STRUCTURAL CALCULATIONS

DESIGNED BY: F.S.

JOB NUMBER: 23088

DATE: 3/23/23

PROJECT: SOUTH GATE PARK - FENCING IMPROVEMENTS
4900 SOUTHERN AVE. SOUTH GATE, CA. 90280

CLIENT: DAVID VOLZ DESIGN LANDSCAPE ARCHITECTS INC.

BUILDING CODE: INTERNATIONAL BUILDING CODE 2021 EDITION, C.B.C. 2022 EDITION

MATERIALS: Except as otherwise specified herein:

Concrete 3,000 PSI at 28 days.
Concrete Block Grade N. Light Weight Units, ASTM C-90
Brick Masonry Grade MW, 2,500 PSI Units, ASTM -62
Reinforced Steel 20,000 PSI (ASTM A615, Grade 40)
Structural Steel 24,000 PSI (Compact) ASTM A572 Grade 50
Structural Pipe 22,000 PSI (ASTM A-36)
Plywood Sheathing D.F.P.A., Structural II, INTR., P.S.1-95
Glu-Laminated Beams 2,400 PSI (D.F.- Larch Comb.'A' or Comb. 24F)
Lumber Grade Marked D.F.-Larch, W.C.L.B.
Soil Bearing Pressure 1500 PSF min. unless specified in soils report.
Grading Rule 16.

DATE SIGNED:

DESIGN REFERENCE: (Including Charts & Tables from):

Lumber & Timber Wood Structural Design Data (Volume1)
National Lumber Manufacturers Association

Steel Manual of Steel Construction, AISC

Concrete Reinforced Concrete Design Handbook,
ACI: Ultimate Strength Design Handbook, ACI

Concrete Block & Masonry Design Manual, by Masonry
Brick Masonry Industry
ASCE 7 Hazards Report

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: Default
Latitude: 33.945592
Longitude: -118.18382
Elevation: 107.32901408413464 ft (NAVD 88)
Site Soil Class:
Results:

PGAₘ : 0.84  
Sₘ₃ : 2.12  
Sₘ₁ : 1.77  
S₁ₜ : 1.41  
S₁₂ : 1.18  
Tₗ : 8  
Sₗ : 1.97  
Sₗ₁ : 0.82  
Vₗ₃ₐ : 260

Seismic Design Category: E

Multi-Period MCEₙ Spectrum

Two-Period MCEₙ Spectrum

Multi-Period Design Spectrum

Two-Period Design Spectrum

MCEₙ: Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.
Wind Analysis for Freestanding Wall & Sign Based on ASCE 7-22

**INPUT DATA**

- Exposure category (B, C or D) = C
- Importance factor, 1.0 only. (Table 1.5-2) = 1.00
- Basic wind speed (ASCE 7 26.5.1) = V = 110 mph (177.03 kph)
- Topographic factor (26.8 & Table 26.8-1) = K_{wa} = 1 Flat
- Height of top = h = 12 ft (3.66 m)
- Vertical dimension (for wall, s = h) = s = 12 ft (3.66 m)
- Horizontal dimension = B = 20 ft (6.10 m)
- Dimension of return corner = L_r = 0.5 ft (0.15 m)

**DESIGN SUMMARY**

- Max horizontal wind pressure = p = 27 psf (1290 N/m²)
- Max total horizontal force at centroid of base = F = 6.47 kips (29 kN)
- Max bending moment at centroid of base = M = 42.69 ft-kips (58 kN-m)
- Max torsion at centroid of base = T = 25.87 ft-kips (35 kN-m)

**ANALYSIS**

**Velocity pressure**

\[ q_v K_u = (0.00256 K_r K_{wa} V^2) K_u = 22.38 \text{ psf} \]

where: \( q_v = \) velocity pressure at mean roof height, h, (Eq. 26.10-1 page 277),

\[ K_r = \text{velocity pressure exposure coefficient evaluated at height, } h, \text{ (Tab. 26.9-1, page 275)} \]

\[ K_{wa} = \text{wind directionality factor, (Tab. 26.6-1, page 274)} \]

\[ h = \text{height of top} \]

**Wind Force Case A: resultant force through the geometric center** (Sec. 29.3.1)

\[ p = q_v K_u G C_f = 27 \text{ psf} \]

\[ F = p A_s = 6.47 \text{ kips} \]

\[ M = F (h - 0.5s) \text{ for sign, } F (0.55h) \text{ for wall} = 42.69 \text{ ft-kips} \]

\[ T = 0.09 \text{ ft-kips} \]

where:

- G = gust effect factor. (Sec. 26.9)
- \( C_f = \) net force coefficient. (Fig. 29.3-1, page 301)
- \( A_s = B s \)

**Wind Force Case B: resultant force at 0.2 B offset of the geometric center** (Sec. 29.3.1)

\[ p = \text{Case A} = 27 \text{ psf} \]

\[ F = \text{Case A} = 6.47 \text{ kips} \]

\[ M = \text{Case A} = 42.69 \text{ ft-kips} \]

\[ T = 0.2 F B = 25.87 \text{ ft-kips} \]

**Wind Force Case C: resultant force different at each region** (Sec. 29.4.1)

\[ p = q_v G C_f \]

\[ F = \Sigma p A_s \]

\[ M = \Sigma [ F (h - 0.5s) \text{ for sign, } F (0.55h) \text{ for wall } ] \]

\[ T = \Sigma T_s \]

<table>
<thead>
<tr>
<th>Distance</th>
<th>( C_f )</th>
<th>( P_i )</th>
<th>( A_{si} )</th>
<th>( F_i )</th>
<th>( M_i )</th>
<th>( T_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ft)</td>
<td>(Fig. 29.3-1)</td>
<td>(psf)</td>
<td>(ft²)</td>
<td>(kips)</td>
<td>(ft-kips)</td>
<td>(ft-kips)</td>
</tr>
<tr>
<td>12.0</td>
<td>1.800</td>
<td>34</td>
<td>144</td>
<td>4.93</td>
<td>32.54</td>
<td>19.72</td>
</tr>
</tbody>
</table>

\[ 20.0 \quad 1.200 \quad 23 \quad 96 \quad 2.19 \quad 14.46 \quad -13.15 \]

\[ \Sigma \quad 7.12 \quad 47.01 \quad 6.57 \]

*Case C may not be considered, footnote 3 of Fig. 8-20*
Wind Analysis for Freestanding Wall & Sign Based on ASCE 7-22

**INPUT DATA**
- Exposure category (B, C or D) = C
- Importance factor, 1.0 only, (Table 1.5-2) \( I_w \) = 1.00
- Basic wind speed (ASCE 7.26.5.1) \( V \) = 110 mph (177.03 kph)
- Topographic factor (26.8 & Table 26.8-1) \( K_d \) = 1 Flat
- Height of top \( h \) = 30 ft (9.14 m)
- Vertical dimension (for wall, \( s = h \)) = 30 ft (9.14 m)
- Horizontal dimension \( B \) = 20 ft (6.10 m)
- Dimension of return corner \( L_r \) = 0.5 ft (0.15 m)

**DESIGN SUMMARY**
- Max horizontal wind pressure \( p \) = 33 psf (1593 N/m²)
- Max total horizontal force at centroid of base \( F \) = 19.96 kips (89 kN)
- Max bending moment at centroid of base \( M \) = 329.32 ft-kips (446 kN-m)
- Max torsion at centroid of base \( T \) = 79.83 ft-kips (108 kN-m)

**ANALYSIS**

**Velocity pressure**

\[ q_n \cdot K_d = (0.00256 \cdot K_d \cdot V^2) \cdot K_d = 25.80 \text{ psf} \]

where:
- \( q_n \) = velocity pressure at mean roof height, \( h \) (Eq. 26.10-1 page 277).
- \( K_d \) = velocity pressure exposure coefficient evaluated at height, \( h \) (Tab. 26.10-1, pg 277)
- \( K_d \) = wind directionality factor (Tab. 26.6-1, page 274)
- \( h \) = height of top

\[ K_d = 1.00 \text{ (Tab. 26.9-1 page 275)} \]

\[ K_d = 0.88 \]

\[ K_d = 0.85 \]

\[ h = 30 \text{ ft} \]

\[ h = 9.14 \text{ m} \]

**Wind Force Case A: resultant force through the geometric center** (Sec. 29.3.1)

\[ p = q_n \cdot K_d \cdot G \cdot C_g \]

\[ F = p \cdot A_s \]

\[ M = F (h - 0.5a) \text{ for sign, } F (0.5h) \text{ for wall} \]

\[ T = 0.00 \text{ ft-kips} \]

where:
- \( G = \) gust effect factor (Sec. 26.9)
- \( C_g = \) net force coefficient (Fig. 29.3-1, page 301)
- \( A_s = B \cdot s \)

**Wind Force Case B: resultant force at 0.2 B offset of the geometric center** (Sec. 29.3.1)

\[ p = \text{Case A} \]

\[ F = \text{Case A} \]

\[ M = \text{Case A} \]

\[ T = 0.2 \cdot F \cdot B \]

\[ T = 600.0 \text{ ft}^2 \]

**Wind Force Case C: resultant force different at each region** (Sec. 29.4.1)

\[ p = q_n \cdot G \cdot C_i \]

\[ F = \Sigma \cdot p \cdot A_s \]

\[ M = \Sigma [ F (h - 0.5a) \text{ for sign, } F (0.5h) \text{ for wall} ] \]

\[ T = \Sigma \cdot T_s \]

<table>
<thead>
<tr>
<th>Distance</th>
<th>( C_i )</th>
<th>( P_i )</th>
<th>( A_{si} )</th>
<th>( F_i )</th>
<th>( M_i )</th>
<th>( T_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>1.800</td>
<td>99</td>
<td>600</td>
<td>23.69</td>
<td>390.84</td>
<td>0.00</td>
</tr>
</tbody>
</table>

\[ \sum 20.0 \cdot 1.200 = 26 \text{ ft} \]

\[ = 23.69 \text{ ft-kips, } 390.84 \text{ ft-kips} \]

\[ \text{Case C may not be considered, footnote 3 of Fig. 6.20} \]
30' HIGH CHAIN LINK FENCE W/ POSTS @ 10' OC.

\[ W_w = 33 \times 0.6 = 19.8 \text{ PSF} \]

\[ W_w = 19.8 \times 10 \times 0.15 \]
\[ = 29.7 \# / \text{lin ft} \quad (15\% \text{ SOIL}) \]

SEE COMP. RUN.

USE 5" R. STD PIPE W/ 24" Ø x 6' DEEP ETC.

30'

12' HIGH CHAIN LINK FENCE W/ POSTS @ 10' OC. MAX

\[ W_w = 24 \times 0.6 = 16.2 \text{ PSF} \]

\[ W_w = 16.2 \times 10 \times 0.15 = 24.3 \# / \text{lin ft} \]

SEE COMP. RUN

12'

10' SEE COMP. RUN.

\[ W_w = 24.3 \# / \text{lin ft} \]
Steel Column

Lic#: RW-08018037, Build: 26.23.2.14
DESCRIPTION: 30'-0" fence

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

General Information
Steel Section Name: Pipe5STD
Analysis Method: Allowable Strength
Steel Stress Grade: Fy: Steel Yield 36.0 ksi
E: Elastic Bending Modulus: 29,000.0 ksi
Overall Column Height: 30 ft
Top & Bottom Fixity: Top Free, Bottom Fixed
Brace condition for deflection (buckling) along columns:
X-X (width) axis:
- Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis:
- Fully braced against buckling ABOUT X-X Axis

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

Applied Loads
- Column self weight included: 438.0 lbs * Dead Load Factor
- BENDING LOADS...
- Lat. Uniform Load creating Mx-X, W = 0.030 k/ft

DESIGN SUMMARY

Bending & Shear Check Results
PASS Max. Axial+Bending Stress Ratio = 0.6627 : 1
Load Combination: +D+0.60W
Location of max. above base: 0.0 ft
At maximum location values are:
- Pa : Axial 0.4380 k
- Pn / Omega : Allowable 88.443 k
- Ma-x : Applied -8.10 k-ft
- Mn-x / Omega : Allowable 12.269 k-ft
- Ma-y : Applied 0.0 k-ft
- Mn-y / Omega : Allowable 12.269 k-ft

PASS Maximum Shear Stress Ratio = 0.02082 : 1
Load Combination: +D+0.60W
Location of max. above base: 0.0 ft
At maximum location values are:
- Va : Applied 0.540 k
- Vn / Omega : Allowable 25.933 k

Load Combination Results

<table>
<thead>
<tr>
<th>Load Combination</th>
<th>Maximum Axial + Bending Stress Ratios</th>
<th>Cbx</th>
<th>Cby</th>
<th>KxLx/Ry</th>
<th>KyLy/Ry</th>
<th>Maximum Shear Ratios</th>
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<td>Stress Ratio</td>
<td>Status</td>
<td>Location</td>
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<td>Stress Ratio</td>
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<td>0.005</td>
<td>PASS</td>
<td>0.00 ft</td>
<td>1.00</td>
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<td>+D+0.60W</td>
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Maximum Reactions

<table>
<thead>
<tr>
<th>Load Combination</th>
<th>Axial Reaction @ Base</th>
<th>X-X Axis Reaction @ Top</th>
<th>Y-Y Axis Reaction @ Base</th>
<th>Y-Y Axis Reaction @ Top</th>
<th>Mx - End Moments @ Top</th>
<th>My - End Moments @ Top</th>
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<tr>
<td>D Only</td>
<td>0.438</td>
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<td>-8.075</td>
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<tr>
<td>+0.60D+0.60W</td>
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<td>0.900</td>
<td>-13.500</td>
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<tr>
<td>W Only</td>
<td>0.263</td>
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Note: Only non-zero reactions are listed.
**Steel Column**

**DESCRIPTION:** 30'-0' fence

### Extreme Reactions

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<th>Item</th>
<th>Extreme Value</th>
<th>Axial Reaction @ Base</th>
<th>X-X Axis Reaction @ Base</th>
<th>Y-Y Axis Reaction @ Base</th>
<th>Mx - End Moments @ Base</th>
<th>k-ft</th>
<th>My - End Moments @ Top</th>
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<td>Reaction, X-X Axis Base</td>
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</table>

### Maximum Deflections for Load Combinations

<table>
<thead>
<tr>
<th>Load Combination</th>
<th>Max. X-Deflection</th>
<th>Distance</th>
<th>Max. Y-Y Deflection</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Only</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>0.000 in</td>
<td>0.000 ft</td>
</tr>
<tr>
<td>+D+0.60W</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>7.560 in</td>
<td>30.000 ft</td>
</tr>
<tr>
<td>+D+0.450W</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>5.670 in</td>
<td>30.000 ft</td>
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<td>0.0000 in</td>
<td>0.000 ft</td>
<td>7.560 in</td>
<td>30.000 ft</td>
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<tr>
<td>+0.60D</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>0.000 in</td>
<td>0.000 ft</td>
</tr>
<tr>
<td>W Only</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>12.487 in</td>
<td>29.759 ft</td>
</tr>
</tbody>
</table>

**Steel Section Properties:** Pipe5STD

- **Depth** = 5.563 in
- **S xx** = 5.14 in^4
- **J** = 28.600 in^4
- **Diameter** = 5.563 in
- **R xx** = 1.886 in
- **Wall Thick** = 0.259 in
- **Z xx** = 6.830 in^3
- **Area** = 4.010 in^2
- **S yy** = 5.146 in^4
- **Weight** = 14.600 plf
- **R yy** = 1.886 in
- **Ycg** = 0.000 in
Steel Column

DESCRIPTION: 30'-0' fence

Sketches

5.56in
Steel Column

Lic# : KW-003637, Build: 20.23.2.14  
CHUCK YAGHI & ASSOCIATES

DESCRIPTION: 12'

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

General Information
Steel Section Name: Pipe4STD
Analysis Method: Allowable Stress
Steel Stress Grade: Fy = Steel Yield
E: Elastic Bending Modulus
36.0 ksi
29,000.0 ksi

Applied Loads
Column self weight included: 129.60 lbs * Dead Load Factor
BENDING LOADS...
Lat. Uniform Load creating Mx-x, W = 0.02430 k/ft

DESIGN SUMMARY
Bending & Shear Check Results
PASS Max. Axial+Bending Stress Ratio = 0.1453 : 1
Load Combination +D+0.60W
Location of max. above base 0.0 ft
At maximum location values are...
Pa: Axial 0.1296 k
Pn / Omega : Allowable 63.808 k
Ma-x: Applied -1.050 k-ft
Mn-x / Omega : Allowable 7.275 k-ft
Ma-y: Applied 0.0 k-ft
Mn-y / Omega : Allowable 7.275 k-ft

PASS Maximum Shear Stress Ratio 0.009140 : 1
Load Combination +D+0.60W
Location of max. above base 0.0 ft
At maximum location values are...
Va: Applied 0.1750 k
Vn / Omega : Allowable 19.143 k

Load Combination Results

<table>
<thead>
<tr>
<th>Load Combination</th>
<th>Maximum Axial + Bending Stress Ratio</th>
<th>Stress Ratio</th>
<th>Status</th>
<th>Location</th>
<th>Cbx</th>
<th>Cby</th>
<th>KxLx/Ry</th>
<th>KyLy/Rx</th>
<th>Maximum Shear Ratio</th>
<th>Status</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Only</td>
<td>0.002 PASS</td>
<td>0.00 ft</td>
<td>1.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>PASS</td>
<td>0.00 ft</td>
<td>0.00 ft</td>
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Maximum Reactions

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<th>X-X Axis Reaction</th>
<th>Y-Y Axis Reaction</th>
<th>Mx - End Moments</th>
<th>My - End Moments</th>
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<td></td>
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<td>@ Top</td>
<td>@ Base @ Top</td>
<td>@ Base @ Top</td>
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Note: Only non-zero reactions are listed.
**Steel Column**

**DESCRIPTION:** 12'  

### Extreme Reactions

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### Maximum Deflections for Load Combinations

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<tr>
<th>Load Combination</th>
<th>Max. X-X Deflection</th>
<th>Distance</th>
<th>Max. Y-Y Deflection</th>
<th>Distance</th>
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<td>0.000 in</td>
<td>0.000 ft</td>
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<tr>
<td>+D+0.80W</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
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<td>0.000 ft</td>
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<td>0.000 ft</td>
<td>0.329 in</td>
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<td>0.0000 in</td>
<td>0.000 ft</td>
<td>0.000 in</td>
<td>0.000 ft</td>
</tr>
<tr>
<td>W Only</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>0.543 in</td>
<td>11.919 ft</td>
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</table>

### Steel Section Properties : Pipe4STD

- **Depth** = 4.500 in
- **Sxx** = 6.82 in^4
- **J** = 13.600 in^4
- **Depth** = 4.500 in
- **Sxx** = 3.03 in^3
- **Wall Thick** = 0.237 in
- **Zxx** = 1.510 in
- **Area** = 2.960 in^2
- **Iyy** = 6.620 in^4
- **Weight** = 10.800 lb
- **Syy** = 3.030 in^3
- **Ryy** = 1.510 lbf
- **Ycg** = 0.000 in
Steel Column

DESCRIPTION: 12'

Sketches

4.50in

+Y

+X
## Steel Column

**LIC #:** KW-36018037, Build: 20.23.2.14  
**CHUCK YAGHI & ASSOCIATES**  
**Project File: southgate.park.ec6**

**DESCRIPTIO: 10'**

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

### General Information
- **Steel Section Name:** Pipe4STD
- **Analysis Method:** Allowable Strength
- **Steel Stress Grade:** Fy : Steel Yield 36.0 ksi  
  E : Elastic Bending Modulus 29,000.0 ksi
- **Overall Column Height:** 10 ft
- **Top & Bottom Fixity:** Top Free, Bottom Fixed
- **Brace condition for deflection (buckling) along columns:**
  - X-X (width) axis:
  - Fully braced against buckling ABOUT Y-Y Axis
  - Y-Y (depth) axis:
  - Fully braced against buckling ABOUT X-X Axis

### Applied Loads
- Column self weight included: 108.0 lbs * Dead Load Factor
- **BENDING LOADS...**
  - Lat. Uniform Load creating Mx-x, W = 0.02430 k/ft

### DESIGN SUMMARY

#### Bending & Shear Check Results
- **PASS** Max. Axial+Bending Stress Ratio = 0.1010 : 1
  - Load Combination: +D+0.60W
  - Location of max. above base: 0.0 ft
  - At maximum location values are:
    - Pa : Axial 0.1080 k
    - Pn / Omega : Allowable
    - Mx-x / Omega : Allowable 63.806 k-ft
    - Ma-x : Applied -0.7280 k-ft
    - Mn-x / Omega : Allowable 7.275 k-ft
    - Ma-y : Applied 0.0 k-ft
    - Mn-y / Omega : Allowable 7.275 k-ft
  - Max. Load Reactions:
    - Top along X-X: 0.0 k
    - Bottom along X-X: 0.0 k
    - Top along Y-Y: 0.0 k
    - Bottom along Y-Y: 0.2430 k
- **PASS** Max. Shear Stress Ratio = 0.07617 : 1
  - Load Combination: +D+0.60W
  - Location of max. above base: 0.0 ft
  - Vx : Applied 0.1458 k
  - Vy / Omega : Allowable 19.143 k

### Load Combination Results

<table>
<thead>
<tr>
<th>Load Combination</th>
<th>Maximum Axial + Bending Stress Ratio</th>
<th>Cbx</th>
<th>Cby</th>
<th>KxLx/Rx</th>
<th>KyLy/Rx</th>
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<th>Stress Ratio</th>
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<th>Location</th>
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### Maximum Reactions

<table>
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<tr>
<th>Load Combination</th>
<th>Axial Reaction @ Base</th>
<th>X-X Axis Reaction @ Base</th>
<th>Y-Y Axis Reaction @ Base</th>
<th>Mx - End Moments k-ft</th>
<th>My - End Moments @ Top</th>
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### Steel Column

**DESCRIPTION:** 10'

#### Extreme Reactions

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<th>Axial Reaction @ Base</th>
<th>X-X Axis Reaction @ Base</th>
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<th>Mx - End Moments @ Base</th>
<th>k-ft</th>
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#### Maximum Deflections for Load Combinations

<table>
<thead>
<tr>
<th>Load Combination</th>
<th>Max. X-X Deflection</th>
<th>Distance</th>
<th>Max. Y-Y Deflection</th>
<th>Distance</th>
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<td>0.000 ft</td>
</tr>
<tr>
<td>+D+0.80W</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>0.159 in</td>
<td>10.000 ft</td>
</tr>
<tr>
<td>+D+0.450W</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>0.119 in</td>
<td>10.000 ft</td>
</tr>
<tr>
<td>+0.60D+0.60W</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>0.159 in</td>
<td>10.000 ft</td>
</tr>
<tr>
<td>+0.60D</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>0.000 in</td>
<td>0.000 ft</td>
</tr>
<tr>
<td>W Only</td>
<td>0.0000 in</td>
<td>0.000 ft</td>
<td>0.262 in</td>
<td>9.933 ft</td>
</tr>
</tbody>
</table>

#### Steel Section Properties: Pipe4STD

- **Depth** = 4.500 in
- **i xx** = 6.82 in^4
- **J** = 13.600 in^4
- **Diameter** = 4.500 in
- **S xx** = 3.03 in^4
- **Wall Thick** = 0.237 in
- **R xx** = 1.510 in
- **Area** = 2.960 in^2
- **I yy** = 6.820 in^4
- **Weight** = 10.800 pcf
- **S y y** = 3.030 in^4
- **R y y** = 1.510 in
- **Y cg** = 0.000 in
Steel Column

DESCRIPTION: 10'

Sketches

+Y

+X

4.50in
**Pole Footing Embedded in Soil**

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

**General Information**
- Pole Footing Shape: Circular
- Pole Footing Diameter: 24.0 in
- Calculate Min. Depth for Allowable Pressures
- No Lateral Restraint at Ground Surface
- Allow Passive: 250.0 pcf
- Max Passive: 1,500.0 psf

**Controlling Values**
- Governing Load Combination: 0.60W
- Lateral Load: 0.540 k
- Moment: 8.10 k-ft

**Pressures at 1/3 Depth**
- Actual: 456.876 psf
- Allowable: 458.036 psf

**Minimum Required Depth**: 5.50 ft

- Footing Base Area: 3.142 ft²
- Maximum Soil Pressure: 0.0 ksf

**Applied Loads**
- Lateral Concentrated Load: k
- Lateral Distributed Loads: k/ft
- Vertical Load: k

<table>
<thead>
<tr>
<th>Load</th>
<th>Concentrated Load (k)</th>
<th>Distributed Loads (k/ft)</th>
<th>Vertical Load (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>D: Dead Load</td>
<td>D: Roof Load</td>
<td>D: Live</td>
</tr>
<tr>
<td>Lr</td>
<td>Lr: Roof Live</td>
<td>L: Live</td>
<td>S: Snow</td>
</tr>
<tr>
<td>L</td>
<td>L: Live</td>
<td>W: Wind</td>
<td>E: Earthquake</td>
</tr>
<tr>
<td>S</td>
<td>S: Snow</td>
<td>H: Lateral Earth</td>
<td>Load distance above ground surface ft</td>
</tr>
<tr>
<td>W</td>
<td>W: Wind</td>
<td></td>
<td>TOP of Load above ground surface 30.0 ft</td>
</tr>
<tr>
<td>E</td>
<td>E: Earthquake</td>
<td></td>
<td>BOTTOM of Load above ground surface ft</td>
</tr>
<tr>
<td>H</td>
<td>H: Lateral Earth</td>
<td></td>
<td>ft</td>
</tr>
</tbody>
</table>

**Load Combination Results**

<table>
<thead>
<tr>
<th>Load Combination</th>
<th>Forces @ Ground Surface</th>
<th>Required Depth (ft)</th>
<th>Pressure at 1/3 Depth</th>
<th>Soil Increase Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Loads (k)</td>
<td>Moments (ft-k)</td>
<td>Actual (psf)</td>
<td>Allow (psf)</td>
</tr>
<tr>
<td>+0.60W</td>
<td>0.540</td>
<td>8.100</td>
<td>456.9</td>
<td>458.0</td>
</tr>
<tr>
<td>+0.450W</td>
<td>0.405</td>
<td>6.075</td>
<td>412.2</td>
<td>412.3</td>
</tr>
</tbody>
</table>
Pole Footing Embedded in Soil

**DESCRIPTION:** 8'

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

**General Information**
Pole Footing Shape: Circular
Pole Footing Diameter: 24.0 in
Calculate Min. Depth for Allowable Pressures
No Lateral Restraint at Ground Surface
Allow Passive: 250.0 pcf
Max Passive: 1,500.0 psf

**Controlling Values**
Governing Load Combinations: 0.60W
Lateral Load: 0.1166 k
Moment: 0.4666 k-ft
NO Ground Surface Restraint
Pressures at 1/3 Depth
- Actual: 183.285 psf
- Allowable: 184.342 psf

**Minimum Required Depth:** 2.250 ft
Footing Base Area: 3.142 ft²
Maximum Soil Pressure: 0.0 ksf

**Applied Loads**

<table>
<thead>
<tr>
<th>Lateral Concentrated Load (k)</th>
<th>Lateral Distributed Loads (k)</th>
<th>Vertical Load (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D: Dead Load</td>
<td>k</td>
<td>k</td>
</tr>
<tr>
<td>Lr: Roof Live</td>
<td>k</td>
<td>k</td>
</tr>
<tr>
<td>L: Live</td>
<td>k</td>
<td>k</td>
</tr>
<tr>
<td>S: Snow</td>
<td>k</td>
<td>k</td>
</tr>
<tr>
<td>W: Wind</td>
<td>k</td>
<td>k</td>
</tr>
<tr>
<td>E: Earthquake</td>
<td>k</td>
<td>k</td>
</tr>
<tr>
<td>H: Lateral Earth</td>
<td>k</td>
<td>k</td>
</tr>
<tr>
<td>Load distance above ground surface (ft)</td>
<td>0.02430</td>
<td>TOP of Load above ground surface (ft)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BOTTOM of Load above ground surface (ft)</td>
</tr>
</tbody>
</table>

**Load Combination Results**

<table>
<thead>
<tr>
<th>Load Combination</th>
<th>Forces at Ground Surface</th>
<th>Required Depth (ft)</th>
<th>Pressure at 1/3 Depth (psf)</th>
<th>Soil Increase Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Loads - (k)</td>
<td>Moments - (ft-k)</td>
<td>Actual - (psf)</td>
<td></td>
</tr>
<tr>
<td>+0.60W</td>
<td>0.000</td>
<td>0.000</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>+0.450W</td>
<td>0.117</td>
<td>0.467</td>
<td>2.25</td>
<td>183.3</td>
</tr>
<tr>
<td></td>
<td>0.087</td>
<td>0.350</td>
<td>2.00</td>
<td>163.9</td>
</tr>
</tbody>
</table>
Pole Footing Embedded in Soil

DESCRIPTION: 10'

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

General Information
Pole Footing Shape: Circular
Pole Footing Diameter: 24.0 in
Calculate Min. Depth for Allowable Pressures
No Lateral Restraint at Ground Surface
Allow Passive: 250.0 pcf
Max Passive: 1,500.0 psf

Controlling Values
Governing Load Combination: 0.60W
Lateral Load: 0.1458 k
Moment: 0.7290 k-ft

NO Ground Surface Restraint
Pressures at 1/3 Depth
Actual: 211.20 psf
Allowable: 211.704 psf

Minimum Required Depth: 2.625 ft
Footing Base Area: 3.142 ft²
Maximum Soil Pressure: 0.0 ksf

Applied Loads
<table>
<thead>
<tr>
<th>Lateral Concentrated Load (k)</th>
<th>Lateral Distributed Loads (k)</th>
<th>Vertical Load (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D: Dead Load k</td>
<td>k/ft</td>
<td>k</td>
</tr>
<tr>
<td>Lr: Roof Live k</td>
<td>k/ft</td>
<td>k</td>
</tr>
<tr>
<td>L: Live k</td>
<td>k/ft</td>
<td>k</td>
</tr>
<tr>
<td>S: Snow k</td>
<td>k</td>
<td>k</td>
</tr>
<tr>
<td>W: Wind k</td>
<td>0.02430</td>
<td>k</td>
</tr>
<tr>
<td>E: Earthquake k</td>
<td>k/ft</td>
<td>k</td>
</tr>
<tr>
<td>H: Lateral Earth k</td>
<td>k/ft</td>
<td>k</td>
</tr>
<tr>
<td>Load distance above ground surface ft</td>
<td>TOP of Load above ground surface 10.0 ft</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BOTTOM of Load above ground surface ft</td>
<td></td>
</tr>
</tbody>
</table>

Load Combination Results

<table>
<thead>
<tr>
<th>Load Combination</th>
<th>Forces @ Ground Surface</th>
<th>Required Depth</th>
<th>Pressure at 1/3 Depth</th>
<th>Soil Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Loads - (k)</td>
<td>Moments - (ft-k)</td>
<td>Actual - (psf)</td>
<td>Allow - (psf)</td>
</tr>
<tr>
<td>+0.60W</td>
<td>0.000</td>
<td>0.000</td>
<td>0.13</td>
<td>0.0</td>
</tr>
<tr>
<td>+0.450W</td>
<td>0.146</td>
<td>0.729</td>
<td>2.63</td>
<td>211.2</td>
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<tr>
<td></td>
<td>0.109</td>
<td>0.547</td>
<td>2.38</td>
<td>189.9</td>
</tr>
</tbody>
</table>
Pole Footing Embedded in Soil

DESCRIPTION: 12'

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

General Information
Pole Footing Shape: Circular
Pole Footing Diameter: 24.0 in
Calculate Min. Depth for Allowable Pressures
No Lateral Restraint at Ground Surface
Allow Passive: 250.0 pcf
Max Passive: 1,500.0 psf

Controlling Values
Governing Load Combination: 0.60W
Lateral Load: 0.1748 k
Moment: 1.048 k-ft
NO Ground Surface Restraint
Pressures at 1/3 Depth
Actual: 236.715 psf
Allowable: 237.262 psf

Minimum Required Depth: 2.875 ft
Footings Base Area: 3.142 ft²
Maximum Soil Pressure: 0.0 ksf

Applied Loads
Lateral Concentrated Load (k)
D: Dead Load
Lr: Roof Live
L: Live
S: Snow
W: Wind
E: Earthquake
H: Lateral Earth
Load distance above ground surface (ft)

Lateral Distributed Loads (k)
TOP of Load above ground surface (ft)
BOTTOM of Load above ground surface (ft)

Vertical Load (k)

Load Combination Results
Load Combination
Forces @ Ground Surface
Loads (k) 0.000 0.000 0.13 0.0 0.0 1.000
Moments (ft-k) 0.000 0.000 0.13 0.0 0.0 1.000
Required Depth (ft) 2.88 2.88 236.7 237.3 1.000
Pressure at 1/3 Depth (psf) 212.5 213.6 1.000
Soil Increase Factor 1.000 1.000