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3632 North Rancho Drive
Las Vegas, Nevada 89130

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Roseville, California 95661

STRUCTURAL CALCULATIONS

FOR

City of Las Vegas Dept. of Public Works

Fremont Street Light Pole Foundations

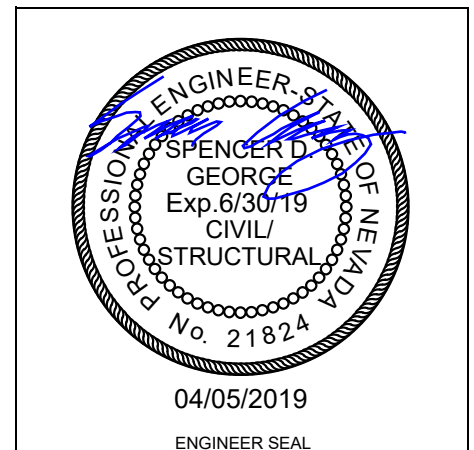
Las Vegas, NV

ES² Project #: 19.2010

April 5, 2019

SHEET INDEX

Basis For Design.....	S1
Foundation Design.....	S5





Basis For Design

Search Information

Address: Fremont St, Las Vegas, NV, USA
Coordinates: 36.1619681, -115.12373530000002
Elevation: 1888 ft
Timestamp: 2019-03-08T17:29:23.579Z
Hazard Type: Wind



ASCE 7-16

MRI 10-Year 70 mph
 MRI 25-Year 75 mph
 MRI 50-Year 80 mph
 MRI 100-Year 85 mph
 Risk Category I 93 mph
 Risk Category II 99 mph
 Risk Category III 105 mph
 Risk Category IV 110 mph

ASCE 7-10

MRI 10-Year 76 mph
 MRI 25-Year 84 mph
 MRI 50-Year 90 mph
 MRI 100-Year 96 mph
 Risk Category I 105 mph
 Risk Category II 115 mph
 Risk Category III-IV 120 mph

ASCE 7-05

ASCE 7-05 Wind Speed 90 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

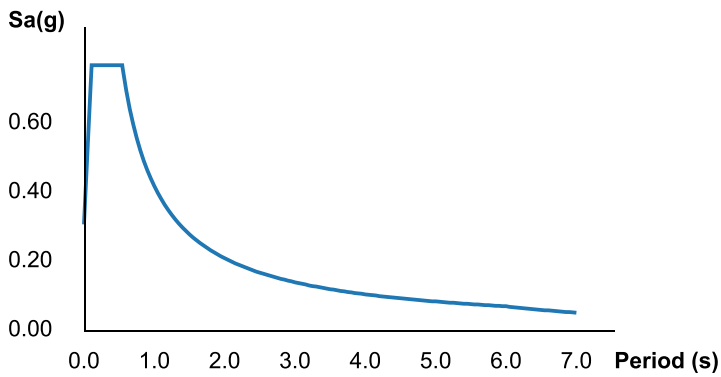
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Search Information

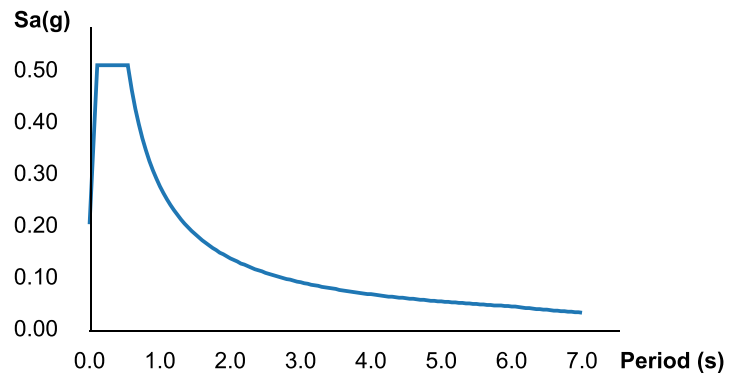
Address: Fremont St, Las Vegas, NV, USA
Coordinates: 36.1619681, -115.12373530000002
Elevation: 1888 ft
Timestamp: 2019-03-08T17:30:58.480Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: II
Site Class: D-default



MCE_R Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S _S	0.572	MCE _R ground motion (period=0.2s)
S ₁	0.188	MCE _R ground motion (period=1.0s)
S _{MS}	0.768	Site-modified spectral acceleration value
S _{M1}	0.418	Site-modified spectral acceleration value
S _{DS}	0.512	Numeric seismic design value at 0.2s SA
S _{D1}	0.278	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	D	Seismic design category
F _a	1.343	Site amplification factor at 0.2s
F _v	2.225	Site amplification factor at 1.0s
	0.897	Coefficient of risk (0.2s)

CR_S		
CR_1	0.919	Coefficient of risk (1.0s)
PGA	0.251	MCE_G peak ground acceleration
F_{PGA}	1.349	Site amplification factor at PGA
PGA_M	0.339	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	0.572	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.638	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.764	Factored deterministic acceleration value (0.2s)
S1RT	0.188	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.204	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.696	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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Structural Design

LATERAL DESIGN OF CONCRETE CAISSONS

NOTES: Delphi Pole

DESCRIPTION: 10 ft Light Pole Base

MEMBER GEOMETRY DATA:

Pole Height: 10 ft
 Pole Diameter: 19 in
 Pedestal Base Height: 6 in
 Pedestal Base Diameter: 3 ft
 Pole Shape: round - rough

Number of Arms: 2
 Arm Length: 15 in
 Arm Rise: 32 in
 Arm Diameter: 6 in
 Luminaire Area: 2.0 sf
 Arm + Luminaire Area: 5.3 sf
 Luminaire Shape: round - very rough
 T.O. Pole Ht: 10.50 ft

LOAD DATA:

Pole Weight: 54 lb/ft of height
 Luminaire Weight: 54 lb each
 Arm Weight: 100 lb each
 Total Weight: 848 lb

SEISMIC FORCE DATA:

Seismic Accel.: 0.287 (ASD - worst case)
 F_{pole} : 155 lb
 $F_{luminaires}$: 31 lb
 F_{arms} : 57 lb
 E_{total} : 243 lb

WIND FORCE DATA:

Risk Category: II - All except I, III, & IV
 V: 99 mph
 Exposure Category: C
 K_{zt} : 1.0
 G: 0.85

α : 9.5
 Z_g : 900 ft

Pole

z: 5.50 ft
 K_z (pole): 0.85
 K_d (pole): 0.95
 q_z : 20.23 psf
 A_f (pole): 15.83 sf
 h/D: 6.32
 C_f (pole): 0.79
 P: 13.56 psf
 F: 215 lb

Luminaire

z: 13.17 ft
 K_z (luminaire): 0.85
 K_d (luminaire): 0.95
 q_z : 20.23 psf
 A_f (luminaire): 5.25 sf
 s/h: 0.16
 B/s: 1.19
 C_f (luminaire): 1.95
 P: 33.54 psf
 F: 176 lb

RESULTANT FORCE:

Wind (Governs)

F_{res} : 391 lb
 h: 8.95 ft
 M(base): 3499 ft-lb
 V(base): 391 lb

ASD WIND = 0.60*W

ASD F_{res} : 234 lb
 ASD M(base): 2100 ft-lb
 ASD V(base): 234 lb

Seismic

F_{res} : 243 lb
 h: 8.28 ft
 M(base): 2016 ft-lb
 V(base): 243 lb

LATERAL DESIGN OF CONCRETE CAISSONS

NOTES: Delphi Pole

DESCRIPTION: 10 ft Light Pole Base

MEMBER GEOMETRY DATA:

h (ht. of load): 8.95 ft
 d (embed) (guess): 4 ft
 b (dia) (guess): 3 ft

LOAD DATA:

AXIAL

P DL: 848 lb
 P LL: 100 lb
 P TL: 948 lb

Base Height: 6 in
 Wt. of Concr. : 150 pcf
 q_{ALLOW} : 2000 psf

LATERAL

Lateral F: 234 lb
 Lateral Bearing: 100 lb/ft²/ft
 Use 2x increase?: Y (y/n)
 Allowable Lateral Bearing: 200 lb/ft²/ft

100 pcf used based on table 1806.2 in the IBC.

NON-CONSTRAINED DESIGN:

d (embed) (guess): 4.00 ft
 b (dia): 3.00 ft
 d (calc.): 2.95 ft
 Use: 4.00 ft
 S1: 267 psf
 A: 0.686

CONSTRAINED DESIGN:

d (embed) (guess): 4.00 ft
 b (dia): 3.00 ft
 d (calc.): 1.93 ft
 Use: 4.00 ft
 S3: 800 psf

CHECK BEARING:

Design Method: Nonconstrained
 Footing Area: 7.1 ft²
 Total Concr. Press.: 75 psf
 q_{BEARING} : 209 psf OK

Use:		
d:	4.00	ft
b:	3	ft
Vol. Concr.:	31.8	cf

COMPARISON:

Diameter, b (ft):	3.00	3.25	3.50	3.75	4.00	4.25	4.50
Req'd depth, d (ft):	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Volume of Concrete (cf):	31.8	37.3	43.3	49.7	56.5	63.8	71.6

Caisson Reinforcing Seismic Design Category C, D, E, F

IBC and ACI 318

Notes: Delphi Pole

Description: 10 ft Light Pole Base

Caisson Dimensions

Caisson Diameter:	36 in
Caisson Area:	1018 in ²
Embedded Pipe Area:	0 in ²
Net Conc Area:	1018 in ²
Perimeter:	113.1 in
S:	4580 in ³
f _c :	4500 psi
cracking ϕ Mn:	69.1 k-ft
Design Mu:	3.5 k-ft

Longitudinal Reinforcing

Longitudinal Reinf Ratio:	0.005
Longitudinal A _s req'd:	5.09 in ²
Longitudinal Bar Size:	6
No. Bars Req'd:	12
Spacing:	10.3 in
<i>(reference 18.10.3.9 for min reinforced Length)</i>	
SDC:	D

Transverse Reinforcing

Bar Size:	4
Spacing:	9 in

Per IBC 18.10.3.9, if design $M_u > \phi M_n$ OR if subject to uplift, reinforcing as noted above is required in caisson

LATERAL DESIGN OF CONCRETE CAISSONS

NOTES: Huntington Pole

DESCRIPTION: 15 ft Light Pole Base

MEMBER GEOMETRY DATA:

Pole Height: 15 ft
 Pole Diameter: 19 in
 Pedestal Base Height: 6 in
 Pedestal Base Diameter: 3 ft
 Pole Shape: round - rough

Number of Arms: 2
 Arm Length: 15 in
 Arm Rise: 32 in
 Arm Diameter: 6 in
 Luminaire Area: 2.0 sf
 Arm + Luminaire Area: 5.3 sf
 Luminaire Shape: round - very rough
 T.O. Pole Ht: 15.50 ft

LOAD DATA:

Pole Weight: 73 lb/ft of height
 Luminaire Weight: 54 lb each
 Arm Weight: 100 lb each
 Total Weight: 1403 lb

SEISMIC FORCE DATA:

Seismic Accel.: 0.287 (ASD - worst case)
 F_{pole} : 314 lb
 $F_{luminaires}$: 31 lb
 F_{arms} : 57 lb
 E_{total} : 403 lb

WIND FORCE DATA:

Risk Category: II - All except I, III, & IV
 V: 99 mph
 Exposure Category: C
 K_{zt} : 1.0
 G: 0.85

α : 9.5
 Z_g : 900 ft

Pole

z: 8.00 ft
 K_z (pole): 0.85
 K_d (pole): 0.95
 q_z : 20.23 psf
 A_f (pole): 23.75 sf
 h/D: 9.47
 C_f (pole): 0.81
 P: 14.00 psf
 F: 332 lb

Luminaire

z: 18.17 ft
 K_z (luminaire): 0.88
 K_d (luminaire): 0.95
 q_z : 21.07 psf
 A_f (luminaire): 5.25 sf
 s/h: 0.12
 B/s: 1.19
 C_f (luminaire): 1.95
 P: 34.92 psf
 F: 183 lb

RESULTANT FORCE:

Wind

F_{res} : 516 lb
 h: 11.61 ft
 M(base): 5989 ft·lb
 V(base): 516 lb

Seismic (Governs)

F_{res} : 403 lb
 h: 10.23 ft
 M(base): 4120 ft·lb
 V(base): 403 lb

ASD WIND = 0.60*W

ASD F_{res} : 309 lb
 ASD M(base): 3594 ft·lb
 ASD V(base): 309 lb

LATERAL DESIGN OF CONCRETE CAISSONS

NOTES: Huntington Pole

DESCRIPTION: 15 ft Light Pole Base

MEMBER GEOMETRY DATA:

h (ht. of load): 10.23 ft
 d (embed) (guess): 4 ft
 b (dia) (guess): 3 ft

LOAD DATA:

AXIAL

P DL: 1403 lb
 P LL: 100 lb
 P TL: 1503 lb

Base Height: 6 in
 Wt. of Concr. : 150 pcf
 q_{ALLOW} : 2000 psf

LATERAL

Lateral F: 403 lb
 Lateral Bearing: 100 lb/ft²/ft
 Use 2x increase?: Y (y/n)
 Allowable Lateral Bearing: 200 lb/ft²/ft

100 pcf used based on table 1806.2 in the IBC.

NON-CONSTRAINED DESIGN:

d (embed) (guess): 4.25 ft
 b (dia): 3.00 ft
 d (calc.): 4.11 ft
 Use: 4.25 ft
 S1: 283 psf
 A: 1.109

CONSTRAINED DESIGN:

d (embed) (guess): 4.25 ft
 b (dia): 3.00 ft
 d (calc.): 2.62 ft
 Use: 4.25 ft
 S3: 850 psf

CHECK BEARING:

Design Method: Nonconstrained
 Footing Area: 7.1 ft²
 Total Concr. Press.: 75 psf
 q_{BEARING} : 288 psf OK

Use:		
d:	4.25	ft
b:	3	ft
Vol. Concr.:	33.6	cf

COMPARISON:

Diameter, b (ft):	3.00	3.25	3.50	3.75	4.00	4.25	4.50
Req'd depth, d (ft):	4.25	4.25	4.00	4.00	4.00	4.00	4.00
Volume of Concrete (cf):	33.6	39.4	43.3	49.7	56.5	63.8	71.6

Caisson Reinforcing Seismic Design Category C, D, E, F

IBC and ACI 318

Notes: Huntington Pole

Description: 15 ft Light Pole Base

Caisson Dimensions

Caisson Diameter:	36 in
Caisson Area:	1018 in ²
Embedded Pipe Area:	0 in ²
Net Conc Area:	1018 in ²
Perimeter:	113.1 in
S:	4580 in ³
f _c :	4500 psi
cracking ϕ Mn:	69.1 k-ft
Design Mu:	6.0 k-ft

Longitudinal Reinforcing

Longitudinal Reinf Ratio:	0.005
Longitudinal A _s req'd:	5.09 in ²
Longitudinal Bar Size:	6
No. Bars Req'd:	12
Spacing:	10.3 in
<i>(reference 18.10.3.9 for min reinforced Length)</i>	
SDC:	D

Transverse Reinforcing

Bar Size:	4
Spacing:	9 in

Per IBC 18.10.3.9, if design $M_u > \phi M_n$ OR if subject to uplift, reinforcing as noted above is required in caisson

LATERAL DESIGN OF CONCRETE CAISSONS

NOTES: Fremont Pole

DESCRIPTION: 14.5 ft Light Pole Base

MEMBER GEOMETRY DATA:

Pole Height: 14.5 ft
 Pole Diameter: 14 in
 Pedestal Base Height: 6 in
 Pedestal Base Diameter: 3 ft
 Pole Shape: round - rough

Number of Arms: 2
 Arm Length: 48 in
 Arm Rise: 52 in
 Arm Diameter: 7 in
 Luminaire Area: 3.5 sf
 Arm + Luminaire Area: 11.7 sf
 Luminaire Shape: round - very rough
 T.O. Pole Ht: 15.00 ft

LOAD DATA:

Pole Weight: 36 lb/ft of height
 Luminaire Weight: 55 lb each
 Arm Weight: 150 lb each
 Total Weight: 932 lb

SEISMIC FORCE DATA:

Seismic Accel.: 0.287 (ASD - worst case)
 F_{pole} : 150 lb
 $F_{luminaires}$: 32 lb
 F_{arms} : 86 lb
 E_{total} : 267 lb

WIND FORCE DATA:

Risk Category: II - All except I, III, & IV
 V: 99 mph
 Exposure Category: C
 K_{zt} : 1.0
 G: 0.85

α : 9.5
 Z_g : 900 ft

Pole

z: 7.75 ft
 K_z (pole): 0.85
 K_d (pole): 0.95
 q_z : 20.23 psf
 A_f (pole): 16.92 sf
 h/D: 12.43
 C_f (pole): 0.83
 P: 14.28 psf
 F: 242 lb

Luminaire

z: 19.33 ft
 K_z (luminaire): 0.90
 K_d (luminaire): 0.95
 q_z : 21.34 psf
 A_f (luminaire): 11.67 sf
 s/h: 0.08
 B/s: 5.49
 C_f (luminaire): 1.95
 P: 35.38 psf
 F: 413 lb

RESULTANT FORCE:

Wind (Governs)

F_{res} : 654 lb
 h: 15.06 ft
 M(base): 9852 ft-lb
 V(base): 654 lb

ASD WIND = 0.60*W

ASD F_{res} : 393 lb
 ASD M(base): 5911 ft-lb
 ASD V(base): 393 lb

Seismic

F_{res} : 267 lb
 h: 12.85 ft
 M(base): 3436 ft-lb
 V(base): 267 lb

LATERAL DESIGN OF CONCRETE CAISSONS

NOTES: Fremont Pole

DESCRIPTION: 14.5 ft Light Pole Base

MEMBER GEOMETRY DATA:

h (ht. of load): 15.06 ft
 d (embed) (guess): 3 ft
 b (dia) (guess): 3 ft

LOAD DATA:

AXIAL

P DL: 932 lb
 P LL: 100 lb
 P TL: 1032 lb

Base Height: 6 in
 Wt. of Concr. : 150 pcf
 q_{ALLOW} : 2000 psf

LATERAL

Lateral F: 393 lb
 Lateral Bearing: 100 lb/ft²/ft
 Use 2x increase?: Y (y/n)
 Allowable Lateral Bearing: 200 lb/ft²/ft

100 pcf used based on table 1806.2 in the IBC.

NON-CONSTRAINED DESIGN:

d (embed) (guess): 4.75 ft
 b (dia): 3.00 ft
 d (calc.): 4.50 ft
 Use: 4.75 ft
 S1: 317 psf
 A: 0.967

CONSTRAINED DESIGN:

d (embed) (guess): 4.75 ft
 b (dia): 3.00 ft
 d (calc.): 2.97 ft
 Use: 4.75 ft
 S3: 950 psf

CHECK BEARING:

Design Method: Nonconstrained
 Footing Area: 7.1 ft²
 Total Concr. Press.: 75 psf
 q_{BEARING} : 221 psf OK

Use:		
d:	4.75	ft
b:	3	ft
Vol. Concr.:	37.1	cf

COMPARISON:

Diameter, b (ft):	3.00	3.25	3.50	3.75	4.00	4.25	4.50
Req'd depth, d (ft):	4.75	4.50	4.50	4.25	4.25	4.25	4.00
Volume of Concrete (cf):	37.1	41.5	48.1	52.5	59.7	67.4	71.6

Caisson Reinforcing Seismic Design Category C, D, E, F

IBC and ACI 318

Notes: Fremont Pole

Description: 14.5 ft Light Pole Base

Caisson Dimensions

Caisson Diameter:	36 in
Caisson Area:	1018 in ²
Embedded Pipe Area:	0 in ²
Net Conc Area:	1018 in ²
Perimeter:	113.1 in
S:	4580 in ³
f _c :	4500 psi
cracking ϕ Mn:	69.1 k-ft
Design Mu:	9.9 k-ft

Longitudinal Reinforcing

Longitudinal Reinf Ratio:	0.005
Longitudinal A _s req'd:	5.09 in ²
Longitudinal Bar Size:	6
No. Bars Req'd:	12
Spacing:	10.3 in
<i>(reference 18.10.3.9 for min reinforced Length)</i>	
SDC:	D

Transverse Reinforcing

Bar Size:	4
Spacing:	9 in

Per IBC 18.10.3.9, if design $M_u > \phi M_n$ OR if subject to uplift, reinforcing as noted above is required in caisson
