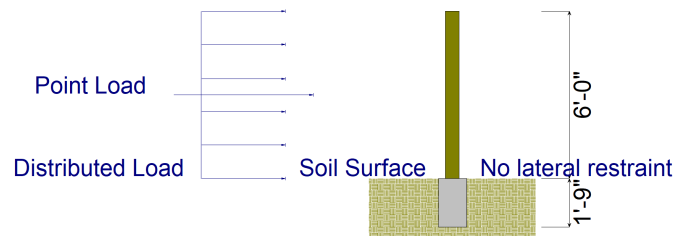
Pole Footing Shape	Circular
Pole Footing Diameter	12.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	300.0 pcf
Max Passive	1,000.0 pcf

Controlling Values

Governing Load Combination : +1.068D+0.70E	
Lateral Load	0.04270 k
Moment	0.1281 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	169.942 psf
Allowable	171.138 psf

Minimum Required Depth	1.750 ft
------------------------	----------

Footing Base Area	0.7854 ft ²
Maximum Soil Pressure	0.6802 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load		0.50 k
Lr : Roof Live		k
L : Live		k
S : Snow		k
W : Wind	0.002780	k
E : Earthquake		k
H : Lateral Earth		k
Load distance above ground surface	TOP of Load above ground surface	
3.0 ft	6.0	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+0.60W	0.010	0.030	1.13	98.3	101.0	1.000
+D-0.60W	0.010	0.030	1.13	98.3	101.0	1.000
+D+0.450W	0.008	0.023	1.00	88.5	91.1	1.000
+D-0.450W	0.008	0.023	1.00	88.5	91.1	1.000
+0.60D+0.60W	0.010	0.030	1.13	98.3	101.0	1.000
+0.60D-0.60W	0.010	0.030	1.13	98.3	101.0	1.000
+1.068D+0.70E	0.043	0.128	1.75	169.9	171.1	1.000
+1.068D-0.70E	0.043	0.128	1.75	169.9	171.1	1.000

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

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Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 6' Tall Chainlink Fence Post (w/o Windscreen)

+1.051D+0.5250E	0.032	0.096	1.63	152.5	153.7	1.000
+1.051D-0.5250E	0.032	0.096	1.63	152.5	153.7	1.000
+0.5315D+0.70E	0.043	0.128	1.75	169.9	171.1	1.000
+0.5315D-0.70E	0.043	0.128	1.75	169.9	171.1	1.000

Pole Footing Embedded in Soil

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 Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 6' Tall Chainlink Fence Post (w/ Windscreen)

Code References

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

General Information

Pole Footing Shape Circular
 Pole Footing Diameter 12.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive 300.0 pcf
 Max Passive 1,000.0 pcf

Controlling Values

Governing Load Combination : +D+0.60W
 Lateral Load 0.5220 k
 Moment 1.566 k-ft

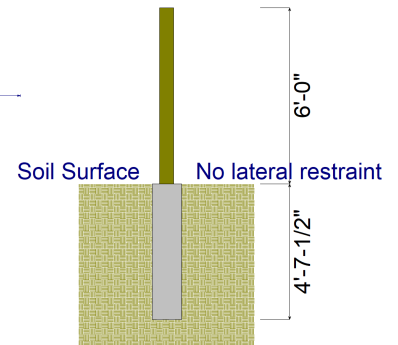
NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual 457.418 psf
 Allowable 457.785 psf

Minimum Required Depth 4.625 ft

Footing Base Area 0.7854 ft²
 Maximum Soil Pressure 0.6802 ksf

Point Load



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load k	k/ft	0.50 k
Lr : Roof Live k	k/ft	k
L : Live k	k/ft	k
S : Snow k	k/ft	k
W : Wind 0.870 k	k/ft	k
E : Earthquake 0.0610 k	k/ft	k
H : Lateral Earth k	k/ft	k
Load distance above ground surface 3.0 ft	TOP of Load above ground surface 6.0 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+0.60W	0.522	1.566	4.63	457.4	457.8	1.000
+D-0.60W	0.522	1.566	4.63	457.4	457.8	1.000
+D+0.450W	0.392	1.175	4.13	405.5	407.3	1.000
+D-0.450W	0.392	1.175	4.13	405.5	407.3	1.000
+0.60D+0.60W	0.522	1.566	4.63	457.4	457.8	1.000
+0.60D-0.60W	0.522	1.566	4.63	457.4	457.8	1.000
+1.068D+0.70E	0.043	0.128	1.75	169.9	171.1	1.000
+1.068D-0.70E	0.043	0.128	1.75	169.9	171.1	1.000

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

File: 04-3_FOUNDATION_CHAINLINK FENCE.ec6
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Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 6' Tall Chainlink Fence Post (w/ Windscreen)

+1.051D+0.5250E	0.032	0.096	1.63	152.5	153.7	1.000
+1.051D-0.5250E	0.032	0.096	1.63	152.5	153.7	1.000
+0.5315D+0.70E	0.043	0.128	1.75	169.9	171.1	1.000
+0.5315D-0.70E	0.043	0.128	1.75	169.9	171.1	1.000

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Chainlink Fence Post Footing (8')

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	8.00 ft	
Pole Size =	3.50 in.	
Additional height from base of footing =	0.00 ft	
Weight of Structure, W_p =	160 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.10 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

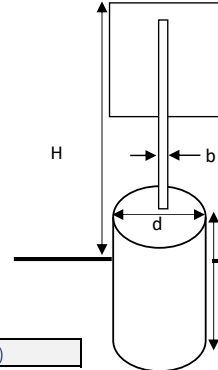
$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	3.26	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W$ =	0.49	W	(12.8-1)
Design Weight of Light Pole =	160	lbs	
Base Shear at bottom of pole, V =	0.078	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	5.333333	ft.	

Sht:	W-1
Date:	12/9/2021
#:	--
Δ :	--

ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

6' POLE w/o WINDSCREEN

Risk Category Factor	=	1
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust-effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	0.85
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	38.4



ASCE Table 1.5-1
ASCE Hazard Tool
ASCE Hazard Tool
ASCE 26.7.2
ASCE 26.7.3
ASCE 26.9.5

ASCE Table 26.10-1
ASCE Table 26.6-1
Table 26.9-1
ASCE (26.8.2)

Figures 29.4-1 through 29.4-4

Velocity Pressure: $q_h = .00256 K_z K_{zt} K_d K_e V^2$	=	16.37 (psf)
Elevation of applied load from ground level	=	8 ft.
Total Height of Pole From Base Plate H	=	8 ft.

ASCE (26.10-1)

Design Wind Force, $F = q_z G C_f A_r$ ASD = 10.02 psf	=	16.70 A_r (psf)
--	---	-------------------

ASCE 29.4-1

A_r projected area normal to applied wind force	=	1.667 ft. ²
M_w	=	0.11 kip-ft
b , diameter of round post or diagonal dimension of square post	=	2.50 in.
d , diameter of footing	=	12 in.
Pole Type	=	round
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	3.48 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_r$	=	27.8 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	0.1 kip-ft

ASCE 29.5-1

Assumed

ASCE (29.4-1)

SOLID FREE STANDING WALLS AND SIGNS (ASCE 7-16 SECTION 29.4.1)

WIND ON CHAINLINK FENCE (w/ WIND SCREEN) (8' TALL)

	i	Risk / Occupancy Category	Table 1.5-1
	C	Exposure Category	Figure 26.5
h	= 8	ft. Height above ground surface	
s	= 8	ft. Vertical dimension of wall or sign	
B	= 8	ft. Horizontal dimension of wall or sign	
L _r	= 0	ft. Horizontal dimension of return corner	Figure 29.3-1
s/h	= 1	Clearance ratio	Figure 29.3-1
B/s	= 1.00	Aspect ratio	Figure 29.3-1
L _r /s	= 0	Return corner aspect ratio	Figure 29.3-1
	0	L _r /s reduction factor	
A _s	= 64	ft ² Gross area of solid free standing wall or sign	Figure 29.3-1
V	= 89	mph Basic wind speed	Figure 26.5-1A
K _z	= 0.85	velocity exposure coefficient	Table 29.3-1
K _{zt}	= 1	= (1+ K ₁ K ₂ K ₃) _z directionality Factor	(26.8-1)
K _d	= 0.85		Table 26.6-1
G	= 0.85	gust-effect factor	
h'	= 4.40	ft. Resultant location of load above ground surface	
q _h	= 14.65	psf pressure at height h	$q_h = .00256K_zK_{zt}K_dV^2$

LOAD CASES

CASE A RESULTANT FORCE THROUGH THE GEOMETRIC CENTER

Figure 29.4-1

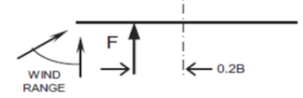
C _f	= 1.45	net force coefficient	(pg. 323)
q _h	= 14.65	psf velocity pressure at height, h	
P	= 18.1	psf = q _h G C _f pressure at height h	



CASE B RESULTANT FORCE at 0.2B FROM GEOMETRIC CENTER

Figure 29.4-1

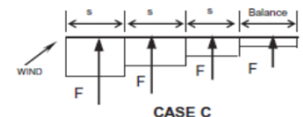
C _f	= 1.45	net force coefficient	
q _h	= 14.65	psf velocity pressure at height, h	
P	= 18.1	psf pressure at height h	



CASE C RESULTANT FORCE AT GEMETRIC CENTER OF REGIONS ALONG WALL OR SIGN

Figure 29.4-1

RF ₁	= 0.96	Reduction Factor for Case C for C _f >3.0
RF ₂	= 0.80	Reduction Factor for Case C



L _r /s	Reduction Factor
0.3	0.9
1	0.75
≥2	0.6

B/s = 1.00 Case C need not be considered

FOR B/s > 2 CASE C MUST BE CONSIDERED

Aspect Ratio B/s ≤ 10 (1)							Aspect Ratio B/s > 10 (1)						
Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)	Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)
0 to s	8	64	0	0	0	0.00	0 to s	8	64	0	0.0	0	0
s to 2s	16	64	0	0	0	0.00	s to 2s	64	0	0	0.0	0	0
2s to 3s	24	64	0	0	0	0.00	2s to 3s	64	0	0	0.0	0	0
3s to 10s	32	64	0	0	0	0.00	3s to 4s	64	0	0	0.0	0	0
max =	0.0	psf		∑	0	0.00	4s to 5s	64	0	0	0.0	0	0
							5s to 6s	64	0	0	0.0	0	0
							>10s	8	64	0	0.0	0	0
							max =	0.0	psf		∑	0	0

DESIGN SUMMARY RESULTS

Design Summary:

		Strength	ASD
Max horizontal wind pressure	=	18.1 psf	10.8 psf
Max horizontal force at centroid	=	1.2 kips	0.7 kps
Max overturning moment	=	5.1 kip-ft	3.1 kip-ft
Max torsion at centroid	=	-1.8 kip-ft	-1.1 kip-ft

Pole Footing Embedded in Soil

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 Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 8' Tall Chainlink Fence Post (w/o Windscreen)

Code References

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

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	12.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	300.0 pcf
Max Passive	1,000.0 pcf

Controlling Values

Governing Load Combination	: +1.068D+0.70E
Lateral Load	0.05460 k
Moment	0.2184 k-ft

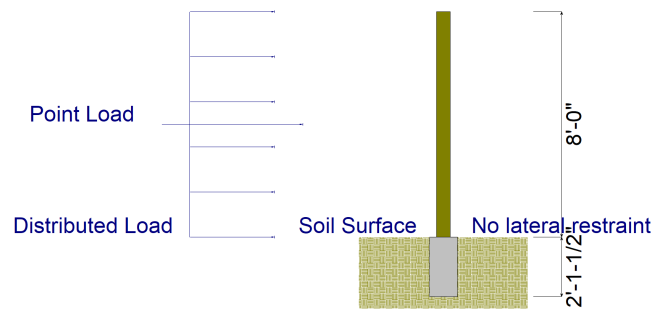
NO Ground Surface Restraint

Pressures at 1/3 Depth

Actual	200.974 psf
Allowable	201.279 psf

Minimum Required Depth	2.125 ft
------------------------	----------

Footing Base Area	0.7854 ft ²
Maximum Soil Pressure	0.6462 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load		0.4750 k
Lr : Roof Live		k
L : Live		k
S : Snow		k
W : Wind	0.003480	k
E : Earthquake		k
H : Lateral Earth		k
Load distance above ground surface	TOP of Load above ground surface	
4.0 ft	8.0	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+0.60W	0.017	0.067	1.38	130.2	130.4	1.000
+D-0.60W	0.017	0.067	1.38	130.2	130.4	1.000
+D+0.450W	0.013	0.050	1.25	117.5	117.5	1.000
+D-0.450W	0.013	0.050	1.25	117.5	117.5	1.000
+0.60D+0.60W	0.017	0.067	1.38	130.2	130.4	1.000
+0.60D-0.60W	0.017	0.067	1.38	130.2	130.4	1.000
+1.068D+0.70E	0.055	0.218	2.13	201.0	201.3	1.000
+1.068D-0.70E	0.055	0.218	2.13	201.0	201.3	1.000

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

File: 04-3_FOUNDATION_CHAINLINK FENCE.ec6
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Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 8' Tall Chainlink Fence Post (w/o Windscreen)

+1.051D+0.5250E	0.041	0.164	1.88	179.7	181.5	1.000
+1.051D-0.5250E	0.041	0.164	1.88	179.7	181.5	1.000
+0.5315D+0.70E	0.055	0.218	2.13	201.0	201.3	1.000
+0.5315D-0.70E	0.055	0.218	2.13	201.0	201.3	1.000

Pole Footing Embedded in Soil

Lic. #: KW-06008078

DESCRIPTION: 8' Tall Chainlink Fence Post (w/ Windscreen)

Code References

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

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	12.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	300.0 pcf
Max Passive	1,000.0 pcf

Controlling Values

Governing Load Combination	: +D+0.60W
Lateral Load	0.720 k
Moment	2.880 k-ft

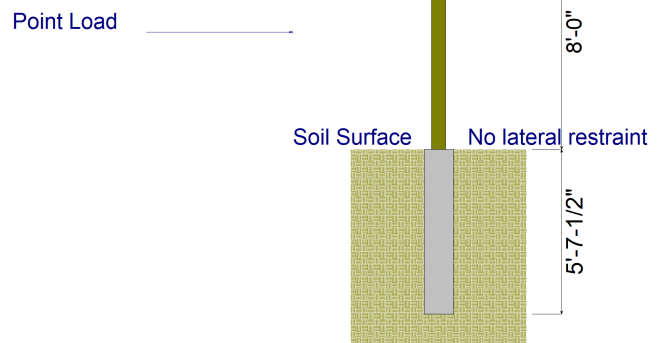
NO Ground Surface Restraint

Pressures at 1/3 Depth

Actual	548.56 psf
Allowable	550.42 psf

Minimum Required Depth	5.625 ft
------------------------	----------

Footing Base Area	0.7854 ft ²
Maximum Soil Pressure	0.6122 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load	k	0.450 k
Lr : Roof Live	k	k
L : Live	k	k
S : Snow	k	k
W : Wind	1.20 k	k
E : Earthquake	0.0780 k	k
H : Lateral Earth	k	k
Load distance above ground surface	TOP of Load above ground surface	
4.0 ft	8.0	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+0.60W	0.720	2.880	5.63	548.6	550.4	1.000
+D-0.60W	0.720	2.880	5.63	548.6	550.4	1.000
+D+0.450W	0.540	2.160	5.00	488.0	489.5	1.000
+D-0.450W	0.540	2.160	5.00	488.0	489.5	1.000
+0.60D+0.60W	0.720	2.880	5.63	548.6	550.4	1.000
+0.60D-0.60W	0.720	2.880	5.63	548.6	550.4	1.000
+1.068D+0.70E	0.055	0.218	2.13	201.0	201.3	1.000
+1.068D-0.70E	0.055	0.218	2.13	201.0	201.3	1.000

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

File: 04-3_FOUNDATION_CHAINLINK FENCE.ec6
Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.17
Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 8' Tall Chainlink Fence Post (w/ Windscreen)

+1.051D+0.5250E	0.041	0.164	1.88	179.7	181.5	1.000
+1.051D-0.5250E	0.041	0.164	1.88	179.7	181.5	1.000
+0.5315D+0.70E	0.055	0.218	2.13	201.0	201.3	1.000
+0.5315D-0.70E	0.055	0.218	2.13	201.0	201.3	1.000

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Chainlink Fence Post Footing (10')

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	10.00 ft	
Pole Size =	4.00 in.	
Additional height from base of footing =	0.00 ft	
Weight of Structure, W_p =	231 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.11 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

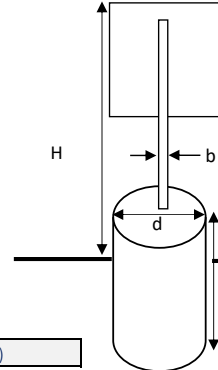
$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	2.76	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W$ =	0.49	W	(12.8-1)
Design Weight of Light Pole =	231	lbs	
Base Shear at bottom of pole, V =	0.113	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	6.666667	ft.	

Sht:	W-1
Date:	12/9/2021
#:	--
Δ :	--

ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

6' POLE w/o WINDSCREEN

Risk Category Factor	=	1
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust -effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	0.85
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	40.0



ASCE Table 1.5-1
ASCE Hazard Tool
ASCE Hazard Tool
ASCE 26.7.2
ASCE 26.7.3
ASCE 26.9.5

ASCE Table 26.10-1
ASCE Table 26.6-1
Table 26.9-1
ASCE (26.8.2)

Figures 29.4-1 through 29.4-4

Velocity Pressure: $q_h = .00256 K_z K_{zt} K_d K_e V^2$	=	16.37 (psf)
Elevation of applied load from ground level	=	10 ft.
Total Height of Pole From Base Plate H	=	10 ft.

ASCE (26.10-1)

Design Wind Force, $F = q_z G C_f A_r$ ASD = 10.02 psf	=	16.70 A_r (psf)
--	---	-------------------

ASCE 29.4-1

A_r projected area normal to applied wind force	=	2.500 ft. ²
M_w	=	0.21 kip-ft
b , diameter of round post or diagonal dimension of square post	=	3.00 in.
d , diameter of footing	=	12 in.
Pole Type	=	round
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	4.17 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_r$	=	41.7 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	0.2 kip-ft

ASCE 29.5-1

Assumed

ASCE (29.4-1)

SOLID FREE STANDING WALLS AND SIGNS (ASCE 7-16 SECTION 29.4.1)

WIND ON CHAINLINK FENCE (w/ WIND SCREEN) (10' TALL)

	i	Risk / Occupancy Category	Table 1.5-1
	C	Exposure Category	Figure 26.5
h	= 10	ft. Height above ground surface	
s	= 10	ft. Vertical dimension of wall or sign	
B	= 8	ft. Horizontal dimension of wall or sign	
L _r	= 0	ft. Horizontal dimension of return corner	Figure 29.3-1
s/h	= 1	Clearance ratio	Figure 29.3-1
B/s	= 0.80	Aspect ratio	Figure 29.3-1
L _r /s	= 0	Return corner aspect ratio	Figure 29.3-1
	0	L _r /s reduction factor	
A _s	= 80	ft ² Gross area of solid free standing wall or sign	Figure 29.3-1
V	= 89	mph Basic wind speed	Figure 26.5-1A
K _z	= 0.85	velocity exposure coefficient	Table 29.3-1
K _{zt}	= 1	= (1 + K ₁ K ₂ K ₃) _z directionality Factor	(26.8-1)
K _d	= 0.85		Table 26.6-1
G	= 0.85	gust-effect factor	
h'	= 5.50	ft. Resultant location of load above ground surface	
q _h	= 14.65	psf pressure at height h	$q_h = .00256K_zK_{zt}K_dV^2$

LOAD CASES

CASE A RESULTANT FORCE THROUGH THE GEOMETRIC CENTER

Figure 29.4-1

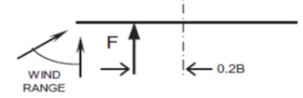
C _f	= 1.49	net force coefficient	(pg. 323)
q _h	= 14.65	psf velocity pressure at height, h	
P	= 18.6	psf = q _h G C _f pressure at height h	



CASE B RESULTANT FORCE at 0.2B FROM GEOMETRIC CENTER

Figure 29.4-1

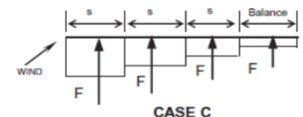
C _f	= 1.49	net force coefficient	
q _h	= 14.65	psf velocity pressure at height, h	
P	= 18.6	psf pressure at height h	



CASE C RESULTANT FORCE AT GEMETRIC CENTER OF REGIONS ALONG WALL OR SIGN

Figure 29.4-1

RF ₁	= 0.96	Reduction Factor for Case C for C _f >3.0
RF ₂	= 0.80	Reduction Factor for Case C



L _r /s	Reduction Factor
0.3	0.9
1	0.75
≥2	0.6

B/s = 0.80 Case C need not be considered

FOR B/s > 2 CASE C MUST BE CONSIDERED

Aspect Ratio B/s ≤ 10 (0.8)							Aspect Ratio B/s > 10 (0.8)						
Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)	Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)
0 to s	10	100	0	0	0	0.00	0 to s	10	100	0	0.0	0	0
s to 2s	20	100	0	0	0	0.00	s to 2s	100	0	0.0	0	0	0
2s to 3s	30	100	0	0	0	0.00	2s to 3s	100	0	0.0	0	0	0
3s to 10s	40	100	0	0	0	0.00	3s to 4s	100	0	0.0	0	0	0
max =	0.0	psf		∑	0	0.00	4s to 5s	100	0	0.0	0	0	0
							5s to 6s	100	0	0.0	0	0	0
							>10s	8	100	0	0.0	0	0
							max =	0.0	psf		∑	0	0

DESIGN SUMMARY RESULTS

Design Summary:

	Strength	ASD
Max horizontal wind pressure	= 18.6 psf	11.1 psf
Max horizontal force at centroid	= 1.5 kips	0.9 kps
Max overturning moment	= 8.2 kip-ft	4.9 kip-ft
Max torsion at centroid	= -2.4 kip-ft	-1.4 kip-ft

Pole Footing Embedded in Soil

File: 04-3_FOUNDATION_CHAINLINK FENCE.ec6
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 Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 10' Tall Chainlink Fence Post (w/o Windscreen)

Code References

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

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	12.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	300.0 pcf
Max Passive	1,000.0 pcf

Controlling Values

Governing Load Combination :	+1.068D+0.70E
Lateral Load	0.09240 k
Moment	0.9240 k-ft

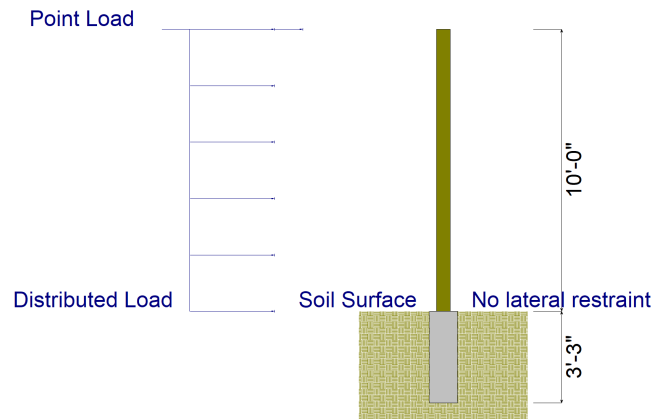
NO Ground Surface Restraint

Pressures at 1/3 Depth

Actual	310.348 psf
Allowable	312.598 psf

Minimum Required Depth	3.250 ft
------------------------	----------

Footing Base Area	0.7854 ft ²
Maximum Soil Pressure	0.8162 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load		0.60 k
Lr : Roof Live		k
L : Live		k
S : Snow		k
W : Wind	0.004170	k
E : Earthquake		k
H : Lateral Earth		k
Load distance above ground surface	TOP of Load above ground surface	
10.0 ft	10.0	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+0.60W	0.025	0.125	1.63	159.8	160.8	1.000
+D-0.60W	0.025	0.125	1.63	159.8	160.8	1.000
+D+0.450W	0.019	0.094	1.50	144.5	144.8	1.000
+D-0.450W	0.019	0.094	1.50	144.5	144.8	1.000
+0.60D+0.60W	0.025	0.125	1.63	159.8	160.8	1.000
+0.60D-0.60W	0.025	0.125	1.63	159.8	160.8	1.000
+1.068D+0.70E	0.092	0.924	3.25	310.3	312.6	1.000
+1.068D-0.70E	0.092	0.924	3.25	310.3	312.6	1.000

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

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Lic. # : KW-06008078

DESCRIPTION: 10' Tall Chainlink Fence Post (w/o Windscreen)

+1.051D+0.5250E	0.069	0.693	2.88	281.1	281.3	1.000
+1.051D-0.5250E	0.069	0.693	2.88	281.1	281.3	1.000
+0.5315D+0.70E	0.092	0.924	3.25	310.3	312.6	1.000
+0.5315D-0.70E	0.092	0.924	3.25	310.3	312.6	1.000

Pole Footing Embedded in Soil

Lic. # : KW-06008078

DESCRIPTION: 10' Tall Chainlink Fence Post (w/ Windscreen)

Code References

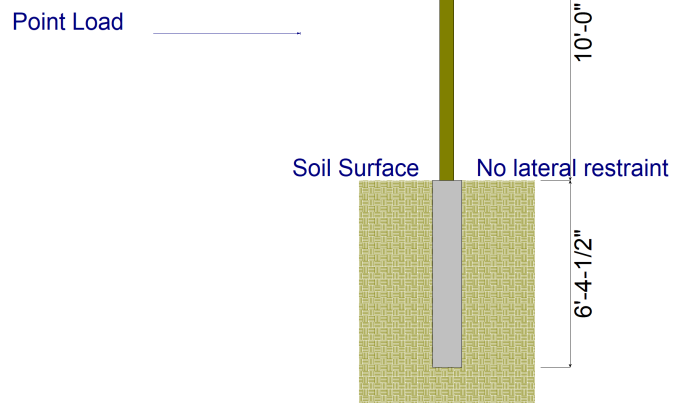
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	12.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	300.0 pcf
Max Passive	1,000.0 pcf

Controlling Values	
Governing Load Combination	: +D+0.60W
Lateral Load	0.90 k
Moment	4.50 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	627.32 psf
Allowable	627.36 psf
Minimum Required Depth 6.375 ft	
Footing Base Area	0.7854 ft ²
Maximum Soil Pressure	1.020 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load		0.750 k
Lr : Roof Live		k
L : Live		k
S : Snow		k
W : Wind	0.0	k
E : Earthquake		k
H : Lateral Earth		k
Load distance above ground surface	TOP of Load above ground surface	
5.0 ft	10.0	
	BOTTOM of Load above ground surface	

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+0.60W	0.900	4.500	6.38	627.3	627.4	1.000
+D-0.60W	0.900	4.500	6.38	627.3	627.4	1.000
+D+0.450W	0.675	3.375	5.63	558.2	558.9	1.000
+D-0.450W	0.675	3.375	5.63	558.2	558.9	1.000
+0.60D+0.60W	0.900	4.500	6.38	627.3	627.4	1.000
+0.60D-0.60W	0.900	4.500	6.38	627.3	627.4	1.000
+1.068D+0.70E	0.079	0.396	2.50	243.1	245.3	1.000
+1.068D-0.70E	0.079	0.396	2.50	243.1	245.3	1.000

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

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Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 10' Tall Chainlink Fence Post (w/ Windscreen)

+1.051D+0.5250E	0.059	0.297	2.25	219.8	219.8	1.000
+1.051D-0.5250E	0.059	0.297	2.25	219.8	219.8	1.000
+0.5315D+0.70E	0.079	0.396	2.50	243.1	245.3	1.000
+0.5315D-0.70E	0.079	0.396	2.50	243.1	245.3	1.000

30' HIGH SAFETY NETTING POST FOOTING

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Safety Netting Post Footing (30')

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	30.00 ft	
Pole Size =	6.00 in.	
Additional height from base of footing =	0.00 ft	
Weight of Structure, W_p =	650 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.26 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

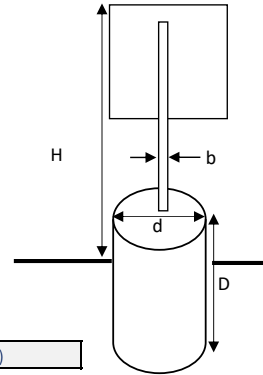
$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	1.21	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W$ =	0.49	W	(12.8-1)
Design Weight of Light Pole =	650	lbs	
Base Shear at bottom of pole, V =	0.318	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	20	ft.	

Sht:	W-1
Date:	12/7/2021
#:	--
Δ :	--

ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

30' SAFETY NETTING POST

Risk Category Factor	=	1
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust-effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	1.01
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	60.0



Velocity Pressure: $q_h = .00256 K_z K_{zt} K_d K_e V^2$	=	19.45 (psf)
Elevation of applied load from ground level	=	30 ft.
Total Height of Pole From Base Plate	H =	30 ft.

Design Wind Force, $F = q_z G C_f A_r$ ASD = 11.906 psf	=	19.84 A_r (psf)
A_r projected area normal to applied wind force	=	15.000 ft. ²
M_w	=	4.46 kip-ft
b, diameter of round post or diagonal dimension of square post	=	6.00 in.
d, diameter of footing	=	24 in.
Pole Type	=	round
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	9.92 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_r$	=	297.6 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	4.5 kip-ft

ASCE Table 1.5-1
ASCE Hazard Tool
ASCE Hazard Tool
ASCE 26.7.2
ASCE 26.7.3
ASCE 26.9.5

ASCE Table 26.10-1
ASCE Table 26.6-1
Table 26.9-1
ASCE (26.8.2)
Figures 29.4-1 through 29.4-4

ASCE (26.10-1)

ASCE 29.4-1

0 ASCE 29.5-1

Assumed

ASCE (29.4-1)

Pole Footing Embedded in Soil

Lic. # : KW-06008078

DESCRIPTION: 30' Tall Safety Netting Post

Code References

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

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 psf
 Max Passive 1,000.0 psf

Controlling Values

Governing Load Combination : +1.068D+0.70E

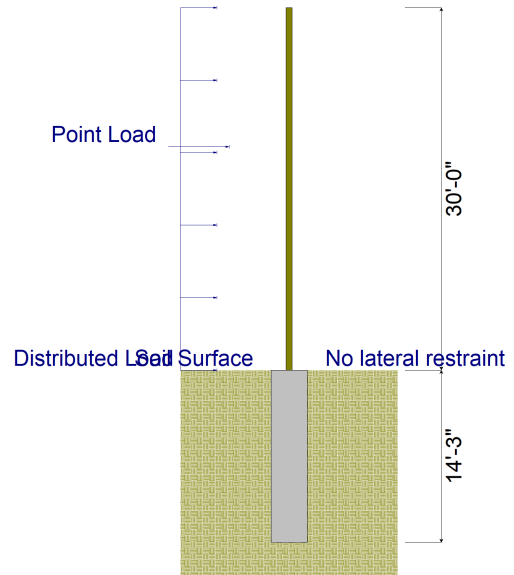
Lateral Load 7.479 k
 Moment 138.366 k-ft

NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual 1,000.0 psf
 Allowable 1,000.0 psf

Minimum Required Depth 14.250 ft

Footing Base Area 7.069 ft²
 Maximum Soil Pressure 0.09825 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load 7.0 k		0.650 k
Lr : Roof Live k		k
L : Live k		k
S : Snow k		k
W : Wind k	0.009920	k
E : Earthquake k		k
H : Lateral Earth k		k
Load distance above ground surface 18.50 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		Required Depth - (ft)	Pressure at 1/3 Depth		Soil Increase Factor
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)	
D Only	7.000	129.500	13.63	998.8	1,000.0	1.000
+D+0.60W	7.179	132.178	13.88	1,000.0	1,000.0	1.000
+D-0.60W	6.821	126.822	13.50	1,000.0	1,000.0	1.000
+D+0.450W	7.134	131.509	13.75	1,000.0	1,000.0	1.000
+D-0.450W	6.866	127.491	13.50	1,000.0	1,000.0	1.000
+0.60D+0.60W	4.379	80.378	10.25	1,000.0	1,000.0	1.000
+0.60D-0.60W	4.021	75.022	9.88	981.3	981.7	1.000
+1.068D+0.70E	7.479	138.366	14.25	1,000.0	1,000.0	1.000
+1.068D-0.70E	7.479	138.366	14.25	1,000.0	1,000.0	1.000

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

File: 05-3_FOUNDATION_SAFETY NETTING.ec6
Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.17
Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 30' Tall Safety Netting Post

+1.051D+0.5250E	7.359	136.149	14.13	1,000.0	1,000.0	1.000
+1.051D-0.5250E	7.359	136.149	14.13	1,000.0	1,000.0	1.000
+0.5315D+0.70E	3.721	68.834	9.63	951.0	951.7	1.000
+0.5315D-0.70E	3.721	68.834	9.63	951.0	951.7	1.000

SCOREBOARD POST FOOTING

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Scoreboard Post Footing (14.5')

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	14.50 ft	
Pole Size =	6.00 in.	
Additional height from base of footing =	0.00 ft	
Weight of Structure, W_p =	150 lbs	Assumed 1/2 of 300# Sign
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.15 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	2.09	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W$ =	0.49	W	(12.8-1)
Design Weight of Light Pole =	150	lbs	
Base Shear at bottom of pole, V =	0.073	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	9.666667	ft.	

SOLID FREE STANDING WALLS AND SIGNS (ASCE 7-16 SECTION 29.4.1)

WIND ON SCOREBOARD

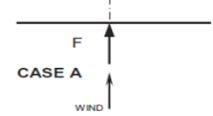
	i	Risk / Occupancy Category	Table 1.5-1
	C	Exposure Category	Figure 26.5
h	= 14.5 ft.	Height above ground surface	
s	= 5 ft.	Vertical dimension of wall or sign	
B	= 10 ft.	Horizontal dimension of wall or sign	
L _r	= 0 ft.	Horizontal dimension of return corner	Figure 29.3-1
s/h	= 0.344828	Clearance ratio	Figure 29.3-1
B/s	= 2.00	Aspect ratio	Figure 29.3-1
L _r /s	= 0	Return corner aspect ratio	Figure 29.3-1
	0	L _r /s reduction factor	
A _s	= 50 ft ²	Gross area of solid free standing wall or sign	Figure 29.3-1
V	= 89 mph	Basic wind speed	Figure 26.5-1A
K _z	= 0.85	velocity exposure coefficient	Table 29.3-1
K _{zt}	= 1 = (1 + K ₁ K ₂ K ₃) _z	directionality Factor	(26.8-1)
K _d	= 0.85		Table 26.6-1
G	= 0.85	gust-effect factor	
h'	= 7.98 ft.	Resultant location of load above ground surface	
q _h	= 14.65 psf	pressure at height h	$q_h = .00256K_zK_{zt}K_dV^2$

LOAD CASES

CASE A RESULTANT FORCE THROUGH THE GEOMETRIC CENTER

Figure 29.4-1

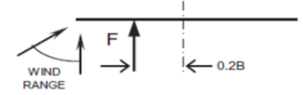
C _f	= 1.8	net force coefficient	(pg. 323)
q _h	= 14.65 psf	velocity pressure at height, h	
P	= 22.4 psf	= q _h G C _f	pressure at height h



CASE B RESULTANT FORCE at 0.2B FROM GEOMETRIC CENTER

Figure 29.4-1

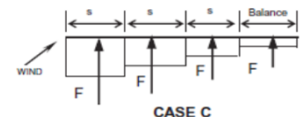
C _f	= 1.8	net force coefficient	
q _h	= 14.65 psf	velocity pressure at height, h	
P	= 22.4 psf	pressure at height h	



CASE C RESULTANT FORCE AT GEMETRIC CENTER OF REGIONS ALONG WALL OR SIGN

Figure 29.4-1

RF ₁	= 0.96	Reduction Factor for Case C for C _f >3.0
RF ₂	= 1.46	Reduction Factor for Case C



L _r /s	Reduction Factor
0.3	0.9
1	0.75
≥2	0.6

B/s = 2.00 Case C need not be considered

FOR B/s > 2 CASE C MUST BE CONSIDERED

Aspect Ratio B/s ≤ 10 (2)							Aspect Ratio B/s > 10 (2)						
Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)	Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)
0 to s	5	25	0	0	0	0.00	0 to s	5	25	0	0.0	0	0
s to 2s	10	25	0	0	0	0.00	s to 2s	10	25	0	0.0	0	0
2s to 3s	15	25	0	0	0	0.00	2s to 3s	25	25	0	0.0	0	0
3s to 10s	20	25	0	0	0	0.00	3s to 4s	25	25	0	0.0	0	0
max =	0.0	psf		Σ	0	0.00	4s to 5s	25	25	0	0.0	0	0
							5s to 6s	25	25	0	0.0	0	0
							>10s	10	25	0	0.0	0	0
							max =	0.0	psf		Σ	0	0

DESIGN SUMMARY RESULTS

Design Summary:

	Strength	ASD
Max horizontal wind pressure	= 22.4 psf	13.4 psf
Max horizontal force at centroid	= 1.1 kips	0.7 kps
Max overturning moment	= 8.9 kip-ft	5.4 kip-ft
Max torsion at centroid	= -2.2 kip-ft	-1.3 kip-ft

Pole Footing Embedded in Soil

Lic. #: KW-06008078

DESCRIPTION: 14.5' Tall Scoreboard

Code References

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

General Information

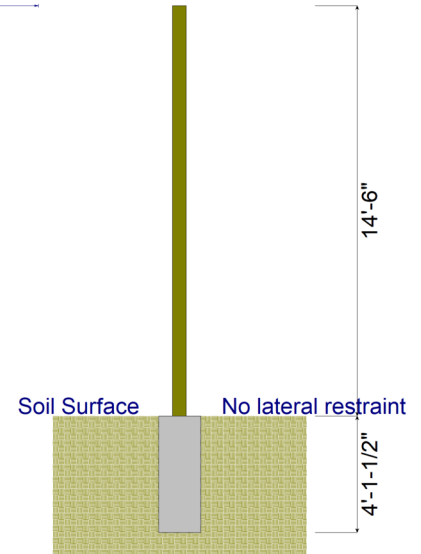
Pole Footing Shape	Circular	
Pole Footing Diameter	18.0 in	Point Load
Calculate Min. Depth for Allowable Pressures		
No Lateral Restraint at Ground Surface		
Allow Passive	300.0 pcf	
Max Passive	1,000.0 pcf	

Controlling Values

Governing Load Combination :	+D+0.60W
Lateral Load	0.210 k
Moment	3.045 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	400.629 psf
Allowable	402.702 psf

Minimum Required Depth **4.125 ft**

Footing Base Area	1.767 ft ²
Maximum Soil Pressure	0.09069 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load		0.150 k
Lr : Roof Live		k
L : Live		k
S : Snow		k
W : Wind		k
E : Earthquake		k
H : Lateral Earth		k
Load distance above ground surface	TOP of Load above ground surface	
14.50 ft	BOTTOM of Load above ground surface	

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+0.60W	0.210	3.045	4.13	400.6	402.7	1.000
+D-0.60W	0.210	3.045	4.13	400.6	402.7	1.000
+D+0.450W	0.158	2.284	3.75	362.0	363.2	1.000
+D-0.450W	0.158	2.284	3.75	362.0	363.2	1.000
+0.60D+0.60W	0.210	3.045	4.13	400.6	402.7	1.000
+0.60D-0.60W	0.210	3.045	4.13	400.6	402.7	1.000
+1.068D+0.70E	0.051	0.741	2.50	242.4	245.0	1.000
+1.068D-0.70E	0.051	0.741	2.50	242.4	245.0	1.000

Pole Footing Embedded in Soil

File: 06-3_FOUNDATION_SCOREBOARD.ec6
Software copyright ENERCALC, INC. 1983-2020, Build:12.20.5.31
Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 14.5' Tall Scoreboard

+1.051D+0.5250E	0.038	0.556	2.25	219.3	221.6	1.000
+1.051D-0.5250E	0.038	0.556	2.25	219.3	221.6	1.000
+0.5315D+0.70E	0.051	0.741	2.50	242.4	245.0	1.000
+0.5315D-0.70E	0.051	0.741	2.50	242.4	245.0	1.000

CHAINLINK GATE POST FOOTING

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Chainlink Gate Post Footing (10')

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	10.00 ft	
Pole Size =	3.50 in.	
Additional height from base of footing =	0.00 ft	
Weight of Structure, W_p =	575 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.11 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	2.76	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W$ =	0.49	W	(12.8-1)
Design Weight of Light Pole =	575	lbs	
Base Shear at bottom of pole, V =	0.281	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	6.666667	ft.	

SOLID FREE STANDING WALLS AND SIGNS (ASCE 7-16 SECTION 29.4.1)

WIND ON CHAINLINK GATE POST (w/ WIND SCREEN) (10' TALL)

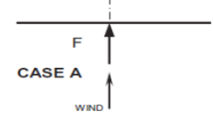
	i	Risk / Occupancy Category	Table 1.5-1
	C	Exposure Category	Figure 26.5
h	= 10	ft. Height above ground surface	
s	= 10	ft. Vertical dimension of wall or sign	
B	= 16	ft. Horizontal dimension of wall or sign	
L _r	= 0	ft. Horizontal dimension of return corner	Figure 29.3-1
s/h	= 1	Clearance ratio	Figure 29.3-1
B/s	= 1.60	Aspect ratio	Figure 29.3-1
L _r /s	= 0	Return corner aspect ratio	Figure 29.3-1
	0	L _r /s reduction factor	
A _s	= 160	ft ² Gross area of solid free standing wall or sign	Figure 29.3-1
V	= 89	mph Basic wind speed	Figure 26.5-1A
K _z	= 0.85	velocity exposure coefficient	Table 29.3-1
K _{zt}	= 1	= (1 + K ₁ K ₂ K ₃) _z directionality Factor	(26.8-1)
K _d	= 0.85		Table 26.6-1
G	= 0.85	gust-effect factor	
h'	= 5.50	ft. Resultant location of load above ground surface	
q _h	= 14.65	psf pressure at height h	$q_h = .00256K_zK_{zt}K_dV^2$

LOAD CASES

CASE A RESULTANT FORCE THROUGH THE GEOMETRIC CENTER

Figure 29.4-1

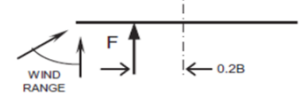
C _f	= 1.42	net force coefficient	(pg. 323)
q _h	= 14.65	psf velocity pressure at height, h	
P	= 17.7	psf = q _h G C _f pressure at height h	



CASE B RESULTANT FORCE at 0.2B FROM GEOMETRIC CENTER

Figure 29.4-1

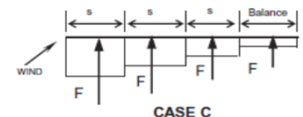
C _f	= 1.42	net force coefficient	
q _h	= 14.65	psf velocity pressure at height, h	
P	= 17.7	psf pressure at height h	



CASE C RESULTANT FORCE AT GEMETRIC CENTER OF REGIONS ALONG WALL OR SIGN

Figure 29.4-1

RF ₁	= 0.96	Reduction Factor for Case C for C _f >3.0
RF ₂	= 0.80	Reduction Factor for Case C



L _r /s	Reduction Factor
0.3	0.9
1	0.75
≥2	0.6

B/s = 1.60 Case C need not be considered

FOR B/s > 2 CASE C MUST BE CONSIDERED

Aspect Ratio B/s ≤ 10 (1.6)							Aspect Ratio B/s > 10 (1.6)						
Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)	Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)
0 to s	10	100	0	0	0	0.00	0 to s	10	100	0	0.0	0	0
s to 2s	20	100	0	0	0	0.00	s to 2s	100	100	0	0.0	0	0
2s to 3s	30	100	0	0	0	0.00	2s to 3s	100	100	0	0.0	0	0
3s to 10s	40	100	0	0	0	0.00	3s to 4s	100	100	0	0.0	0	0
max =	0.0	psf		∑	0	0.00	4s to 5s	100	100	0	0.0	0	0
							5s to 6s	100	100	0	0.0	0	0
							>10s	16	100	0	0.0	0	0
							max =	0.0	psf		∑	0	0

DESIGN SUMMARY RESULTS

Design Summary:

		Strength	ASD
Max horizontal wind pressure	=	17.7 psf	10.6 psf
Max horizontal force at centroid	=	2.8 kips	1.7 kps
Max overturning moment	=	15.6 kip-ft	9.3 kip-ft
Max torsion at centroid	=	-9.0 kip-ft	-5.4 kip-ft

Pole Footing Embedded in Soil

File: 07-3_FOUNDATION_CHAINLINK_GATE.ec6
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 Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 10' Tall Chainlink Gate Post (w/ Windscreen)

Code References

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

General Information

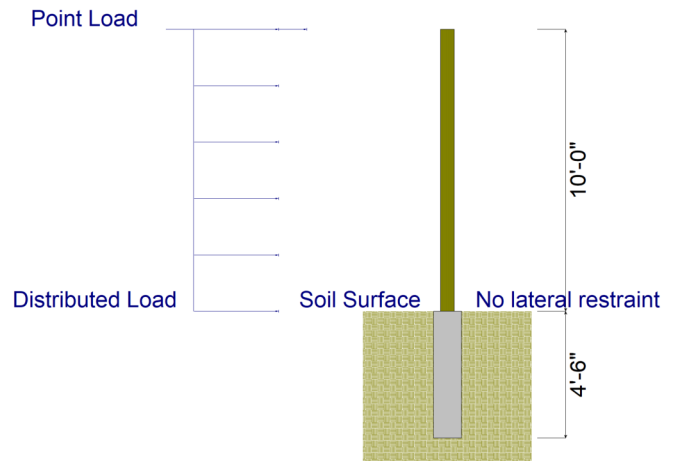
Pole Footing Shape Circular
 Pole Footing Diameter 12.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive 300.0 psf
 Max Passive 1,000.0 psf

Controlling Values

Governing Load Combination : +D+0.60W
 Lateral Load 0.3816 k
 Moment 1.908 k-ft
NO Ground Surface Restraint
 Pressures at 1/3 Depth
 Actual 445.311 psf
 Allowable 445.712 psf

Minimum Required Depth 4.50 ft

Footing Base Area 0.7854 ft²
 Maximum Soil Pressure 1.020 ksf



Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (klf)		Vertical Load (k)	
D : Dead Load	k		k/ft		0.750 k
Lr : Roof Live	k		k/ft		k
L : Live	k		k/ft		k
S : Snow	k		k/ft		k
W : Wind	k	0.06360	k/ft		k
E : Earthquake	0.2810 k		k/ft		k
H : Lateral Earth	k		k/ft		k
Load distance above ground surface	10.0 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		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+0.60W	0.382	1.908	4.50	445.3	445.7	1.000
+D-0.60W	0.382	1.908	4.50	445.3	445.7	1.000
+D+0.450W	0.286	1.431	4.00	396.8	399.2	1.000
+D-0.450W	0.286	1.431	4.00	396.8	399.2	1.000
+0.60D+0.60W	0.382	1.908	4.50	445.3	445.7	1.000
+0.60D-0.60W	0.382	1.908	4.50	445.3	445.7	1.000
+1.068D+0.70E	0.197	1.967	4.13	409.0	411.0	1.000
+1.068D-0.70E	0.197	1.967	4.13	409.0	411.0	1.000

Pole Footing Embedded in Soil

File: 07-3_FOUNDATION_CHAINLINK GATE.ec6
Software copyright ENERCALC, INC. 1983-2020, Build:12.20.5.31
Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 10' Tall Chainlink Gate Post (w/ Windscreen)

+1.051D+0.5250E	0.148	1.475	3.75	367.9	370.1	1.000
+1.051D-0.5250E	0.148	1.475	3.75	367.9	370.1	1.000
+0.5315D+0.70E	0.197	1.967	4.13	409.0	411.0	1.000
+0.5315D-0.70E	0.197	1.967	4.13	409.0	411.0	1.000

MONUMENT SIGN FOOTING

SOLID FREE STANDING WALLS AND SIGNS (ASCE 7-16 SECTION 29.4.1)

WIND ON MONUMENT SIGN

	i	Risk / Occupancy Category	Table 1.5-1
	C	Exposure Category	Figure 26.5
h	= 3	ft. Height above ground surface	
s	= 3	ft. Vertical dimension of wall or sign	
B	= 8	ft. Horizontal dimension of wall or sign	
L _r	= 0	ft. Horizontal dimension of return corner	Figure 29.3-1
s/h	= 1	Clearance ratio	Figure 29.3-1
B/s	= 2.67	Aspect ratio	Figure 29.3-1
L _r /s	= 0	Return corner aspect ratio	Figure 29.3-1
	0	L _r /s reduction factor	
A _s	= 24	ft ² Gross area of solid free standing wall or sign	Figure 29.3-1
V	= 89	mph Basic wind speed	Figure 26.5-1A
K _z	= 0.85	velocity exposure coefficient	Table 29.3-1
K _{zt}	= 1	= (1 + K ₁ K ₂ K ₃) _z directionality Factor	(26.8-1)
K _d	= 0.85		Table 26.6-1
G	= 0.85	gust-effect factor	
h'	= 1.65	ft. Resultant location of load above ground surface	
q _h	= 14.65	psf pressure at height h	$q_h = .00256K_zK_{zt}K_dV^2$

LOAD CASES

CASE A RESULTANT FORCE THROUGH THE GEOMETRIC CENTER

Figure 29.4-1

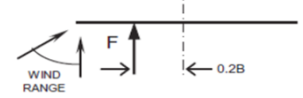
C _f	= 1.37	net force coefficient	(pg. 323)
q _h	= 14.65	psf velocity pressure at height, h	
P	= 17.1	psf = q _h G C _f pressure at height h	



CASE B RESULTANT FORCE at .2B FROM GEOMETRIC CENTER

Figure 29.4-1

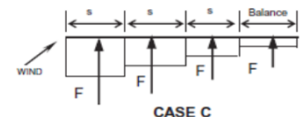
C _f	= 1.37	net force coefficient	
q _h	= 14.65	psf velocity pressure at height, h	
P	= 17.1	psf pressure at height h	



CASE C RESULTANT FORCE AT GEMETRIC CENTER OF REGIONS ALONG WALL OR SIGN

Figure 29.4-1

RF ₁	= 0.96	Reduction Factor for Case C for C _f > 3.0
RF ₂	= 0.80	Reduction Factor for Case C



L _r /s	Reduction Factor
0.3	0.9
1	0.75
≥2	0.6

B/s = 2.67 Case C must be considered

FOR B/s > 2 CASE C MUST BE CONSIDERED

Aspect Ratio B/s ≤ 10 (2.667)							Aspect Ratio B/s > 10 (2.667)						
Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)	Region	Dist	A _i	C _F	P _i (psf)	F (lbs)	M (kip-ft)
0 to s	3	9	3.44	33.047	297.42	0.49	0 to s	3	9		0.0	0	0
s to 2s	6	9	2.26	22.515	202.64	0.33	s to 2s	6	9		0.0	0	0
2s to 3s	9	9	1.66	16.538	148.84	0.25	2s to 3s	9	9		0.0	0	0
3s to 10s	12	9	1.05	10.461	94.145	0.16	3s to 4s	9	9		0.0	0	0
max =	33.0	psf		Σ	743.04	1.23	4s to 5s	9	9		0.0	0	0
							5s to 6s	9	9		0.0	0	0
							>10s	8	9		0.0	0	0
							max =	0.0	psf		Σ	0	0

DESIGN SUMMARY RESULTS

Design Summary:

	Strength	ASD
Max horizontal wind pressure	= 33.0 psf	19.8 psf
Max horizontal force at centroid	= 0.4 kips	0.2 kps
Max overturning moment	= 0.7 kip-ft	0.4 kip-ft
Max torsion at centroid	= -0.7 kip-ft	-0.4 kip-ft

General Footing

Lic. #: KW-06008078

DESCRIPTION: MONUMENT SIGN FOOTING

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
 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	

Soil Design Values

Allowable Soil Bearing	=	1.0	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	300.0	pcf
Soil/Concrete Friction Coeff.	=	0.530	

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
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

Increases based on footing Depth

Footing base depth below soil surface	=	1.50	ft
Allow press. increase per foot of depth when footing base is below	=		ksf

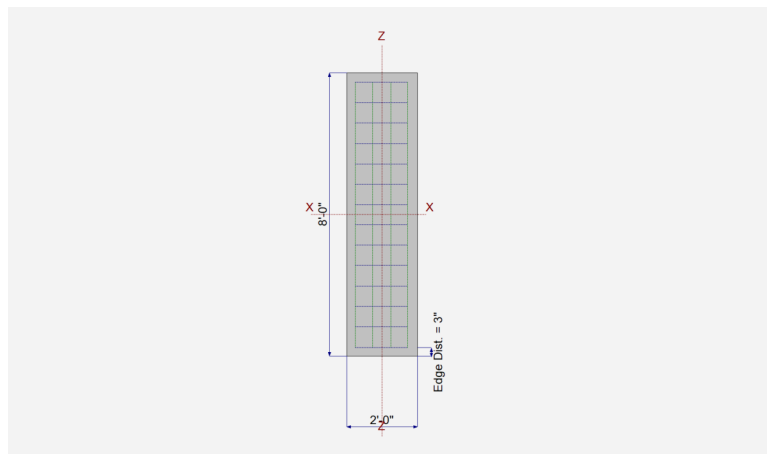
Increases based on footing plan dimension

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

Dimensions

Width parallel to X-X Axis	=	2.0	ft
Length parallel to Z-Z Axis	=	8.0	ft
Footing Thickness	=	24.0	in

Pedestal dimensions...	=		in
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

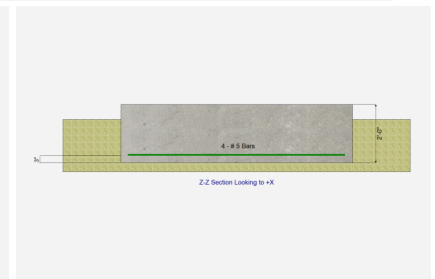
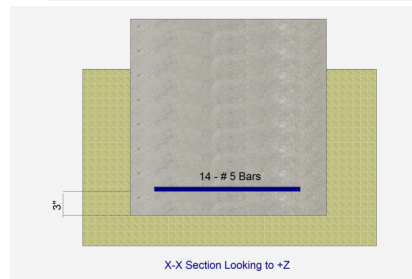
Bars parallel to X-X Axis	=	
Number of Bars	=	14
Reinforcing Bar Size	=	# 5
Bars parallel to Z-Z Axis	=	
Number of Bars	=	4.0
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

Bars along X-X Axis

# Bars required within zone	=	40.0 %
# Bars required on each side of zone	=	60.0 %



Applied Loads

	D	L _r	L	S	W	E	H
P : Column Load	=	2.0					k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k

General Footing

Lic. #: KW-06008078

DESCRIPTION: MONUMENT SIGN FOOTING

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.4150	Soil Bearing	0.4150 ksf	1.0 ksf	D Only about Z-Z axis
PASS	n/a	Overturing - X-X	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Overturing - Z-Z	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.001760	Z Flexure (+X)	0.08750 k-ft/ft	49.708 k-ft/ft	+1.40D
PASS	0.001760	Z Flexure (-X)	0.08750 k-ft/ft	49.708 k-ft/ft	+1.40D
PASS	0.02476	X Flexure (+Z)	1.40 k-ft/ft	56.555 k-ft/ft	+1.40D
PASS	0.02476	X Flexure (-Z)	1.40 k-ft/ft	56.555 k-ft/ft	+1.40D
PASS	n/a	1-way Shear (+X)	0.0 psi	75.0 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	0.02074	1-way Shear (+Z)	1.556 psi	75.0 psi	+1.40D
PASS	0.02074	1-way Shear (-Z)	1.556 psi	75.0 psi	+1.40D
PASS	n/a	2-way Punching	1.280 psi	75.0 psi	+1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Zecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
			(in)		(in)	Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.0	n/a	0.0	0.4150	0.4150	n/a	n/a	n/a	n/a	0.415
X-X, +0.60D	1.0	n/a	0.0	0.2490	0.2490	n/a	n/a	n/a	n/a	0.249
Z-Z, D Only	1.0	0.0	n/a	n/a	n/a	0.4150	0.4150	0.4150	0.4150	0.415
Z-Z, +0.60D	1.0	0.0	n/a	n/a	n/a	0.2490	0.2490	0.2490	0.2490	0.249

Overturing Stability

Rotation Axis & Load Combination...	Overturing Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturing				
All units k				

Sliding Stability

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

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	1.40	+Z	Bottom	0.5184	Min Temp %	0.620	56.555	OK
X-X, +1.40D	1.40	-Z	Bottom	0.5184	Min Temp %	0.620	56.555	OK
X-X, +1.20D	1.20	+Z	Bottom	0.5184	Min Temp %	0.620	56.555	OK
X-X, +1.20D	1.20	-Z	Bottom	0.5184	Min Temp %	0.620	56.555	OK
X-X, +0.90D	0.90	+Z	Bottom	0.5184	Min Temp %	0.620	56.555	OK
X-X, +0.90D	0.90	-Z	Bottom	0.5184	Min Temp %	0.620	56.555	OK
Z-Z, +1.40D	0.08750	-X	Bottom	0.5184	Min Temp %	0.5425	49.708	OK
Z-Z, +1.40D	0.08750	+X	Bottom	0.5184	Min Temp %	0.5425	49.708	OK
Z-Z, +1.20D	0.0750	-X	Bottom	0.5184	Min Temp %	0.5425	49.708	OK
Z-Z, +1.20D	0.0750	+X	Bottom	0.5184	Min Temp %	0.5425	49.708	OK
Z-Z, +0.90D	0.05625	-X	Bottom	0.5184	Min Temp %	0.5425	49.708	OK
Z-Z, +0.90D	0.05625	+X	Bottom	0.5184	Min Temp %	0.5425	49.708	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	0.00 psi	1.56 psi	1.56 psi	1.56 psi	75.00 psi	0.02	OK
+1.20D	0.00 psi	0.00 psi	1.33 psi	1.33 psi	1.33 psi	75.00 psi	0.02	OK
+0.90D	0.00 psi	0.00 psi	1.00 psi	1.00 psi	1.00 psi	75.00 psi	0.01	OK

General Footing

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DESCRIPTION: MONUMENT SIGN FOOTING

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	1.28 psi	150.00psi	0.008533	OK
+1.20D	1.10 psi	150.00psi	0.007314	OK
+0.90D	0.82 psi	150.00psi	0.005486	OK

BACKSTOP HOOD POST FOOTING

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Backstop Post Footing

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	30.00 ft	
Pole Size =	6.00 in.	
Additional height from base of footing =	0.00 ft	
Weight of Structure, W_p =	650 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.26 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

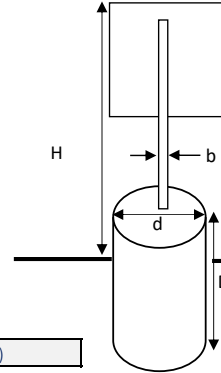
$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	1.21	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W$ =	0.49	W	(12.8-1)
Design Weight of Light Pole =	650	lbs	
Base Shear at bottom of pole, V =	0.318	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	20	ft.	

Sht:	W-1
Date:	12/7/2021
#:	--
Δ :	--

ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

BACKSTOP HOOD POST

Risk Category Factor	=	1
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust-effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	1.01
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	60.0



ASCE Table 1.5-1
ASCE Hazard Tool
ASCE Hazard Tool
ASCE 26.7.2
ASCE 26.7.3
ASCE 26.9.5

ASCE Table 26.10-1
ASCE Table 26.6-1
Table 26.9-1
ASCE (26.8.2)
Figures 29.4-1 through 29.4-4

Velocity Pressure: $q_h = .00256 K_z K_{zt} K_d K_e V^2$	=	19.45 (psf)
Elevation of applied load from ground level	=	30 ft.
Total Height of Pole From Base Plate H	=	30 ft.

ASCE (26.10-1)

Design Wind Force, $F = q_z G C_f A_r$ ASD = 11.906 psf	=	19.84 A_r (psf)
A_r projected area normal to applied wind force	=	15.000 $ft.^2$
M_w	=	4.46 kip-ft
b , diameter of round post or diagonal dimension of square post	=	6.00 in.
d , diameter of footing	=	24 in.
Pole Type	=	round
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	9.92 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_r$	=	297.6 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	4.5 kip-ft

ASCE 29.4-1

0 ASCE 29.5-1

Assumed

ASCE (29.4-1)

Project Title:
Engineer:
Project ID:
Project Descr:

Pole Footing Embedded in Soil

File: 09-3_FOUNDATION_BACKSTOP.ec6
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Innovative Structural Engineering, Inc. (ISE)

Lic. # : KW-06008078

DESCRIPTION: 30' Tall Backstop Hood Post

+1.051D+0.5250E	0.167	2.504	3.75	373.2	374.5	1.000
+1.051D-0.5250E	0.167	2.504	3.75	373.2	374.5	1.000
+0.5315D+0.70E	0.223	3.339	4.25	414.0	414.6	1.000
+0.5315D-0.70E	0.223	3.339	4.25	414.0	414.6	1.000

FOUL BALL POLE FOOTING

**Design of Non-Building Structures per ASCE 7-16
 Isolated Pole Footing**

Seismic Design of Non-Building Structures per ASCE 7-16 15.4

Design Parameters for Foul Ball Pole Footing (30')

Site Class =	D	ASCE 7-16, Sec. 11.4.2
S_s =	0.535 g	Per ASCE 7 Hazards Report
S_1 =	0.214 g	Per ASCE 7 Hazards Report
Site Coefficient, F_a =	1.372	Table 11.4-1
Site Coefficient, F_v =	2.172	Table 11.4-2
$S_{DS} = 2/3 F_a * S_s$ =	0.489	ASCE 7-16, EQ 11.4-3
Seismic Design Category =	D	1613.5.6(1) &(2)
Risk Category =	I	Table 1.5-1
$S_{D1} = 2/3 F_v * S_1$ =	0.310	ASCE 7-16, EQ 11.4-4
Importance Factor, I_e =	1.00	ASCE 7-16, Table 1.5-2
Height of Pole, z =	30.00 ft	
Pole Size =	6.00 in.	
Additional height from base of footing =	0.00 ft	
Weight of Structure, W_p =	100 lbs	From Manufacturer
R =	1.00	Table 15.4-2
Long Period Trans, T_L =	12.00 sec	Per ASCE 7 Hazards Report
C_t =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
Approximate fundamental period $T = C_t (h_n)^x$ =	0.26 sec	12.8-7

Determine Seismic Base Shear - ASCE 7-16 Section 15.4.1

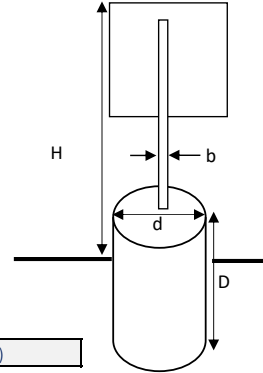
$C_s = S_{DS} / (R/I_e) =$	0.49	Seismic Response Coefficient	(12.8-2)
C_s shall not be less than:			
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215		(12.8-5)
$C_{s (min)} = 0.044 S_{DS} I_e =$	0.0215	Replace the minimum specified in eq. 12.8-5	(15.4-1)
If $S_1 \geq 0.6g$ the minimum specified value in equation 12.8-6 shall be replaced with eq 15.4-2			
$C_{s max} = .5 S_1 / (R/I_e) =$	0.107		(12.8-6)
$C_{s max} = .8 S_1 / (R/I_e) =$	0.1712		(15.4-2)
The Value of C_s need not exceed the following:			
$C_{s, Max.} =$	1.21	for $T \leq T_L$	(12.8-3)
$C_{s used} =$	0.49		
Seismic Base Shear, $V = C_s W =$	0.49	W	(12.8-1)
Design Weight of Light Pole =	100	lbs	
Base Shear at bottom of pole, $V =$	0.049	kips = $C_s W_p$	15.4.1
Seismic Load acting at 2/3 from bottom =	20	ft.	

Sht:	W-1
Date:	12/7/2021
#:	--
Δ :	--

ASCE 7 Chapter 29.5 Wind Loading on Isolated Pole

30' SAFETY NETTING POST

Risk Category Factor	=	1
Basic Wind Speed (3s Gust), V	=	89 mph
z_g ground elevation above sea level	=	1421 ft.
Surface Roughness	=	C
Exposure Category	=	C
G_f Gust-effect factor	=	0.85
Wind Load Parameters:		
K_z Velocity pressure exposure coefficient	=	1.01
K_d Wind load directionality factor	=	1
K_e Ground Elevation Factor	=	0.950
K_{zt} Topographic Factor	=	1
C_f	=	1.2
h/D	=	60.0



ASCE Table 1.5-1
ASCE Hazard Tool
ASCE Hazard Tool
ASCE 26.7.2
ASCE 26.7.3
ASCE 26.9.5

ASCE Table 26.10-1
ASCE Table 26.6-1
Table 26.9-1
ASCE (26.8.2)
Figures 29.4-1 through 29.4-4

Velocity Pressure: $q_h = .00256 K_z K_{zt} K_d K_e V^2$	=	19.45 (psf)
Elevation of applied load from ground level	=	30 ft.
Total Height of Pole From Base Plate	H =	30 ft.

ASCE (26.10-1)

Design Wind Force, $F = q_z G C_f A_r$ ASD = 11.906 psf	=	19.84 A_r (psf)
A_r projected area normal to applied wind force	=	15.000 ft. ²
M_w	=	4.46 kip-ft
b, diameter of round post or diagonal dimension of square post	=	6.00 in.
d, diameter of footing	=	24 in.
Pole Type	=	round
restrained or unrestrained ?	=	Unrestrained
Lateral Distributed Load applied on face of column $F = q_z G C_f$	=	9.92 plf
Equiv. Lateral Concentrated Load applied at center of pole $F = q_z G C_f A_r$	=	297.6 lbs
Moment Applied at Bottom of Pole $F \times 1/2H$	=	4.5 kip-ft

ASCE 29.4-1

ASCE 29.5-1

Assumed

ASCE (29.4-1)

Pole Footing Embedded in Soil

Lic. #: KW-06008078

DESCRIPTION: 30' Tall Foul Ball Pole

Code References

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

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 300.0 psf
 Max Passive 1,000.0 psf

Controlling Values

Governing Load Combination : +D+0.60W

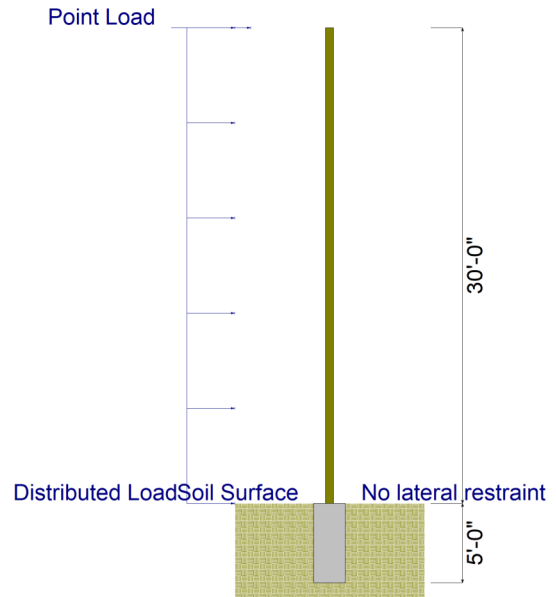
Lateral Load 0.3586 k
 Moment 8.078 k-ft

NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual **498.166** psf
 Allowable **498.811** psf

Minimum Required Depth 5.0 ft

Footing Base Area 3.142 ft²
 Maximum Soil Pressure 0.03401 ksf



Applied Loads

Lateral Concentrated Load (k)	Lateral Distributed Loads (klf)	Vertical Load (k)
D : Dead Load k		0.10 k
Lr : Roof Live k		k
L : Live k		k
S : Snow k		k
W : Wind 0.30 k	0.009920	k
E : Earthquake 0.0490 k		k
H : Lateral Earth k		k
Load distance above ground surface 30.0 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		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+0.60W	0.359	8.078	5.00	498.2	498.8	1.000
+D-0.60W	0.359	8.078	5.00	498.2	498.8	1.000
+D+0.450W	0.269	6.059	4.63	450.0	450.8	1.000
+D-0.450W	0.269	6.059	4.63	450.0	450.8	1.000
+0.60D+0.60W	0.359	8.078	5.00	498.2	498.8	1.000
+0.60D-0.60W	0.359	8.078	5.00	498.2	498.8	1.000
+1.068D+0.70E	0.034	1.029	2.50	240.1	242.3	1.000
+1.068D-0.70E	0.034	1.029	2.50	240.1	242.3	1.000

Pole Footing Embedded in Soil

File: 10-3_FOUNDATION_FOUL BALL POLE.ec6
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Innovative Structural Engineering, Inc. (ISE)

Lic. #: KW-06008078

DESCRIPTION: 30' Tall Foul Ball Pole

+1.051D+0.5250E	0.026	0.772	2.25	217.1	219.9	1.000
+1.051D-0.5250E	0.026	0.772	2.25	217.1	219.9	1.000
+0.5315D+0.70E	0.034	1.029	2.50	240.1	242.3	1.000
+0.5315D-0.70E	0.034	1.029	2.50	240.1	242.3	1.000