

PRCNC20220578

MUSCO SPORTS LIGHTING, LLC
Light Structure Pole and Foundation - Standard

These calculations must be on site and made available by the Permittee for all inspections.

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ITEM:
Structural Calculations
Pole/Foundation - Standard

PROJECT:
Cascade Christian
Field Lighting
Puyallup, WA


PROJECT # (scan #):
217954 (217954E)

DATE:
09 December 2024

ENGINEER:
Structural Engineers, P.C.
114 Nicholas Drive
Marshalltown, IA 50158

**City of Puyallup
Building
REVIEWED
FOR
COMPLIANCE**

BSnowden
06/11/2025
1:53:42 PM



City of Puyallup Development & Permitting Services ISSUED PERMIT	
Building	Planning
Engineering	Public Works
Fire	Traffic



Matthe
w L.
Pfeifer,
PE

Digitally signed
by Matthew L.
Pfeifer, PE
Date:
2024.12.09
08:59:15 -06'00'

Matthew L. Pfeifer – No. 52537
License Renewal Date: January 28, 2026

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC

PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)

DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES

REFERENCE: INTERNATIONAL BUILDING CODE 2018

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CODE REFERENCE

AASHTO 2013

Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals
American Association of State Highway and Transportation Officials (AASHTO), Washington D.C.

ASCE 7-16

Minimum Design Loads for Buildings and Other Structures
American Society of Civil Engineers (ASCE), New York, New York

IBC 2018

International Building Code 2018
International Code Council, Inc., Washington, DC

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REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

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POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

WIND DESIGN PARAMETERS

REFER ASCE 7-16:

Code: IBC 2018 (ASCE 7-16)
 Wind Category: V = 100 mph
 Exposure Category C

Wind Design Pressures:

Elev. (ft)	K_z	q_z (psf)	G_f	C_f	F / A_f (psf)
0.0-15.0	0.849	20.64	1.26	0.70	18.27
20.0	0.902	21.93	1.26	0.70	19.41
25.0	0.945	22.99	1.26	0.70	20.34
30.0	0.982	23.89	1.26	0.70	21.14
40.0	1.044	25.38	1.26	0.70	22.46
50.0	1.094	26.60	1.26	0.70	23.54
60.0	1.137	27.64	1.26	1.20	41.93
70.0	1.174	28.55	1.26	1.20	43.31
70.1	1.174	28.56	1.26	1.20	43.32
80.0	1.208	29.37			
90.0	1.238	30.10			
100.0	1.266	30.78			
120.0	1.315	31.98			
140.0	1.359	33.04			
160.0	1.397	33.98			
180.0	1.432	34.83			

$q_z = 0.00256 * K_z * K_{zt} * K_d * K_e * V^2$ (Eq. 26.10-1)

$K_z =$ As listed above. (§26.10.1 & Table 26.10-1)

$K_{zt} = 1.00$ (§26.8.2 & Fig. 26.8-1)

$K_d = 0.95$ (pole) (§26.6 & Table 26.6-1)
 0.85 (attachments)

$K_e = 1.00$ (Table 26.9-1)

Risk Category: II (Table 1.5-1)

$F = q_z * G_f * C_f * A_f$ (Eq. 29.4-1)

$G_f = 1.26$ (Eq. 26.11-10)

$C_f =$ As listed above for pole. (For Pole, Fig. 29.4-1)
 1.00 (For Fixtures - included in EPA)

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POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

WIND DESIGN PARAMETERS, CONTINUED

DEAD & WIND LOAD CASES - POLE TOP LUMINAIRES & ECE's					
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _w (ft-lbs)	V _w (lbs)	T _w (ft-lbs)
69.594	0	399	0	456	916
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
10.000	0	100	0	0	0

DEAD & WIND LOAD CASES - OTHER ATTACHMENTS					
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _w (ft-lbs)	V _w (lbs)	T _w (ft-lbs)
NA	NA	NA	NA	NA	NA
15.500	0	92	0	94	66
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

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NATURAL FREQUENCY

REFER AASHTO 2009:

First Modal Frequency (with Luminaire Mass), $f_{n1} = n_1 = 1.732 / 2\pi * \sqrt{(E * I * g / (W * L^3 + 0.236 * w * L^4))}$
 $f_{n1} = n_1 =$ 0.448 Hz (Eq. C11-3)

$E =$ 29000 ksi
 $I =$ 83.708 in⁴ (average of top and bottom pole sections) (Eq. C11-4)
 $g =$ 386 in/s²
 $W =$ 0.399 kips
 $L =$ 817 in
 $w =$ 0.001 k/in

Fundamental Period, $T = 1 / f_{n1}$
 $T =$ 2.234 s

GUST-EFFECT FACTOR

REFER ASCE 7-16:

Gust-Effect Factor, $G_f = 0.925 * (1 + 1.7 * I_z * \sqrt{(g_Q^2 * Q^2 + g_R^2 * R^2)}) / (1 + 1.7 * g_v * I_z)$
 $G_f =$ 1.26 (Eq. 26.11-10)

$z^- =$ 42.1 ft (§26.11.4)
 $I_z =$ 0.1921 (Eq. 26.11-7)
 $L_z =$ 525 ft (Eq. 26.11-9)
 $Q =$ 0.921 (Eq. 26.11-8)
 $g_Q =$ 3.40 (§26.11.5)
 $g_v =$ 3.40 (§26.11.5)
 $g_R =$ 3.99 (Eq. 26.11-11)
 $V_z^- =$ 99.0 ft/s (Eq. 26.11-16)
 $N_1 =$ 2.37 (Eq. 26.11-14)
 $R_n =$ 0.0805 (Eq. 26.11-13)
 $\eta_h =$ 1.46 (§26.11.5)
 $R_h =$ 0.463 (Eq. 26.11-15)
 $\eta_B =$ 0.008 (§26.11.5)
 $R_B =$ 0.995 (Eq. 26.11-15)
 $\eta_L =$ 0.028 (§26.11.5)
 $R_L =$ 0.982 (Eq. 26.11-15)
 $R =$ 1.213 (Eq. 26.11-12)

Exposure Parameters Exposure: C (Table 26.11-1)

$\alpha =$ 9.5 $b^- =$ 0.65
 $z_g =$ 900 ft $c =$ 0.20
 $a^{\wedge} =$ 0.11 $\ell =$ 500 ft
 $b^{\wedge} =$ 1.00 $\epsilon^- =$ 0.20
 $\alpha^- =$ 0.15 $z_{min} =$ 15 ft

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POLE INFORMATION

Wind loading in accordance with: IBC 2018 (ASCE 7-16)
 Analysis in accordance with: AASHTO Standard, 2013 Edition (LTS-6)

Light Structure Catalog No. = LSS70A
 Number of Fixtures = 7
 Fixture Arrangement = (5)
 Platforms = NA
 EPA of Fixtures & Accessories = 18.2 sq ft
 Weight of Dressed Pole = 1,662 lb
 Pole Natural Frequency = 0.448 Hz
 Pole Damping Ratio = 0.025
 Allowable Stress Increase, ASI = 1.00
 Wind Speed = 100 mph
 Exposure Category = C
 Risk Category = II
 Topographic Factor = 1.00

Light Structure Data: F_y
 (ksi)
 Mounting Section 38
 Extension No. 3 NA
 Extension No. 2 NA
 Extension No. 1 NA
 Top Section 55
 Bottom Section 55

Special Concentrated Loads (When Present):

Load No.	Elev.* (ft)	Quantity	Description	EPA (sq ft)	Weight (lbs)
1	NA	NA	NA	NA	NA
2	15.50	2	LED-BTF	1.80	35
3	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA

* Elevation listed is relative to local grade.

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Element Forces (D+0.6W)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
70.094	0.000	0.000	0.000	0.000
70.000	0.000	0.001	0.001	0.000
69.000	0.205	0.285	0.405	0.549
68.000	0.568	0.296	0.412	0.549
67.000	0.942	0.306	0.418	0.549
66.000	1.327	0.317	0.426	0.549
65.000	1.725	0.328	0.439	0.549
64.000	2.134	0.338	0.447	0.549
63.000	2.554	0.349	0.454	0.549
62.000	2.985	0.360	0.461	0.549
61.000	3.427	0.371	0.468	0.549
60.000	3.880	0.383	0.475	0.549
59.000	4.345	0.394	0.483	0.549
58.000	4.819	0.404	0.490	0.549
57.000	5.302	0.411	0.498	0.549
56.000	5.791	0.418	0.506	0.549
55.000	6.287	0.425	0.515	0.549
54.000	6.789	0.433	0.523	0.549
53.000	7.299	0.441	0.532	0.549
52.000	7.816	0.448	0.541	0.549
51.000	8.340	0.456	0.550	0.549
50.000	8.871	0.464	0.559	0.549
49.000	9.409	0.473	0.568	0.549
48.000	9.955	0.481	0.578	0.549
47.000	10.508	0.489	0.588	0.549
46.000	11.069	0.498	0.598	0.549
45.000	11.637	0.507	0.608	0.549
44.000	12.214	0.516	0.619	0.549
43.000	12.797	0.525	0.629	0.549
42.000	13.389	0.534	0.640	0.549
41.000	13.989	0.543	0.651	0.549
40.000	14.596	0.552	0.662	0.549
39.000	15.212	0.561	0.673	0.549
38.000	15.836	0.571	0.685	0.549
37.000	16.468	0.581	0.697	0.549
36.000	17.108	0.590	0.709	0.549
35.000	17.757	0.600	0.721	0.549
34.000	18.414	0.610	0.737	0.549
33.000	19.080	0.620	0.768	0.549
32.000	19.755	0.630	0.798	0.549

Deflection	
Elev. (ft)	δ (in)
70.094	47.6
70.000	47.5
69.000	46.0
68.000	44.6
67.000	43.1
66.000	41.6
65.000	40.2
64.000	38.8
63.000	37.4
62.000	36.0
61.000	34.6
60.000	33.3
59.000	32.0
58.000	30.7
57.000	29.4
56.000	28.2
55.000	27.0
54.000	25.8
53.000	24.7
52.000	23.5
51.000	22.5
50.000	21.4
49.000	20.4
48.000	19.4
47.000	18.4
46.000	17.5
45.000	16.6
44.000	15.7
43.000	14.9
42.000	14.0
41.000	13.3
40.000	12.5
39.000	11.8
38.000	11.1
37.000	10.4
36.000	9.7
35.000	9.1
34.000	8.5
33.000	8.0
32.000	7.4

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

Element Forces (D+0.6W)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
31.000	20.440	0.640	0.817	0.549
30.000	21.134	0.650	0.835	0.549
29.000	21.837	0.660	0.854	0.549
28.000	22.549	0.670	0.873	0.549
27.000	23.270	0.680	0.893	0.549
26.000	24.001	0.691	0.912	0.549
25.000	24.741	0.701	0.932	0.549
24.000	25.489	0.711	0.953	0.549
23.000	26.248	0.722	0.973	0.549
22.000	27.015	0.732	0.994	0.549
21.000	27.791	0.743	1.015	0.549
20.000	28.577	0.753	1.037	0.549
19.000	29.372	0.764	1.058	0.549
18.000	30.175	0.774	1.080	0.549
17.000	30.988	0.785	1.102	0.549
16.000	31.810	0.796	1.125	0.549
15.000	32.670	0.863	1.240	0.589
14.000	33.568	0.873	1.263	0.589
13.000	34.475	0.884	1.286	0.589
12.000	35.391	0.895	1.310	0.589
11.000	36.315	0.906	1.334	0.589
10.000	37.250	0.917	1.458	0.589
9.000	38.193	0.928	1.483	0.589
8.000	39.146	0.940	1.507	0.589
7.000	40.107	0.951	1.532	0.589
6.000	41.077	0.963	1.558	0.589
5.000	42.057	0.975	1.583	0.589
4.000	43.045	0.987	1.609	0.589
3.000	44.042	0.999	1.635	0.589
2.000	45.049	1.011	1.662	0.589

Deflection	
Elev. (ft)	δ (in)
31.000	6.9
30.000	6.4
29.000	6.0
28.000	5.5
27.000	5.1
26.000	4.7
25.000	4.3
24.000	3.9
23.000	3.5
22.000	3.2
21.000	2.9
20.000	2.6
19.000	2.3
18.000	2.0
17.000	1.8
16.000	1.5
15.000	1.3
14.000	1.1
13.000	0.9
12.000	0.8
11.000	0.6
10.000	0.5
9.000	0.4
8.000	0.3
7.000	0.2
6.000	0.1
5.000	0.1
4.000	0.0
3.000	0.0
2.000	0.0

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

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Actual & Allowable Stresses								(D+0.6W)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
70.094	0.000	0.505	22.800	0.000	25.080	0.000	12.540	0.000
70.000	0.000	0.505	22.800	0.000	25.080	0.001	12.540	0.000
69.000	0.229	0.505	22.800	1.211	25.080	1.828	12.540	0.080
68.000	0.229	0.505	22.800	3.265	25.080	1.797	12.540	0.161
67.000	0.230	0.505	22.800	5.275	25.080	1.767	12.540	0.240
66.000	0.231	0.505	22.800	7.243	25.080	1.738	12.540	0.318
65.000	0.235	0.505	22.800	9.171	25.080	1.711	12.540	0.395
64.000	0.246	0.505	33.000	11.922	36.300	1.799	18.150	0.346
63.000	0.243	0.505	33.000	13.469	36.300	1.723	18.150	0.387
62.000	0.239	0.505	33.000	14.883	36.300	1.653	18.150	0.426
61.000	0.237	0.505	33.000	16.179	36.300	1.588	18.150	0.461
60.000	0.234	0.505	33.000	17.371	36.300	1.529	18.150	0.493
59.000	0.232	0.505	33.000	18.469	36.300	1.475	18.150	0.522
58.000	0.230	0.505	33.000	19.479	36.300	1.422	18.150	0.550
57.000	0.228	0.505	33.000	20.401	36.300	1.371	18.150	0.575
56.000	0.226	0.505	33.000	21.239	36.300	1.323	18.150	0.597
55.000	0.225	0.505	33.000	22.002	36.300	1.279	18.150	0.618
54.000	0.223	0.505	33.000	22.697	36.300	1.237	18.150	0.637
53.000	0.222	0.505	33.000	23.333	36.300	1.198	18.150	0.654
52.000	0.221	0.505	33.000	23.914	36.300	1.162	18.150	0.670
51.000	0.220	0.505	33.000	24.446	36.300	1.128	18.150	0.684
50.000	0.219	0.505	33.000	24.935	36.300	1.097	18.150	0.697
49.000	0.218	0.505	33.000	25.383	36.300	1.067	18.150	0.709
48.000	0.217	0.505	33.000	25.795	36.300	1.039	18.150	0.720
47.000	0.217	0.505	33.000	26.175	36.300	1.012	18.150	0.731
46.000	0.216	0.505	33.000	26.525	36.300	0.988	18.150	0.740
45.000	0.216	0.505	33.000	26.848	36.300	0.964	18.150	0.749
44.000	0.215	0.505	33.000	27.146	36.300	0.942	18.150	0.757
43.000	0.215	0.505	33.000	27.422	36.300	0.921	18.150	0.765
42.000	0.215	0.505	33.000	27.677	36.300	0.902	18.150	0.771
41.000	0.215	0.505	33.000	27.914	36.300	0.883	18.150	0.778
40.000	0.215	0.505	33.000	28.134	36.084	0.865	18.150	0.788
39.000	0.215	0.505	33.000	28.337	35.842	0.849	18.150	0.799
38.000	0.215	0.505	33.000	28.527	35.607	0.833	18.150	0.810
37.000	0.215	0.505	33.000	28.703	35.380	0.818	18.150	0.820
36.000	0.215	0.505	33.000	28.868	35.161	0.804	18.150	0.830
35.000	0.216	0.505	33.000	29.021	34.948	0.790	18.150	0.839
34.000	0.217	0.505	33.000	29.164	34.742	0.777	17.742	0.848
33.000	0.223	0.505	33.000	29.298	34.542	0.765	17.343	0.857
32.000	0.228	0.505	33.000	29.425	34.347	0.754	16.958	0.866

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Actual & Allowable Stresses								(D+0.6W)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
31.000	0.158	0.505	33.000	21.154	36.300	0.516	18.150	0.588
30.000	0.159	0.505	33.000	21.213	36.300	0.509	18.150	0.590
29.000	0.161	0.505	33.000	21.267	36.300	0.501	18.150	0.592
28.000	0.162	0.505	33.000	21.318	36.300	0.494	18.150	0.593
27.000	0.163	0.505	33.000	21.365	36.300	0.487	18.150	0.594
26.000	0.164	0.505	33.000	21.409	36.300	0.481	18.150	0.595
25.000	0.166	0.505	33.000	21.450	36.300	0.475	18.150	0.597
24.000	0.167	0.505	33.000	21.489	36.300	0.469	18.150	0.598
23.000	0.168	0.505	33.000	21.524	36.300	0.463	18.150	0.599
22.000	0.169	0.505	33.000	21.558	36.300	0.458	18.150	0.600
21.000	0.171	0.505	33.000	21.588	36.300	0.453	18.150	0.601
20.000	0.172	0.505	33.000	21.617	36.300	0.448	18.150	0.601
19.000	0.173	0.505	33.000	21.643	36.300	0.443	18.150	0.602
18.000	0.175	0.505	33.000	21.668	36.300	0.438	18.150	0.603
17.000	0.176	0.505	33.000	21.691	36.300	0.434	18.150	0.603
16.000	0.177	0.505	33.000	21.712	36.300	0.430	18.150	0.604
15.000	0.193	0.505	33.000	21.750	36.300	0.456	18.150	0.606
14.000	0.194	0.505	33.000	21.805	36.300	0.451	18.150	0.607
13.000	0.196	0.505	33.000	21.857	36.300	0.447	18.150	0.609
12.000	0.197	0.505	33.000	21.906	36.300	0.443	18.150	0.610
11.000	0.198	0.505	33.000	21.951	36.300	0.439	18.150	0.611
10.000	0.214	0.505	33.000	21.994	36.300	0.436	18.150	0.613
9.000	0.215	0.505	33.000	22.035	36.145	0.432	18.150	0.617
8.000	0.216	0.505	33.000	22.073	35.981	0.429	18.150	0.621
7.000	0.217	0.505	33.000	22.109	35.821	0.425	18.150	0.624
6.000	0.218	0.505	33.000	22.142	35.664	0.422	18.150	0.628
5.000	0.220	0.505	33.000	22.174	35.511	0.419	18.150	0.632
4.000	0.221	0.505	33.000	22.203	35.361	0.417	18.150	0.635
3.000	0.222	0.505	33.000	22.231	35.214	0.414	18.150	0.639
2.000	0.223	0.505	33.000	22.256	35.070	0.411	18.150	0.642

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

SEISMIC DESIGN PARAMETERS

REFER ASCE 7-16:

1. Seismic Ground Motion Values

$S_S =$	1.270 g	$S_1 =$	0.440 g	(Fig. 22-1ff.)
Site Class:		DEFAULT (D)		(§11.4.3)
Seismic Design Category:		D		(Tables 11.6-1 & 11.6-2)
See §11.4.8, Exception #2				
$S_{DS} =$	1.020 g	$S_{D1} =$	0.550 g	(Eq. 11.4-3 & 11.4-4)
T =	2.234 s	$T_L =$	6.0 s	(Fig. 22-12ff.)
$T_0 =$	0.108 s	$T_S =$	0.539 s	(§11.4.6)

2. Pole Shaft

V =	$C_s * W =$		0.264 kips	(Eq. 12.8-1)
$C_{s,basic} =$	$S_{DS} / (R / I)$		0.680	(Eq. 12.8-2)
$C_{s,max} =$		Includes 1.5x factor	0.246	(Eq. 12.8-3 & 12.8-4)
$C_{s,min1} =$			0.045	(Eq. 15.4-1)
$C_{s,min2} =$			NA	(Eq. 15.4-2)
$C_s =$			0.246	
R =			1.5	(Table 15.4-2)
$I_e =$			1.00	(Table 1.5-1 & Table 1.5-2)
W =			1.071 kips	

Vertical Distribution:

$F_x =$	$C_{vx} * V$			(Eq. 12.8-11)
$C_{vx} =$	$(w_x * h_x^k) / \sum(w_i * h_i^k)$			(Eq. 12.8-12)
k =			1.867	(§12.8.3)

Deflections:

$\delta_x =$	$C_d * \delta_{xe} / I_e$			(Eq. 12.8-15)
$C_d =$			1.5	(Table 15.4-2)

3. Light Fixtures & Other Attachments

$F_p =$	$0.4 * a_p * S_{DS} * W_p / (R_p / I_p) * (1 + 2 * z / h)$			(Eq. 13.3-1)
$F_{p,max} =$	$1.6 * S_{DS} * I_p * W_p$			(Eq. 13.3-2)
$F_{p,min} =$	$0.3 * S_{DS} * I_p * W_p$			(Eq. 13.3-3)
$a_p =$			1.0	(Table 13.6-1 for Light fixture)
$R_p =$			1.50	(Table 13.6-1 for Light fixture)
$I_p =$			1.0	(§13.1.3)

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

SEISMIC DESIGN PARAMETERS, CONTINUED

REFER ASCE 7-16:

4. Seismic Load Effect

$E = E_{mh} \text{ or } E_h \pm E_v$ (Eq. 12.4-1, 12.4-2, 12.4-5, 12.4-6)

Pole Shaft:

$E_{mh} = \Omega_o * Q_E$ (Eq. 12.4-7)

$\Omega_o = 1.5$ (Table 15.4-2)

Light Fixtures & Other Attachments:

$E_h = \rho * Q_E$ (Eq. 12.4-3)

$\rho = 1.0$ (§12.3.4.1)

$E_v = 0.2 * S_{DS} * D$ (Eq. 12.4-4a)

$Q_E = V \text{ or } F_p$ (§12.4.2.1)

DEAD & SEISMIC LOAD CASES - POLE TOP LUMINAIRES & ECE'S						
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _e (ft-lbs)	V _e (lbs)	P _e (lbs)	T _e (ft-lbs)
69.594	0	399	0	324	81	649
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
10.000	0	100	0	31	20	0

DEAD & SEISMIC LOAD CASES - OTHER ATTACHMENTS						
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _e (ft-lbs)	V _e (lbs)	P _e (lbs)	T _e (ft-lbs)
NA	NA	NA	NA	NA	NA	NA
15.500	0	92	0	35	19	25
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

POLE INFORMATION

Seismic loading in accordance with: IBC 2018 (ASCE 7-16)
 Analysis in accordance with: AASHTO Standard, 2013 Edition (LTS-6)

Light Structure Catalog No. = LSS70A
 Number of Fixtures = 7
 Fixture Arrangement = (5)
 Platforms = NA
 Weight of Dressed Pole = 1,662 lb
 Pole Natural Frequency = 0.448 Hz
 Allowable Stress Increase, ASI = 1.00
 Importance Factor = 1.00

Seismic Analysis Procedure: Equivalent Lateral Force Analysis
 Basic Seismic Force Resisting System: Pole Concrete/Steel
 Total Seismic Base Shear = 785 lb

Light Structure Data: F_y
 (ksi)
 Mounting Section 38
 Extension No. 3 NA
 Extension No. 2 NA
 Extension No. 1 NA
 Top Section 55
 Bottom Section 55

Special Concentrated Loads (When Present):

Load No.	Elev.* (ft)	Quantity	Description	a_p	R_p	Weight (lbs)
1	NA	NA	NA	NA	NA	NA
2	15.50	2	LED-BTF	1.0	1.50	35
3	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA	NA

* Elevation listed is relative to local grade.

STRUCTURAL ENGINEERS, PC

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 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

Element Forces (D+0.7E)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
70.094	0.000	0.000	0.000	0.000
70.000	0.000	0.001	0.001	0.000
69.000	0.186	0.234	0.463	0.454
68.000	0.518	0.241	0.471	0.454
67.000	0.857	0.247	0.478	0.454
66.000	1.205	0.255	0.487	0.454
65.000	1.565	0.267	0.502	0.454
64.000	1.935	0.275	0.511	0.454
63.000	2.313	0.281	0.519	0.454
62.000	2.696	0.287	0.526	0.454
61.000	3.085	0.293	0.535	0.454
60.000	3.480	0.299	0.543	0.454
59.000	3.881	0.305	0.552	0.454
58.000	4.286	0.311	0.560	0.454
57.000	4.698	0.317	0.569	0.454
56.000	5.114	0.323	0.579	0.454
55.000	5.535	0.328	0.588	0.454
54.000	5.961	0.334	0.598	0.454
53.000	6.392	0.340	0.608	0.454
52.000	6.828	0.345	0.618	0.454
51.000	7.268	0.351	0.628	0.454
50.000	7.713	0.356	0.639	0.454
49.000	8.161	0.362	0.650	0.454
48.000	8.614	0.367	0.661	0.454
47.000	9.070	0.372	0.672	0.454
46.000	9.530	0.377	0.683	0.454
45.000	9.994	0.382	0.695	0.454
44.000	10.461	0.387	0.707	0.454
43.000	10.932	0.392	0.719	0.454
42.000	11.405	0.396	0.731	0.454
41.000	11.881	0.401	0.744	0.454
40.000	12.360	0.405	0.757	0.454
39.000	12.842	0.409	0.770	0.454
38.000	13.326	0.414	0.783	0.454
37.000	13.812	0.418	0.796	0.454
36.000	14.300	0.421	0.810	0.454
35.000	14.790	0.425	0.824	0.454
34.000	15.282	0.430	0.843	0.454
33.000	15.780	0.438	0.877	0.454
32.000	16.285	0.446	0.912	0.454

Deflection	
Elev. (ft)	δ (in)
70.094	53.1
70.000	53.0
69.000	51.3
68.000	49.6
67.000	48.0
66.000	46.3
65.000	44.6
64.000	43.0
63.000	41.4
62.000	39.8
61.000	38.3
60.000	36.8
59.000	35.3
58.000	33.8
57.000	32.4
56.000	31.0
55.000	29.6
54.000	28.3
53.000	27.0
52.000	25.8
51.000	24.5
50.000	23.4
49.000	22.2
48.000	21.1
47.000	20.0
46.000	19.0
45.000	18.0
44.000	17.0
43.000	16.0
42.000	15.1
41.000	14.3
40.000	13.4
39.000	12.6
38.000	11.9
37.000	11.1
36.000	10.4
35.000	9.7
34.000	9.1
33.000	8.5
32.000	7.9

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

Element Forces (D+0.7E)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
31.000	16.794	0.451	0.933	0.454
30.000	17.307	0.455	0.955	0.454
29.000	17.823	0.459	0.976	0.454
28.000	18.342	0.463	0.998	0.454
27.000	18.863	0.466	1.020	0.454
26.000	19.386	0.470	1.043	0.454
25.000	19.911	0.473	1.066	0.454
24.000	20.438	0.476	1.089	0.454
23.000	20.966	0.479	1.112	0.454
22.000	21.496	0.482	1.136	0.454
21.000	22.026	0.484	1.160	0.454
20.000	22.557	0.487	1.185	0.454
19.000	23.088	0.489	1.209	0.454
18.000	23.620	0.491	1.234	0.454
17.000	24.151	0.493	1.260	0.454
16.000	24.682	0.494	1.285	0.454
15.000	25.227	0.520	1.417	0.472
14.000	25.784	0.522	1.443	0.472
13.000	26.339	0.523	1.470	0.472
12.000	26.894	0.524	1.497	0.472
11.000	27.446	0.525	1.524	0.472
10.000	27.998	0.547	1.666	0.472
9.000	28.570	0.548	1.694	0.472
8.000	29.139	0.548	1.723	0.472
7.000	29.706	0.548	1.751	0.472
6.000	30.270	0.549	1.780	0.472
5.000	30.831	0.549	1.809	0.472
4.000	31.389	0.549	1.839	0.472
3.000	31.943	0.549	1.869	0.472
2.000	32.494	0.549	1.899	0.472

Deflection	
Elev. (ft)	δ (in)
31.000	7.3
30.000	6.8
29.000	6.3
28.000	5.8
27.000	5.4
26.000	4.9
25.000	4.5
24.000	4.1
23.000	3.7
22.000	3.4
21.000	3.0
20.000	2.7
19.000	2.4
18.000	2.1
17.000	1.8
16.000	1.6
15.000	1.4
14.000	1.2
13.000	1.0
12.000	0.8
11.000	0.6
10.000	0.5
9.000	0.4
8.000	0.3
7.000	0.2
6.000	0.1
5.000	0.1
4.000	0.0
3.000	0.0
2.000	0.0

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

Actual & Allowable Stresses								(D+0.7E)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
70.094	0.000	0.505	22.800	0.000	25.080	0.000	12.540	0.000
70.000	0.000	0.505	22.800	0.000	25.080	0.001	12.540	0.000
69.000	0.262	0.505	22.800	1.097	25.080	1.510	12.540	0.070
68.000	0.262	0.505	22.800	2.977	25.080	1.482	12.540	0.144
67.000	0.263	0.505	22.800	4.801	25.080	1.455	12.540	0.216
66.000	0.264	0.505	22.800	6.575	25.080	1.430	12.540	0.287
65.000	0.269	0.505	22.800	8.319	25.080	1.412	12.540	0.356
64.000	0.281	0.505	33.000	10.810	36.300	1.482	18.150	0.313
63.000	0.277	0.505	33.000	12.194	36.300	1.416	18.150	0.350
62.000	0.274	0.505	33.000	13.440	36.300	1.356	18.150	0.384
61.000	0.271	0.505	33.000	14.564	36.300	1.300	18.150	0.415
60.000	0.268	0.505	33.000	15.579	36.300	1.248	18.150	0.442
59.000	0.265	0.505	33.000	16.496	36.300	1.199	18.150	0.467
58.000	0.263	0.505	33.000	17.326	36.300	1.154	18.150	0.489
57.000	0.260	0.505	33.000	18.076	36.300	1.113	18.150	0.510
56.000	0.258	0.505	33.000	18.756	36.300	1.074	18.150	0.528
55.000	0.257	0.505	33.000	19.372	36.300	1.037	18.150	0.545
54.000	0.255	0.505	33.000	19.929	36.300	1.003	18.150	0.560
53.000	0.254	0.505	33.000	20.434	36.300	0.971	18.150	0.573
52.000	0.252	0.505	33.000	20.891	36.300	0.941	18.150	0.586
51.000	0.251	0.505	33.000	21.305	36.300	0.912	18.150	0.597
50.000	0.250	0.505	33.000	21.679	36.300	0.885	18.150	0.607
49.000	0.249	0.505	33.000	22.016	36.300	0.860	18.150	0.616
48.000	0.248	0.505	33.000	22.320	36.300	0.836	18.150	0.625
47.000	0.248	0.505	33.000	22.593	36.300	0.813	18.150	0.632
46.000	0.247	0.505	33.000	22.838	36.300	0.792	18.150	0.639
45.000	0.247	0.505	33.000	23.057	36.300	0.771	18.150	0.644
44.000	0.246	0.505	33.000	23.251	36.300	0.752	18.150	0.650
43.000	0.246	0.505	33.000	23.424	36.300	0.733	18.150	0.654
42.000	0.246	0.505	33.000	23.576	36.300	0.716	18.150	0.658
41.000	0.246	0.505	33.000	23.709	36.300	0.699	18.150	0.662
40.000	0.246	0.505	33.000	23.824	36.084	0.682	18.150	0.669
39.000	0.246	0.505	33.000	23.922	35.842	0.667	18.150	0.676
38.000	0.246	0.505	33.000	24.005	35.607	0.652	18.150	0.683
37.000	0.246	0.505	33.000	24.074	35.380	0.638	18.150	0.689
36.000	0.246	0.505	33.000	24.129	35.161	0.624	18.150	0.695
35.000	0.246	0.505	33.000	24.172	34.948	0.611	18.150	0.700
34.000	0.248	0.505	33.000	24.204	34.742	0.599	17.742	0.705
33.000	0.254	0.505	33.000	24.231	34.542	0.590	17.343	0.710
32.000	0.261	0.505	33.000	24.256	34.347	0.581	16.958	0.715

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

Actual & Allowable Stresses								(D+0.7E)
Elev. (ft)	f _a (ksi)	F _a (ksi)	F _{a-csr} (ksi)	f _b (ksi)	F _b (ksi)	f _v (ksi)	F _v (ksi)	CSR/ ASI
31.000	0.181	0.505	33.000	17.381	36.300	0.397	18.150	0.485
30.000	0.182	0.505	33.000	17.372	36.300	0.389	18.150	0.485
29.000	0.184	0.505	33.000	17.358	36.300	0.382	18.150	0.484
28.000	0.185	0.505	33.000	17.340	36.300	0.375	18.150	0.484
27.000	0.186	0.505	33.000	17.319	36.300	0.368	18.150	0.483
26.000	0.188	0.505	33.000	17.293	36.300	0.361	18.150	0.482
25.000	0.189	0.505	33.000	17.263	36.300	0.355	18.150	0.482
24.000	0.191	0.505	33.000	17.230	36.300	0.349	18.150	0.481
23.000	0.192	0.505	33.000	17.193	36.300	0.342	18.150	0.480
22.000	0.194	0.505	33.000	17.153	36.300	0.337	18.150	0.479
21.000	0.195	0.505	33.000	17.110	36.300	0.331	18.150	0.478
20.000	0.197	0.505	33.000	17.063	36.300	0.325	18.150	0.476
19.000	0.198	0.505	33.000	17.013	36.300	0.320	18.150	0.475
18.000	0.200	0.505	33.000	16.961	36.300	0.314	18.150	0.474
17.000	0.201	0.505	33.000	16.905	36.300	0.309	18.150	0.472
16.000	0.203	0.505	33.000	16.847	36.300	0.304	18.150	0.471
15.000	0.221	0.505	33.000	16.795	36.300	0.312	18.150	0.470
14.000	0.222	0.505	33.000	16.749	36.300	0.307	18.150	0.468
13.000	0.223	0.505	33.000	16.699	36.300	0.302	18.150	0.467
12.000	0.225	0.505	33.000	16.646	36.300	0.297	18.150	0.466
11.000	0.226	0.505	33.000	16.590	36.300	0.292	18.150	0.464
10.000	0.244	0.505	33.000	16.531	36.300	0.294	18.150	0.463
9.000	0.246	0.505	33.000	16.483	36.145	0.289	18.150	0.464
8.000	0.247	0.505	33.000	16.431	35.981	0.285	18.150	0.464
7.000	0.248	0.505	33.000	16.375	35.821	0.280	18.150	0.465
6.000	0.250	0.505	33.000	16.317	35.664	0.276	18.150	0.465
5.000	0.251	0.505	33.000	16.255	35.511	0.272	18.150	0.466
4.000	0.252	0.505	33.000	16.191	35.361	0.267	18.150	0.466
3.000	0.254	0.505	33.000	16.123	35.214	0.263	18.150	0.466
2.000	0.255	0.505	33.000	16.054	35.070	0.259	18.150	0.466

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

Reaction Forces & Structural Adequacy			(D+0.6W)
1. Reaction Forces			
Load Combination D+0.6W			
Moment	M =	47.071 ft-k	
Shear	V =	1.011 kips	
Axial	P =	1.662 kips	
Torque	T =	0.589 ft-k	
Component Forces: D			
Moment	$M_d =$	3.456 ft-k	
Including P-delta	$M_{d-pd} =$	3.456 ft-k	
Axial	$P_d =$	1.662 kips	
Component Forces: W			
Moment	$M_w =$	72.691 ft-k	
Shear	$V_w =$	1.685 kips	
Torque	$T_w =$	0.982 ft-k	
2. Pole Adequacy			
Maximum Combined Stress Ratio	CSR =	0.866	
w/ Allowable Stress Increase	CSR/ASI =	0.866	OK
Pole Top Deflection	$\delta_{max} =$	48 in	
Allowable Deflection (0.15 x h)	$\delta_{all} =$	123 in	OK

Second-order analysis completed using the deflected shape of the pole resulting from the applied forces magnified by 1.45 per AASHTO §4.8.2

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

Reaction Forces & Structural Adequacy			(D+0.7E)
1. Reaction Forces			
Load Combination D+0.7E			
Moment	M =	33.593 ft-k	
Shear	V =	0.549 kips	
Axial	P =	1.899 kips	
Torque	T =	0.472 ft-k	
Component Forces: D			
Moment	M _d =	3.821 ft-k	
Including P-delta	M _{d-pd} =	3.821 ft-k	
Axial	P _d =	1.662 kips	
Component Forces: E (E _h & E _v)			
Moment (E _h)	M _{eh} =	41.752 ft-k	
Shear (E _h)	V _{eh} =	0.785 kips	
Torque (E _h)	T _{eh} =	0.674 ft-k	
Moment (E _v)	M _{ev} =	0.779	
Including P-delta	M _{ev-pd} =	0.779	
Axial (E _v)	P _{ev} =	0.339	
2. Pole Adequacy			
Maximum Combined Stress Ratio	CSR =	0.715	
w/ Allowable Stress Increase	CSR/ASI =	0.715	OK
Pole Top Deflection	δ _{max} =	53 in	
Allowable Deflection (0.15 x h)	δ _{all} =	123 in	OK

Second-order analysis completed using the deflected shape of the pole resulting from the applied forces magnified by 1.45 per AASHTO §4.8.2

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

PRECAST BASE

REFERENCE: ICC-ES REPORT ESR-3765

TABLE 1 - PRESTRESSED CONCRETE BASES						
BOTTOM DIAMETER (inches)	TOP DIAMETER (inches)	BASE LENGTH (ft)	TAPER LENGTH (in)	PROJ. ABOVE GR. (inches)	DESIGN MOM. STR. (ft-kips)	DESIGN AXIAL STR. (kips)
13.375	12.250	20.000	100	96	114	274
For combined moment loads and axial loads: $m_a / M_a + a_a / A_a \leq 1$						
Where: m_a = Actual moment.		M_a = Design moment strength.		a_a = Actual axial load.		A_a = Design axial strength.

Precast Base Adequacy:

From Table 1	ϕM_n (ft-k)	ϕP_n (kips)				
Design Strength	114	274				
Load Combination	M_u (ft-k)	$M_u / \phi M_n$	P_u (kips)	$P_u / \phi P_n$	Combined	
1.2D+1.0W	80.2	0.706	3.5	0.013	0.719	OK
1.2D+1.0E	48.7	0.429	3.8	0.014	0.443	OK

Note: Precast Base critical forces calculated at 2.0 ft below grade.

STRUCTURAL ENGINEERS, PC

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F1, F2; LSS70A 7 (5)

DRILLED PIER FOUNDATION DESIGN

GEOTECHNICAL REFERENCE: Report No. 092-08048 by Krazan & Associates, Inc.

APPLIED LOADS:

V = 1.01 kips
 M = 47.07 ft-k Ignored Depth = 2.0 ft
 M_{adj} = 49.09 ft-k Equivalent Moment Arm, h = 48.6 ft

Input Soil Profile Information for Each Zone				
Soil Zone No.	Depth to Top of Zone (ft)	Diameter b (ft)	Allowable Pressure, S (ksf/ft)	Zone Thickness (ft)
1	2.0	2.50	0.200	

Solve NONCONSTRAINED Depth of Embedment Formula for Each Zone:						
Soil Zone No.	Test d (ft)	Pressure @ d/3, S_1 (ksf)	Parameter A (ft)	Solve d (ft)	Percent Contributed	Depth Contributed (ft)
1	9.61	0.641	1.477	9.61	1.000	9.611
Sum					1.000	9.611

Total Embedment Depth Required:
 D = 11.611 (ft)

PIER DETAILS
 Diameter = 30 in
 Embedment Depth = 12.0 ft

EQUATION REFERENCE:
 Section 1807.3.2.1
 $A = (2.34 * V) / (S_1 * b)$
 $d = 0.5A * (1 + \sqrt{1 + 4.36 * h / A})$

STRUCTURAL ENGINEERS, PC
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PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

INDEX FOR POLE(S) F3:

Material	Page Reference
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STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

WIND DESIGN PARAMETERS

REFER ASCE 7-16:

Code: IBC 2018 (ASCE 7-16)
 Wind Category: V = 100 mph
 Exposure Category C

Wind Design Pressures:

Elev. (ft)	K _z	q _z (psf)	G _f	C _f	F / A _f (psf)
0.0-15.0	0.849	20.64	1.24	0.70	17.98
20.0	0.902	21.93	1.24	0.70	19.10
25.0	0.945	22.99	1.24	0.70	20.02
30.0	0.982	23.89	1.24	0.70	20.81
40.0	1.044	25.38	1.24	0.70	22.11
50.0	1.094	26.60	1.24	0.70	23.17
60.0	1.137	27.64	1.24	0.70	24.08
70.0	1.174	28.55	1.24	0.70	24.87
70.2	1.175	28.57	1.24	0.70	24.88
80.0	1.208	29.37			
90.0	1.238	30.10			
100.0	1.266	30.78			
120.0	1.315	31.98			
140.0	1.359	33.04			
160.0	1.397	33.98			
180.0	1.432	34.83			

$q_z = 0.00256 * K_z * K_{zt} * K_d * K_e * V^2$ (Eq. 26.10-1)

$K_z =$ As listed above. (§26.10.1 & Table 26.10-1)

$K_{zt} =$ 1.00 (Table 26.8.2 & Fig. 26.8-1)

$K_d =$ 0.95 (pole) (Table 26.6 & Table 26.6-1)
 0.85 (attachments)

$K_e =$ 1.00 (Table 26.9-1)

Risk Category: II (Table 1.5-1)

$F = q_z * G_f * C_f * A_f$ (Eq. 29.4-1)

$G_f =$ 1.24 (Eq. 26.11-10)

$C_f =$ As listed above for pole. (For Pole, Fig. 29.4-1)
 1.00 (For Fixtures - included in EPA)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC

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DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES

REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

WIND DESIGN PARAMETERS, CONTINUED

DEAD & WIND LOAD CASES - POLE TOP LUMINAIRES & ECE's					
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _w (ft-lbs)	V _w (lbs)	T _w (ft-lbs)
69.683	0	609	0	666	1,218
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
10.000	0	180	0	0	0

DEAD & WIND LOAD CASES - OTHER ATTACHMENTS					
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _w (ft-lbs)	V _w (lbs)	T _w (ft-lbs)
19.000	0	92	0	97	68
15.500	0	92	0	93	65
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

STRUCTURAL ENGINEERS, PC

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 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

NATURAL FREQUENCY

REFER AASHTO 2009:

First Modal Frequency (with Luminaire Mass), $f_{n1} = n_1 = 1.732 / 2\pi * \sqrt{(E * I * g / (W * L^3 + 0.236 * w * L^4))}$
 $f_{n1} = n_1 = 0.473$ Hz (Eq. C11-3)

$E = 29000$ ksi
 $I = 140.899$ in⁴ (average of top and bottom pole sections) (Eq. C11-4)
 $g = 386$ in/s²
 $W = 0.609$ kips
 $L = 818$ in
 $w = 0.002$ k/in

Fundamental Period, $T = 1 / f_{n1}$
 $T = 2.113$ s

GUST-EFFECT FACTOR

REFER ASCE 7-16:

Gust-Effect Factor, $G_f = 0.925 * (1 + 1.7 * I_z * \sqrt{(g_Q^2 * Q^2 + g_R^2 * R^2)}) / (1 + 1.7 * g_v * I_z)$
 $G_f = 1.24$ (Eq. 26.11-10)

$z^- = 42.1$ ft (§26.11.4)
 $I_z = 0.1920$ (Eq. 26.11-7)
 $L_z = 525$ ft (Eq. 26.11-9)
 $Q = 0.921$ (Eq. 26.11-8)
 $g_Q = 3.40$ (§26.11.5)
 $g_v = 3.40$ (§26.11.5)
 $g_R = 4.01$ (Eq. 26.11-11)
 $V_z^- = 99.0$ ft/s (Eq. 26.11-16)
 $N_1 = 2.51$ (Eq. 26.11-14)
 $R_n = 0.0779$ (Eq. 26.11-13)
 $\eta_h = 1.54$ (§26.11.5)
 $R_h = 0.448$ (Eq. 26.11-15)
 $\eta_B = 0.013$ (§26.11.5)
 $R_B = 0.992$ (Eq. 26.11-15)
 $\eta_L = 0.043$ (§26.11.5)
 $R_L = 0.972$ (Eq. 26.11-15)
 $R = 1.168$ (Eq. 26.11-12)

Exposure Parameters Exposure: C (Table 26.11-1)

$\alpha = 9.5$ $b^- = 0.65$
 $z_g = 900$ ft $c = 0.20$
 $a^{\wedge} = 0.11$ $\ell = 500$ ft
 $b^{\wedge} = 1.00$ $\epsilon^- = 0.20$
 $\alpha^- = 0.15$ $z_{min} = 15$ ft

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

POLE INFORMATION

Wind loading in accordance with: IBC 2018 (ASCE 7-16)
 Analysis in accordance with: AASHTO Standard, 2013 Edition (LTS-6)

Light Structure Catalog No. = LSS70C
 Number of Fixtures = 13
 Fixture Arrangement = (5) / (4)
 Platforms = NA
 EPA of Fixtures & Accessories = 29.0 sq ft
 Weight of Dressed Pole = 2,531 lb
 Pole Natural Frequency = 0.473 Hz
 Pole Damping Ratio = 0.025
 Allowable Stress Increase, ASI = 1.00
 Wind Speed = 100 mph
 Exposure Category = C
 Risk Category = II
 Topographic Factor = 1.00

Light Structure Data: F_y
 (ksi)
 Mounting Section 38
 Extension No. 3 NA
 Extension No. 2 NA
 Extension No. 1 NA
 Top Section 55
 Bottom Section 55

Special Concentrated Loads (When Present):

Load No.	Elev.* (ft)	Quantity	Description	EPA (sq ft)	Weight (lbs)
1	19.00	2	LED-BTF	1.80	35
2	15.50	2	LED-BTF	1.80	35
3	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA

* Elevation listed is relative to local grade.

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POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Element Forces (D+0.6W)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
70.183	0.000	0.000	0.000	0.000
70.000	0.000	0.002	0.002	0.000
69.000	0.306	0.410	0.621	0.731
68.000	0.776	0.419	0.631	0.731
67.000	1.255	0.428	0.641	0.731
66.000	1.744	0.437	0.660	0.731
65.000	2.244	0.446	0.685	0.731
64.000	2.754	0.455	0.700	0.731
63.000	3.274	0.464	0.715	0.731
62.000	3.804	0.474	0.730	0.731
61.000	4.344	0.483	0.745	0.731
60.000	4.895	0.493	0.761	0.731
59.000	5.455	0.502	0.777	0.731
58.000	6.026	0.512	0.793	0.731
57.000	6.607	0.522	0.809	0.731
56.000	7.198	0.532	0.826	0.731
55.000	7.800	0.542	0.843	0.731
54.000	8.413	0.553	0.860	0.731
53.000	9.037	0.563	0.878	0.731
52.000	9.671	0.574	0.896	0.731
51.000	10.316	0.584	0.914	0.731
50.000	10.972	0.595	0.932	0.731
49.000	11.639	0.606	0.951	0.731
48.000	12.317	0.617	0.970	0.731
47.000	13.006	0.628	0.989	0.731
46.000	13.707	0.640	1.009	0.731
45.000	14.418	0.651	1.029	0.731
44.000	15.141	0.663	1.049	0.731
43.000	15.876	0.674	1.069	0.731
42.000	16.622	0.686	1.098	0.731
41.000	17.380	0.698	1.139	0.731
40.000	18.151	0.709	1.181	0.731
39.000	18.934	0.721	1.201	0.731
38.000	19.728	0.733	1.222	0.731
37.000	20.533	0.745	1.244	0.731
36.000	21.350	0.757	1.265	0.731
35.000	22.177	0.768	1.287	0.731
34.000	23.015	0.780	1.309	0.731
33.000	23.864	0.792	1.332	0.731
32.000	24.724	0.805	1.354	0.731

Deflection	
Elev. (ft)	δ (in)
70.183	27.9
70.000	27.8
69.000	27.0
68.000	26.3
67.000	25.6
66.000	24.9
65.000	24.1
64.000	23.4
63.000	22.7
62.000	22.0
61.000	21.3
60.000	20.7
59.000	20.0
58.000	19.3
57.000	18.6
56.000	18.0
55.000	17.4
54.000	16.7
53.000	16.1
52.000	15.5
51.000	14.9
50.000	14.3
49.000	13.7
48.000	13.1
47.000	12.6
46.000	12.0
45.000	11.5
44.000	11.0
43.000	10.4
42.000	9.9
41.000	9.4
40.000	9.0
39.000	8.5
38.000	8.0
37.000	7.6
36.000	7.2
35.000	6.7
34.000	6.3
33.000	5.9
32.000	5.6

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

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 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Element Forces (D+0.6W)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
31.000	25.596	0.817	1.377	0.731
30.000	26.478	0.829	1.401	0.731
29.000	27.372	0.841	1.424	0.731
28.000	28.277	0.854	1.448	0.731
27.000	29.193	0.866	1.472	0.731
26.000	30.120	0.879	1.497	0.731
25.000	31.058	0.891	1.521	0.731
24.000	32.007	0.904	1.546	0.731
23.000	32.967	0.916	1.571	0.731
22.000	33.938	0.929	1.597	0.731
21.000	34.921	0.942	1.623	0.731
20.000	35.914	0.954	1.649	0.731
19.000	36.919	1.025	1.768	0.772
18.000	37.994	1.038	1.794	0.772
17.000	39.079	1.050	1.821	0.772
16.000	40.175	1.063	1.848	0.772
15.000	41.310	1.131	1.968	0.811
14.000	42.484	1.144	1.996	0.811
13.000	43.669	1.156	2.024	0.811
12.000	44.863	1.169	2.052	0.811
11.000	46.068	1.182	2.081	0.811
10.000	47.284	1.195	2.290	0.811
9.000	48.511	1.208	2.319	0.811
8.000	49.748	1.222	2.348	0.811
7.000	50.996	1.235	2.378	0.811
6.000	52.254	1.249	2.408	0.811
5.000	53.522	1.263	2.439	0.811
4.000	54.800	1.276	2.469	0.811
3.000	56.089	1.290	2.500	0.811
2.000	57.388	1.304	2.531	0.811

Deflection	
Elev. (ft)	δ (in)
31.000	5.2
30.000	4.8
29.000	4.5
28.000	4.2
27.000	3.8
26.000	3.5
25.000	3.2
24.000	3.0
23.000	2.7
22.000	2.5
21.000	2.2
20.000	2.0
19.000	1.8
18.000	1.6
17.000	1.4
16.000	1.2
15.000	1.0
14.000	0.9
13.000	0.7
12.000	0.6
11.000	0.5
10.000	0.4
9.000	0.3
8.000	0.2
7.000	0.2
6.000	0.1
5.000	0.1
4.000	0.0
3.000	0.0
2.000	0.0

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Actual & Allowable Stresses								(D+0.6W)
Elev. (ft)	f _a (ksi)	F _a (ksi)	F _{a-csr} (ksi)	f _b (ksi)	F _b (ksi)	f _v (ksi)	F _v (ksi)	CSR/ ASI
70.183	0.000	0.797	22.800	0.000	25.080	0.000	12.540	0.000
70.000	0.001	0.797	22.800	0.000	25.080	0.001	12.540	0.000
69.000	0.226	0.797	22.800	0.778	25.080	1.178	12.540	0.050
68.000	0.226	0.797	22.800	1.912	25.080	1.155	12.540	0.095
67.000	0.226	0.797	22.800	3.003	25.080	1.133	12.540	0.138
66.000	0.230	0.797	22.800	4.055	25.080	1.112	12.540	0.180
65.000	0.235	0.797	22.800	5.070	25.080	1.092	12.540	0.220
64.000	0.171	0.797	33.000	4.573	36.300	0.787	18.150	0.133
63.000	0.172	0.797	33.000	5.231	36.300	0.767	18.150	0.151
62.000	0.172	0.797	33.000	5.851	36.300	0.747	18.150	0.168
61.000	0.172	0.797	33.000	6.438	36.300	0.729	18.150	0.184
60.000	0.173	0.797	33.000	6.992	36.300	0.712	18.150	0.199
59.000	0.173	0.797	33.000	7.518	36.300	0.696	18.150	0.214
58.000	0.174	0.797	33.000	8.017	36.300	0.680	18.150	0.228
57.000	0.175	0.797	33.000	8.490	36.300	0.666	18.150	0.241
56.000	0.175	0.797	33.000	8.941	36.300	0.652	18.150	0.253
55.000	0.176	0.797	33.000	9.369	36.300	0.639	18.150	0.265
54.000	0.177	0.797	33.000	9.778	36.300	0.626	18.150	0.276
53.000	0.177	0.797	33.000	10.167	36.300	0.615	18.150	0.287
52.000	0.178	0.797	33.000	10.539	36.300	0.603	18.150	0.297
51.000	0.179	0.797	33.000	10.894	36.300	0.593	18.150	0.307
50.000	0.180	0.797	33.000	11.234	36.300	0.583	18.150	0.316
49.000	0.181	0.797	33.000	11.560	36.300	0.573	18.150	0.325
48.000	0.181	0.797	33.000	11.872	36.300	0.564	18.150	0.334
47.000	0.182	0.797	33.000	12.171	36.300	0.555	18.150	0.342
46.000	0.183	0.797	33.000	12.459	36.300	0.547	18.150	0.350
45.000	0.184	0.797	33.000	12.735	36.300	0.539	18.150	0.357
44.000	0.185	0.797	33.000	13.000	36.300	0.532	18.150	0.365
43.000	0.186	0.797	33.000	13.256	36.300	0.524	18.150	0.372
42.000	0.189	0.797	33.000	13.502	36.300	0.518	18.150	0.378
41.000	0.193	0.797	33.000	13.740	36.300	0.511	18.150	0.385
40.000	0.198	0.797	33.000	13.970	36.300	0.505	18.150	0.392
39.000	0.205	0.797	33.000	15.197	36.300	0.525	18.150	0.426
38.000	0.206	0.797	33.000	15.413	36.300	0.519	18.150	0.432
37.000	0.207	0.797	33.000	15.621	36.300	0.512	18.150	0.437
36.000	0.208	0.797	33.000	15.820	36.300	0.506	18.150	0.443
35.000	0.209	0.797	33.000	16.012	36.300	0.500	18.150	0.448
34.000	0.210	0.797	33.000	16.198	36.300	0.495	18.150	0.453
33.000	0.211	0.797	33.000	16.376	36.300	0.490	18.150	0.458
32.000	0.211	0.797	33.000	16.548	36.300	0.485	18.150	0.463

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Actual & Allowable Stresses								(D+0.6W)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
31.000	0.212	0.797	33.000	16.714	36.300	0.480	18.150	0.468
30.000	0.213	0.797	33.000	16.874	36.300	0.475	18.150	0.472
29.000	0.214	0.797	33.000	17.029	36.300	0.471	18.150	0.476
28.000	0.215	0.797	33.000	17.179	36.300	0.466	18.150	0.480
27.000	0.217	0.797	33.000	17.323	36.300	0.462	18.150	0.484
26.000	0.218	0.797	33.000	17.463	36.180	0.458	18.150	0.490
25.000	0.219	0.797	33.000	17.598	36.016	0.455	18.150	0.496
24.000	0.220	0.797	33.000	17.729	35.855	0.451	18.150	0.502
23.000	0.221	0.797	33.000	17.856	35.697	0.447	18.150	0.507
22.000	0.222	0.797	33.000	17.978	35.543	0.444	18.150	0.513
21.000	0.223	0.797	33.000	18.097	35.393	0.441	18.150	0.519
20.000	0.224	0.797	33.000	18.212	35.245	0.438	18.150	0.524
19.000	0.238	0.797	33.000	18.323	35.101	0.460	18.150	0.530
18.000	0.239	0.797	33.000	18.460	34.959	0.457	18.150	0.536
17.000	0.240	0.797	33.000	18.593	34.821	0.453	17.900	0.542
16.000	0.241	0.797	33.000	18.720	34.685	0.450	17.628	0.548
15.000	0.254	0.797	33.000	18.857	34.552	0.470	17.363	0.554
14.000	0.255	0.797	33.000	19.002	34.422	0.467	17.105	0.561
13.000	0.256	0.797	33.000	19.141	34.294	0.464	16.852	0.567
12.000	0.257	0.797	33.000	19.276	34.168	0.461	16.606	0.573
11.000	0.258	0.797	33.000	19.405	34.046	0.458	16.366	0.579
10.000	0.281	0.797	33.000	19.531	33.925	0.455	16.132	0.585
9.000	0.282	0.797	33.000	19.653	33.807	0.452	15.903	0.591
8.000	0.283	0.797	33.000	19.771	33.691	0.450	15.680	0.596
7.000	0.284	0.797	33.000	19.885	33.577	0.447	15.461	0.602
6.000	0.285	0.797	33.000	19.995	33.465	0.445	15.248	0.607
5.000	0.286	0.797	33.000	20.101	33.355	0.443	15.040	0.612
4.000	0.287	0.797	33.000	20.204	33.248	0.441	14.836	0.617
3.000	0.288	0.797	33.000	20.304	33.142	0.439	14.637	0.622
2.000	0.289	0.797	33.000	20.400	33.038	0.437	14.442	0.627

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STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

SEISMIC DESIGN PARAMETERS

REFER ASCE 7-16:

1. Seismic Ground Motion Values

$S_S =$	1.270 g	$S_1 =$	0.440 g	(Fig. 22-1ff.)
Site Class:		DEFAULT (D)		(§11.4.3)
Seismic Design Category:		D		(Tables 11.6-1 & 11.6-2)
See §11.4.8, Exception #2				
$S_{DS} =$	1.020 g	$S_{D1} =$	0.550 g	(Eq. 11.4-3 & 11.4-4)
T =	2.113 s	$T_L =$	6.0 s	(Fig. 22-12ff.)
$T_0 =$	0.108 s	$T_S =$	0.539 s	(§11.4.6)

2. Pole Shaft

V =	$C_s * W =$	0.405 kips	(Eq. 12.8-1)
$C_{s,basic} =$	$S_{DS} / (R / I)$	0.680	(Eq. 12.8-2)
$C_{s,max} =$	Includes 1.5x factor	0.260	(Eq. 12.8-3 & 12.8-4)
$C_{s,min1} =$		0.045	(Eq. 15.4-1)
$C_{s,min2} =$		NA	(Eq. 15.4-2)
$C_s =$		0.260	
R =		1.5	(Table 15.4-2)
$I_e =$		1.00	(Table 1.5-1 & Table 1.5-2)
W =		1.557 kips	

Vertical Distribution:

$F_x =$	$C_{vx} * V$		(Eq. 12.8-11)
$C_{vx} =$	$(w_x * h_x^k) / \sum(w_i * h_i^k)$		(Eq. 12.8-12)
k =		1.806	(§12.8.3)

Deflections:

$\delta_x =$	$C_d * \delta_{xe} / I_e$		(Eq. 12.8-15)
$C_d =$		1.5	(Table 15.4-2)

3. Light Fixtures & Other Attachments

$F_p =$	$0.4 * a_p * S_{DS} * W_p / (R_p / I_p) * (1 + 2 * z / h)$		(Eq. 13.3-1)
$F_{p,max} =$	$1.6 * S_{DS} * I_p * W_p$		(Eq. 13.3-2)
$F_{p,min} =$	$0.3 * S_{DS} * I_p * W_p$		(Eq. 13.3-3)
$a_p =$		1.0	(Table 13.6-1 for Light fixture)
$R_p =$		1.50	(Table 13.6-1 for Light fixture)
$I_p =$		1.0	(§13.1.3)

STRUCTURAL ENGINEERS, PC
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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

SEISMIC DESIGN PARAMETERS, CONTINUED

REFER ASCE 7-16:

4. Seismic Load Effect

$E = E_{mh} \text{ or } E_h \pm E_v$ (Eq. 12.4-1, 12.4-2, 12.4-5, 12.4-6)

Pole Shaft:

$E_{mh} = \Omega_o * Q_E$ (Eq. 12.4-7)

$\Omega_o = 1.5$ (Table 15.4-2)

Light Fixtures & Other Attachments:

$E_h = \rho * Q_E$ (Eq. 12.4-3)

$\rho = 1.0$ (§12.3.4.1)

$E_v = 0.2 * S_{DS} * D$ (Eq. 12.4-4a)

$Q_E = V \text{ or } F_p$ (§12.4.2.1)

DEAD & SEISMIC LOAD CASES - POLE TOP LUMINAIRES & ECE'S						
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _e (ft-lbs)	V _e (lbs)	P _e (lbs)	T _e (ft-lbs)
69.683	0	609	0	495	124	924
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
10.000	0	180	0	55	37	0

DEAD & SEISMIC LOAD CASES - OTHER ATTACHMENTS						
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _e (ft-lbs)	V _e (lbs)	P _e (lbs)	T _e (ft-lbs)
19.000	0	92	0	38	19	27
15.500	0	92	0	35	19	25
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

POLE INFORMATION

Seismic loading in accordance with: IBC 2018 (ASCE 7-16)
 Analysis in accordance with: AASHTO Standard, 2013 Edition (LTS-6)

Light Structure Catalog No. = LSS70C
 Number of Fixtures = 13
 Fixture Arrangement = (5) / (4)
 Platforms = NA
 Weight of Dressed Pole = 2,531 lb
 Pole Natural Frequency = 0.473 Hz
 Allowable Stress Increase, ASI = 1.00
 Importance Factor = 1.00

Seismic Analysis Procedure: Equivalent Lateral Force Analysis
 Basic Seismic Force Resisting System: Pole Concrete/Steel
 Total Seismic Base Shear = 1231 lb

Light Structure Data: F_y
 (ksi)
 Mounting Section 38
 Extension No. 3 NA
 Extension No. 2 NA
 Extension No. 1 NA
 Top Section 55
 Bottom Section 55

Special Concentrated Loads (When Present):

Load No.	Elev.* (ft)	Quantity	Description	a_p	R_p	Weight (lbs)
1	19.00	2	LED-BTF	1.0	1.50	35
2	15.50	2	LED-BTF	1.0	1.50	35
3	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA	NA

* Elevation listed is relative to local grade.

STRUCTURAL ENGINEERS, PC

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POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Element Forces (D+0.7E)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
70.183	0.000	0.000	0.000	0.000
70.000	0.000	0.002	0.002	0.000
69.000	0.285	0.357	0.710	0.647
68.000	0.731	0.365	0.721	0.647
67.000	1.187	0.374	0.733	0.647
66.000	1.656	0.390	0.755	0.647
65.000	2.146	0.409	0.783	0.647
64.000	2.653	0.421	0.800	0.647
63.000	3.173	0.432	0.817	0.647
62.000	3.705	0.443	0.834	0.647
61.000	4.249	0.454	0.852	0.647
60.000	4.805	0.465	0.869	0.647
59.000	5.373	0.476	0.888	0.647
58.000	5.952	0.486	0.906	0.647
57.000	6.542	0.496	0.925	0.647
56.000	7.143	0.507	0.944	0.647
55.000	7.755	0.517	0.963	0.647
54.000	8.378	0.527	0.983	0.647
53.000	9.010	0.536	1.003	0.647
52.000	9.653	0.546	1.024	0.647
51.000	10.306	0.555	1.044	0.647
50.000	10.968	0.564	1.065	0.647
49.000	11.639	0.573	1.087	0.647
48.000	12.319	0.582	1.109	0.647
47.000	13.008	0.591	1.131	0.647
46.000	13.705	0.599	1.153	0.647
45.000	14.411	0.608	1.176	0.647
44.000	15.124	0.615	1.199	0.647
43.000	15.845	0.623	1.222	0.647
42.000	16.574	0.634	1.254	0.647
41.000	17.317	0.648	1.301	0.647
40.000	18.076	0.662	1.349	0.647
39.000	18.845	0.669	1.373	0.647
38.000	19.619	0.675	1.397	0.647
37.000	20.398	0.681	1.421	0.647
36.000	21.182	0.687	1.446	0.647
35.000	21.971	0.693	1.471	0.647
34.000	22.763	0.699	1.496	0.647
33.000	23.560	0.704	1.522	0.647
32.000	24.360	0.709	1.548	0.647

Deflection	
Elev. (ft)	δ (in)
70.183	37.3
70.000	37.1
69.000	36.2
68.000	35.2
67.000	34.2
66.000	33.2
65.000	32.2
64.000	31.3
63.000	30.3
62.000	29.4
61.000	28.4
60.000	27.5
59.000	26.6
58.000	25.7
57.000	24.8
56.000	23.9
55.000	23.0
54.000	22.2
53.000	21.3
52.000	20.5
51.000	19.7
50.000	18.9
49.000	18.1
48.000	17.3
47.000	16.6
46.000	15.8
45.000	15.1
44.000	14.4
43.000	13.7
42.000	13.0
41.000	12.4
40.000	11.7
39.000	11.1
38.000	10.5
37.000	9.9
36.000	9.3
35.000	8.8
34.000	8.2
33.000	7.7
32.000	7.2

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Element Forces (D+0.7E)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
31.000	25.163	0.714	1.574	0.647
30.000	25.969	0.719	1.601	0.647
29.000	26.778	0.723	1.628	0.647
28.000	27.589	0.727	1.655	0.647
27.000	28.402	0.731	1.682	0.647
26.000	29.216	0.735	1.710	0.647
25.000	30.032	0.739	1.739	0.647
24.000	30.850	0.742	1.767	0.647
23.000	31.668	0.745	1.796	0.647
22.000	32.486	0.748	1.825	0.647
21.000	33.305	0.751	1.855	0.647
20.000	34.124	0.754	1.884	0.647
19.000	34.944	0.782	2.020	0.666
18.000	35.791	0.784	2.050	0.666
17.000	36.638	0.786	2.081	0.666
16.000	37.482	0.788	2.112	0.666
15.000	38.339	0.814	2.249	0.683
14.000	39.208	0.816	2.281	0.683
13.000	40.074	0.817	2.313	0.683
12.000	40.937	0.818	2.345	0.683
11.000	41.798	0.819	2.378	0.683
10.000	42.657	0.859	2.617	0.683
9.000	43.552	0.859	2.650	0.683
8.000	44.444	0.860	2.684	0.683
7.000	45.331	0.860	2.718	0.683
6.000	46.215	0.861	2.752	0.683
5.000	47.093	0.861	2.787	0.683
4.000	47.967	0.861	2.822	0.683
3.000	48.836	0.861	2.857	0.683
2.000	49.700	0.861	2.893	0.683

Deflection	
Elev. (ft)	δ (in)
31.000	6.7
30.000	6.2
29.000	5.8
28.000	5.4
27.000	4.9
26.000	4.5
25.000	4.2
24.000	3.8
23.000	3.5
22.000	3.1
21.000	2.8
20.000	2.5
19.000	2.2
18.000	2.0
17.000	1.7
16.000	1.5
15.000	1.3
14.000	1.1
13.000	0.9
12.000	0.8
11.000	0.6
10.000	0.5
9.000	0.4
8.000	0.3
7.000	0.2
6.000	0.1
5.000	0.1
4.000	0.0
3.000	0.0
2.000	0.0

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Actual & Allowable Stresses								(D+0.7E)
Elev. (ft)	f _a (ksi)	F _a (ksi)	F _{a-csr} (ksi)	f _b (ksi)	F _b (ksi)	f _v (ksi)	F _v (ksi)	CSR/ ASI
70.183	0.000	0.797	22.800	0.000	25.080	0.000	12.540	0.000
70.000	0.001	0.797	22.800	0.000	25.080	0.001	12.540	0.000
69.000	0.258	0.797	22.800	0.724	25.080	1.039	12.540	0.047
68.000	0.259	0.797	22.800	1.802	25.080	1.019	12.540	0.090
67.000	0.259	0.797	22.800	2.841	25.080	1.000	12.540	0.131
66.000	0.263	0.797	22.800	3.851	25.080	0.986	12.540	0.171
65.000	0.269	0.797	22.800	4.848	25.080	0.976	12.540	0.211
64.000	0.196	0.797	33.000	4.406	36.300	0.706	18.150	0.129
63.000	0.196	0.797	33.000	5.069	36.300	0.689	18.150	0.147
62.000	0.197	0.797	33.000	5.699	36.300	0.673	18.150	0.164
61.000	0.197	0.797	33.000	6.297	36.300	0.658	18.150	0.181
60.000	0.198	0.797	33.000	6.865	36.300	0.643	18.150	0.196
59.000	0.198	0.797	33.000	7.405	36.300	0.630	18.150	0.211
58.000	0.199	0.797	33.000	7.919	36.300	0.617	18.150	0.225
57.000	0.200	0.797	33.000	8.407	36.300	0.604	18.150	0.239
56.000	0.200	0.797	33.000	8.872	36.300	0.592	18.150	0.252
55.000	0.201	0.797	33.000	9.315	36.300	0.581	18.150	0.264
54.000	0.202	0.797	33.000	9.736	36.300	0.570	18.150	0.275
53.000	0.203	0.797	33.000	10.138	36.300	0.559	18.150	0.286
52.000	0.204	0.797	33.000	10.520	36.300	0.549	18.150	0.297
51.000	0.204	0.797	33.000	10.884	36.300	0.540	18.150	0.307
50.000	0.205	0.797	33.000	11.230	36.300	0.530	18.150	0.316
49.000	0.206	0.797	33.000	11.560	36.300	0.521	18.150	0.326
48.000	0.207	0.797	33.000	11.874	36.300	0.513	18.150	0.334
47.000	0.208	0.797	33.000	12.173	36.300	0.504	18.150	0.342
46.000	0.210	0.797	33.000	12.457	36.300	0.496	18.150	0.350
45.000	0.211	0.797	33.000	12.728	36.300	0.489	18.150	0.358
44.000	0.212	0.797	33.000	12.985	36.300	0.481	18.150	0.365
43.000	0.213	0.797	33.000	13.230	36.300	0.474	18.150	0.372
42.000	0.216	0.797	33.000	13.463	36.300	0.467	18.150	0.378
41.000	0.221	0.797	33.000	13.690	36.300	0.463	18.150	0.384
40.000	0.226	0.797	33.000	13.912	36.300	0.458	18.150	0.391
39.000	0.235	0.797	33.000	15.125	36.300	0.475	18.150	0.424
38.000	0.236	0.797	33.000	15.328	36.300	0.468	18.150	0.430
37.000	0.236	0.797	33.000	15.518	36.300	0.461	18.150	0.435
36.000	0.237	0.797	33.000	15.696	36.300	0.454	18.150	0.440
35.000	0.238	0.797	33.000	15.864	36.300	0.447	18.150	0.445
34.000	0.240	0.797	33.000	16.020	36.300	0.441	18.150	0.449
33.000	0.241	0.797	33.000	16.167	36.300	0.434	18.150	0.453
32.000	0.242	0.797	33.000	16.304	36.300	0.428	18.150	0.457

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Actual & Allowable Stresses								(D+0.7E)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
31.000	0.243	0.797	33.000	16.431	36.300	0.422	18.150	0.461
30.000	0.244	0.797	33.000	16.550	36.300	0.416	18.150	0.464
29.000	0.245	0.797	33.000	16.659	36.300	0.410	18.150	0.467
28.000	0.246	0.797	33.000	16.760	36.300	0.404	18.150	0.470
27.000	0.247	0.797	33.000	16.854	36.300	0.399	18.150	0.472
26.000	0.249	0.797	33.000	16.939	36.180	0.393	18.150	0.476
25.000	0.250	0.797	33.000	17.017	36.016	0.388	18.150	0.481
24.000	0.251	0.797	33.000	17.088	35.855	0.383	18.150	0.485
23.000	0.252	0.797	33.000	17.152	35.697	0.377	18.150	0.489
22.000	0.254	0.797	33.000	17.209	35.543	0.372	18.150	0.492
21.000	0.255	0.797	33.000	17.259	35.393	0.367	18.150	0.496
20.000	0.256	0.797	33.000	17.304	35.245	0.362	18.150	0.499
19.000	0.272	0.797	33.000	17.343	35.101	0.369	18.150	0.503
18.000	0.273	0.797	33.000	17.390	34.959	0.364	18.150	0.506
17.000	0.274	0.797	33.000	17.431	34.821	0.359	17.900	0.509
16.000	0.276	0.797	33.000	17.466	34.685	0.355	17.628	0.512
15.000	0.290	0.797	33.000	17.501	34.552	0.360	17.363	0.516
14.000	0.292	0.797	33.000	17.536	34.422	0.356	17.105	0.519
13.000	0.293	0.797	33.000	17.565	34.294	0.351	16.852	0.522
12.000	0.294	0.797	33.000	17.589	34.168	0.346	16.606	0.524
11.000	0.295	0.797	33.000	17.607	34.046	0.342	16.366	0.527
10.000	0.321	0.797	33.000	17.620	33.925	0.347	16.132	0.530
9.000	0.322	0.797	33.000	17.645	33.807	0.342	15.903	0.532
8.000	0.323	0.797	33.000	17.663	33.691	0.338	15.680	0.535
7.000	0.324	0.797	33.000	17.676	33.577	0.334	15.461	0.537
6.000	0.325	0.797	33.000	17.684	33.465	0.330	15.248	0.539
5.000	0.327	0.797	33.000	17.687	33.355	0.326	15.040	0.541
4.000	0.328	0.797	33.000	17.685	33.248	0.322	14.836	0.542
3.000	0.329	0.797	33.000	17.678	33.142	0.318	14.637	0.544
2.000	0.330	0.797	33.000	17.667	33.038	0.314	14.442	0.545

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Reaction Forces & Structural Adequacy			(D+0.6W)
1. Reaction Forces			
Load Combination D+0.6W			
Moment	M =	59.997 ft-k	
Shear	V =	1.304 kips	
Axial	P =	2.531 kips	
Torque	T =	0.811 ft-k	
Component Forces: D			
Moment	$M_d =$	3.508 ft-k	
Including P-delta	$M_{d-pd} =$	3.508 ft-k	
Axial	$P_d =$	2.531 kips	
Component Forces: W			
Moment	$M_w =$	94.148 ft-k	
Shear	$V_w =$	2.174 kips	
Torque	$T_w =$	1.352 ft-k	
2. Pole Adequacy			
Maximum Combined Stress Ratio	CSR =	0.627	
w/ Allowable Stress Increase	CSR/ASI =	0.627	OK
Pole Top Deflection	$\delta_{max} =$	28 in	
Allowable Deflection (0.15 x h)	$\delta_{all} =$	123 in	OK

Second-order analysis completed using the deflected shape of the pole resulting from the applied forces magnified by 1.45 per AASHTO §4.8.2

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

Reaction Forces & Structural Adequacy			(D+0.7E)
1. Reaction Forces			
Load Combination D+0.7E			
Moment	M =	51.423 ft-k	
Shear	V =	0.861 kips	
Axial	P =	2.893 kips	
Torque	T =	0.683 ft-k	
Component Forces: D			
Moment	M _d =	4.662 ft-k	
Including P-delta	M _{d-pd} =	4.662 ft-k	
Axial	P _d =	2.531 kips	
Component Forces: E (E _h & E _v)			
Moment (E _h)	M _{eh} =	65.850 ft-k	
Shear (E _h)	V _{eh} =	1.231 kips	
Torque (E _h)	T _{eh} =	0.976 ft-k	
Moment (E _v)	M _{ev} =	0.951	
Including P-delta	M _{ev-pd} =	0.951	
Axial (E _v)	P _{ev} =	0.516	
2. Pole Adequacy			
Maximum Combined Stress Ratio	CSR =	0.545	
w/ Allowable Stress Increase	CSR/ASI =	0.545	OK
Pole Top Deflection	δ _{max} =	37 in	
Allowable Deflection (0.15 x h)	δ _{all} =	123 in	OK

Second-order analysis completed using the deflected shape of the pole resulting from the applied forces magnified by 1.45 per AASHTO §4.8.2

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

PRECAST BASE

REFERENCE: ICC-ES REPORT ESR-3765

TABLE 1 - PRESTRESSED CONCRETE BASES						
BOTTOM DIAMETER (inches)	TOP DIAMETER (inches)	BASE LENGTH (ft)	TAPER LENGTH (in)	PROJ. ABOVE GR. (inches)	DESIGN MOM. STR. (ft-kips)	DESIGN AXIAL STR. (kips)
15.750	14.563	22.000	101	96	161	361
For combined moment loads and axial loads: $m_a / M_a + a_a / A_a \leq 1$						
Where: m_a = Actual moment. a_a = Actual axial load. M_a = Design moment strength. A_a = Design axial strength.						

Precast Base Adequacy:

From Table 1	ϕM_n (ft-k)	ϕP_n (kips)				
Design Strength	161	361				
Load Combination	M_u (ft-k)	$M_u / \phi M_n$	P_u (kips)	$P_u / \phi P_n$	Combined	
1.2D+1.0W	102.7	0.637	4.9	0.014	0.651	OK
1.2D+1.0E	74.9	0.464	5.5	0.015	0.479	OK

Note: Precast Base critical forces calculated at 2.0 ft below grade.

STRUCTURAL ENGINEERS, PC

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F3; LSS70C 13 (5) / (4)

DRILLED PIER FOUNDATION DESIGN

GEOTECHNICAL REFERENCE: Report No. 092-08048 by Krazan & Associates, Inc.

APPLIED LOADS:

V = 1.30 kips
 M = 60.00 ft-k Ignored Depth = 2.0 ft
 M_{adj} = 62.61 ft-k Equivalent Moment Arm, h = 48.0 ft

Input Soil Profile Information for Each Zone				
Soil Zone No.	Depth to Top of Zone (ft)	Diameter b (ft)	Allowable Pressure, S (ksf/ft)	Zone Thickness (ft)
1	2.0	2.50	0.200	

Solve NONCONSTRAINED Depth of Embedment Formula for Each Zone:						
Soil Zone No.	Test d (ft)	Pressure @ d/3, S_1 (ksf)	Parameter A (ft)	Solve d (ft)	Percent Contributed	Depth Contributed (ft)
1	10.48	0.698	1.748	10.48	1.000	10.477
Sum					1.000	10.477

Total Embedment Depth Required:
 D = 12.477 (ft)

PIER DETAILS

Diameter = 30 in
 Embedment Depth = 14.0 ft

EQUATION REFERENCE:
 Section 1807.3.2.1
 $A = (2.34 * V) / (S_1 * b)$
 $d = 0.5A * (1 + \sqrt{1 + 4.36 * h / A})$

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC

PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)

DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES

REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

INDEX FOR POLE(S) F4:

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STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

WIND DESIGN PARAMETERS

REFER ASCE 7-16:

Code: IBC 2018 (ASCE 7-16)
 Wind Category: V = 100 mph
 Exposure Category C

Wind Design Pressures:

Elev. (ft)	K_z	q_z (psf)	G_f	C_f	F / A_f (psf)
0.0-15.0	0.849	20.64	1.27	0.70	18.35
20.0	0.902	21.93	1.27	0.70	19.49
25.0	0.945	22.99	1.27	0.70	20.43
30.0	0.982	23.89	1.27	0.70	21.23
40.0	1.044	25.38	1.27	0.70	22.56
50.0	1.094	26.60	1.27	0.70	23.64
60.0	1.137	27.64	1.27	1.20	42.11
70.0	1.174	28.55	1.27	1.20	43.50
70.1	1.174	28.56	1.27	1.20	43.51
80.0	1.208	29.37			
90.0	1.238	30.10			
100.0	1.266	30.78			
120.0	1.315	31.98			
140.0	1.359	33.04			
160.0	1.397	33.98			
180.0	1.432	34.83			

$q_z = 0.00256 * K_z * K_{zt} * K_d * K_e * V^2$ (Eq. 26.10-1)

$K_z =$ As listed above. (§26.10.1 & Table 26.10-1)

$K_{zt} = 1.00$ (§26.8.2 & Fig. 26.8-1)

$K_d = 0.95$ (pole) (§26.6 & Table 26.6-1)
 0.85 (attachments)

$K_e = 1.00$ (Table 26.9-1)

Risk Category: II (Table 1.5-1)

$F = q_z * G_f * C_f * A_f$ (Eq. 29.4-1)

$G_f = 1.27$ (Eq. 26.11-10)

$C_f =$ As listed above for pole. (For Pole, Fig. 29.4-1)
 1.00 (For Fixtures - included in EPA)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC

PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)

DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES

REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

WIND DESIGN PARAMETERS, CONTINUED

DEAD & WIND LOAD CASES - POLE TOP LUMINAIRES & ECE's					
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _w (ft-lbs)	V _w (lbs)	T _w (ft-lbs)
69.594	0	211	0	250	402
67.136	0	211	0	248	399
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
10.000	0	160	0	0	0

DEAD & WIND LOAD CASES - OTHER ATTACHMENTS					
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _w (ft-lbs)	V _w (lbs)	T _w (ft-lbs)
NA	NA	NA	NA	NA	NA
15.500	0	92	0	95	67
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

NATURAL FREQUENCY

REFER AASHTO 2009:

First Modal Frequency (with Luminaire Mass), $f_{n1} = n_1 = 1.732 / 2\pi * \sqrt{(E * I * g / (W * L^3 + 0.236 * w * L^4))}$
 $f_{n1} = n_1 =$ 0.440 Hz (Eq. C11-3)

$E =$ 29000 ksi
 $I =$ 83.708 in⁴ (average of top and bottom pole sections) (Eq. C11-4)
 $g =$ 386 in/s²
 $W =$ 0.422 kips
 $L =$ 817 in
 $w =$ 0.001 k/in

Fundamental Period, $T = 1 / f_{n1}$
 $T =$ 2.273 s

GUST-EFFECT FACTOR

REFER ASCE 7-16:

Gust-Effect Factor, $G_f = 0.925 * (1 + 1.7 * I_z * \sqrt{(g_Q^2 * Q^2 + g_R^2 * R^2)}) / (1 + 1.7 * g_v * I_z)$
 $G_f =$ 1.27 (Eq. 26.11-10)

$z^- =$ 42.1 ft (§26.11.4)
 $I_z =$ 0.1921 (Eq. 26.11-7)
 $L_z =$ 525 ft (Eq. 26.11-9)
 $Q =$ 0.921 (Eq. 26.11-8)
 $g_Q =$ 3.40 (§26.11.5)
 $g_v =$ 3.40 (§26.11.5)
 $g_R =$ 3.99 (Eq. 26.11-11)
 $V_z^- =$ 99.0 ft/s (Eq. 26.11-16)
 $N_1 =$ 2.33 (Eq. 26.11-14)
 $R_n =$ 0.0814 (Eq. 26.11-13)
 $\eta_h =$ 1.43 (§26.11.5)
 $R_h =$ 0.468 (Eq. 26.11-15)
 $\eta_B =$ 0.008 (§26.11.5)
 $R_B =$ 0.995 (Eq. 26.11-15)
 $\eta_L =$ 0.027 (§26.11.5)
 $R_L =$ 0.982 (Eq. 26.11-15)
 $R =$ 1.226 (Eq. 26.11-12)

Exposure Parameters Exposure: C (Table 26.11-1)

$\alpha =$ 9.5 $b^- =$ 0.65
 $z_g =$ 900 ft $c =$ 0.20
 $a^{\wedge} =$ 0.11 $\ell =$ 500 ft
 $b^{\wedge} =$ 1.00 $\epsilon^- =$ 0.20
 $\alpha^- =$ 0.15 $z_{min} =$ 15 ft

STRUCTURAL ENGINEERS, PC

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 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

POLE INFORMATION

Wind loading in accordance with: IBC 2018 (ASCE 7-16)
 Analysis in accordance with: AASHTO Standard, 2013 Edition (LTS-6)

Light Structure Catalog No. = LSS70A
 Number of Fixtures = 10
 Fixture Arrangement = (4+4)
 Platforms = NA
 EPA of Fixtures & Accessories = 19.4 sq ft
 Weight of Dressed Pole = 1,745 lb
 Pole Natural Frequency = 0.440 Hz
 Pole Damping Ratio = 0.025
 Allowable Stress Increase, ASI = 1.00
 Wind Speed = 100 mph
 Exposure Category = C
 Risk Category = II
 Topographic Factor = 1.00

Light Structure Data: F_y
 (ksi)
 Mounting Section 38
 Extension No. 3 NA
 Extension No. 2 NA
 Extension No. 1 NA
 Top Section 55
 Bottom Section 55

Special Concentrated Loads (When Present):

Load No.	Elev.* (ft)	Quantity	Description	EPA (sq ft)	Weight (lbs)
1	NA	NA	NA	NA	NA
2	15.50	2	LED-BTF	1.80	35
3	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA

* Elevation listed is relative to local grade.

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POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Element Forces (D+0.6W)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
70.094	0.000	0.000	0.000	0.000
70.000	0.000	0.001	0.001	0.000
69.000	0.115	0.161	0.218	0.241
68.000	0.321	0.172	0.224	0.241
67.000	0.578	0.331	0.441	0.480
66.000	0.994	0.342	0.450	0.480
65.000	1.422	0.353	0.463	0.480
64.000	1.863	0.364	0.470	0.480
63.000	2.314	0.374	0.477	0.480
62.000	2.776	0.385	0.484	0.480
61.000	3.249	0.397	0.491	0.480
60.000	3.734	0.408	0.498	0.480
59.000	4.229	0.420	0.506	0.480
58.000	4.735	0.429	0.514	0.480
57.000	5.249	0.437	0.521	0.480
56.000	5.770	0.444	0.530	0.480
55.000	6.297	0.451	0.538	0.480
54.000	6.832	0.459	0.546	0.480
53.000	7.373	0.467	0.555	0.480
52.000	7.921	0.474	0.564	0.480
51.000	8.476	0.482	0.573	0.480
50.000	9.039	0.490	0.582	0.480
49.000	9.608	0.499	0.592	0.480
48.000	10.185	0.507	0.601	0.480
47.000	10.770	0.516	0.611	0.480
46.000	11.362	0.524	0.621	0.480
45.000	11.961	0.533	0.631	0.480
44.000	12.568	0.542	0.642	0.480
43.000	13.183	0.551	0.652	0.480
42.000	13.806	0.560	0.663	0.480
41.000	14.436	0.569	0.674	0.480
40.000	15.075	0.578	0.685	0.480
39.000	15.721	0.588	0.697	0.480
38.000	16.375	0.597	0.708	0.480
37.000	17.038	0.607	0.720	0.480
36.000	17.708	0.617	0.732	0.480
35.000	18.387	0.627	0.744	0.480
34.000	19.074	0.637	0.761	0.480
33.000	19.771	0.647	0.791	0.480
32.000	20.476	0.657	0.822	0.480

Deflection	
Elev. (ft)	δ (in)
70.094	49.0
70.000	48.8
69.000	47.3
68.000	45.9
67.000	44.4
66.000	42.9
65.000	41.5
64.000	40.0
63.000	38.6
62.000	37.1
61.000	35.8
60.000	34.4
59.000	33.0
58.000	31.7
57.000	30.4
56.000	29.2
55.000	27.9
54.000	26.7
53.000	25.5
52.000	24.4
51.000	23.3
50.000	22.2
49.000	21.1
48.000	20.1
47.000	19.1
46.000	18.1
45.000	17.2
44.000	16.3
43.000	15.4
42.000	14.5
41.000	13.7
40.000	12.9
39.000	12.2
38.000	11.5
37.000	10.8
36.000	10.1
35.000	9.4
34.000	8.8
33.000	8.3
32.000	7.7

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Element Forces (D+0.6W)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
31.000	21.191	0.667	0.840	0.480
30.000	21.915	0.677	0.859	0.480
29.000	22.648	0.687	0.877	0.480
28.000	23.390	0.697	0.897	0.480
27.000	24.141	0.707	0.916	0.480
26.000	24.901	0.718	0.936	0.480
25.000	25.671	0.728	0.956	0.480
24.000	26.450	0.738	0.976	0.480
23.000	27.237	0.749	0.996	0.480
22.000	28.034	0.759	1.017	0.480
21.000	28.840	0.770	1.038	0.480
20.000	29.655	0.781	1.060	0.480
19.000	30.479	0.791	1.081	0.480
18.000	31.312	0.802	1.103	0.480
17.000	32.155	0.812	1.126	0.480
16.000	33.006	0.823	1.148	0.480
15.000	33.895	0.891	1.263	0.520
14.000	34.823	0.901	1.286	0.520
13.000	35.759	0.912	1.310	0.520
12.000	36.704	0.923	1.333	0.520
11.000	37.658	0.934	1.357	0.520
10.000	38.622	0.945	1.541	0.520
9.000	39.595	0.957	1.566	0.520
8.000	40.578	0.968	1.591	0.520
7.000	41.569	0.980	1.616	0.520
6.000	42.568	0.991	1.641	0.520
5.000	43.577	1.003	1.667	0.520
4.000	44.594	1.015	1.692	0.520
3.000	45.620	1.027	1.719	0.520
2.000	46.655	1.039	1.745	0.520

Deflection	
Elev. (ft)	δ (in)
31.000	7.2
30.000	6.7
29.000	6.2
28.000	5.7
27.000	5.3
26.000	4.8
25.000	4.4
24.000	4.0
23.000	3.7
22.000	3.3
21.000	3.0
20.000	2.7
19.000	2.4
18.000	2.1
17.000	1.8
16.000	1.6
15.000	1.4
14.000	1.2
13.000	1.0
12.000	0.8
11.000	0.7
10.000	0.5
9.000	0.4
8.000	0.3
7.000	0.2
6.000	0.1
5.000	0.1
4.000	0.0
3.000	0.0
2.000	0.0

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Actual & Allowable Stresses								(D+0.6W)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
70.094	0.000	0.505	22.800	0.000	25.080	0.000	12.540	0.000
70.000	0.000	0.505	22.800	0.000	25.080	0.001	12.540	0.000
69.000	0.123	0.505	22.800	0.679	25.080	0.843	12.540	0.037
68.000	0.125	0.505	22.800	1.847	25.080	0.835	12.540	0.084
67.000	0.243	0.505	22.800	3.238	25.080	1.615	12.540	0.156
66.000	0.244	0.505	22.800	5.424	25.080	1.591	12.540	0.243
65.000	0.248	0.505	22.800	7.563	25.080	1.567	12.540	0.328
64.000	0.259	0.505	33.000	10.404	36.300	1.648	18.150	0.303
63.000	0.255	0.505	33.000	12.200	36.300	1.580	18.150	0.351
62.000	0.252	0.505	33.000	13.839	36.300	1.518	18.150	0.396
61.000	0.248	0.505	33.000	15.338	36.300	1.462	18.150	0.437
60.000	0.246	0.505	33.000	16.713	36.300	1.410	18.150	0.474
59.000	0.243	0.505	33.000	17.979	36.300	1.361	18.150	0.508
58.000	0.241	0.505	33.000	19.140	36.300	1.315	18.150	0.540
57.000	0.238	0.505	33.000	20.199	36.300	1.269	18.150	0.569
56.000	0.236	0.505	33.000	21.162	36.300	1.227	18.150	0.595
55.000	0.235	0.505	33.000	22.039	36.300	1.187	18.150	0.619
54.000	0.233	0.505	33.000	22.838	36.300	1.150	18.150	0.640
53.000	0.232	0.505	33.000	23.568	36.300	1.116	18.150	0.660
52.000	0.230	0.505	33.000	24.235	36.300	1.083	18.150	0.678
51.000	0.229	0.505	33.000	24.846	36.300	1.053	18.150	0.695
50.000	0.228	0.505	33.000	25.406	36.300	1.025	18.150	0.710
49.000	0.227	0.505	33.000	25.920	36.300	0.998	18.150	0.724
48.000	0.226	0.505	33.000	26.392	36.300	0.973	18.150	0.737
47.000	0.225	0.505	33.000	26.827	36.300	0.950	18.150	0.749
46.000	0.225	0.505	33.000	27.226	36.300	0.928	18.150	0.759
45.000	0.224	0.505	33.000	27.595	36.300	0.907	18.150	0.769
44.000	0.224	0.505	33.000	27.935	36.300	0.887	18.150	0.779
43.000	0.223	0.505	33.000	28.248	36.300	0.869	18.150	0.787
42.000	0.223	0.505	33.000	28.538	36.300	0.851	18.150	0.795
41.000	0.223	0.505	33.000	28.807	36.300	0.834	18.150	0.802
40.000	0.222	0.505	33.000	29.055	36.084	0.819	18.150	0.814
39.000	0.222	0.505	33.000	29.285	35.842	0.804	18.150	0.826
38.000	0.222	0.505	33.000	29.499	35.607	0.790	18.150	0.837
37.000	0.222	0.505	33.000	29.697	35.380	0.777	18.150	0.848
36.000	0.222	0.505	33.000	29.880	35.161	0.764	18.150	0.858
35.000	0.223	0.505	33.000	30.051	34.948	0.752	18.150	0.868
34.000	0.224	0.505	33.000	30.210	34.742	0.741	17.742	0.878
33.000	0.229	0.505	33.000	30.359	34.542	0.730	17.343	0.888
32.000	0.235	0.505	33.000	30.499	34.347	0.719	16.958	0.897

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Actual & Allowable Stresses								(D+0.6W)
Elev. (ft)	f _a (ksi)	F _a (ksi)	F _{a-csr} (ksi)	f _b (ksi)	F _b (ksi)	f _v (ksi)	F _v (ksi)	CSR/ ASI
31.000	0.163	0.505	33.000	21.931	36.300	0.493	18.150	0.610
30.000	0.164	0.505	33.000	21.997	36.300	0.486	18.150	0.612
29.000	0.165	0.505	33.000	22.057	36.300	0.479	18.150	0.613
28.000	0.166	0.505	33.000	22.113	36.300	0.473	18.150	0.615
27.000	0.167	0.505	33.000	22.165	36.300	0.467	18.150	0.616
26.000	0.168	0.505	33.000	22.213	36.300	0.461	18.150	0.618
25.000	0.170	0.505	33.000	22.257	36.300	0.456	18.150	0.619
24.000	0.171	0.505	33.000	22.298	36.300	0.451	18.150	0.620
23.000	0.172	0.505	33.000	22.336	36.300	0.446	18.150	0.621
22.000	0.173	0.505	33.000	22.371	36.300	0.441	18.150	0.622
21.000	0.175	0.505	33.000	22.403	36.300	0.436	18.150	0.623
20.000	0.176	0.505	33.000	22.433	36.300	0.432	18.150	0.624
19.000	0.177	0.505	33.000	22.460	36.300	0.428	18.150	0.625
18.000	0.178	0.505	33.000	22.485	36.300	0.424	18.150	0.625
17.000	0.180	0.505	33.000	22.507	36.300	0.420	18.150	0.626
16.000	0.181	0.505	33.000	22.528	36.300	0.416	18.150	0.627
15.000	0.197	0.505	33.000	22.566	36.300	0.443	18.150	0.628
14.000	0.198	0.505	33.000	22.620	36.300	0.439	18.150	0.630
13.000	0.199	0.505	33.000	22.671	36.300	0.435	18.150	0.631
12.000	0.200	0.505	33.000	22.718	36.300	0.431	18.150	0.632
11.000	0.201	0.505	33.000	22.762	36.300	0.428	18.150	0.634
10.000	0.226	0.505	33.000	22.804	36.300	0.424	18.150	0.636
9.000	0.227	0.505	33.000	22.844	36.145	0.421	18.150	0.639
8.000	0.228	0.505	33.000	22.880	35.981	0.418	18.150	0.643
7.000	0.229	0.505	33.000	22.914	35.821	0.415	18.150	0.647
6.000	0.230	0.505	33.000	22.946	35.664	0.412	18.150	0.651
5.000	0.231	0.505	33.000	22.975	35.511	0.410	18.150	0.654
4.000	0.232	0.505	33.000	23.002	35.361	0.407	18.150	0.658
3.000	0.233	0.505	33.000	23.027	35.214	0.405	18.150	0.661
2.000	0.234	0.505	33.000	23.050	35.070	0.403	18.150	0.665

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

SEISMIC DESIGN PARAMETERS

REFER ASCE 7-16:

1. Seismic Ground Motion Values

$S_S =$	1.270 g	$S_1 =$	0.440 g	(Fig. 22-1ff.)
Site Class:		DEFAULT (D)		(§11.4.3)
Seismic Design Category:		D		(Tables 11.6-1 & 11.6-2)
See §11.4.8, Exception #2				
$S_{DS} =$	1.020 g	$S_{D1} =$	0.550 g	(Eq. 11.4-3 & 11.4-4)
T =	2.273 s	$T_L =$	6.0 s	(Fig. 22-12ff.)
$T_0 =$	0.108 s	$T_S =$	0.539 s	(§11.4.6)

2. Pole Shaft

V =	$C_s * W =$	0.259 kips	(Eq. 12.8-1)
$C_{s,basic} =$	$S_{DS} / (R / I)$	0.680	(Eq. 12.8-2)
$C_{s,max} =$	Includes 1.5x factor	0.242	(Eq. 12.8-3 & 12.8-4)
$C_{s,min1} =$		0.045	(Eq. 15.4-1)
$C_{s,min2} =$		NA	(Eq. 15.4-2)
$C_s =$		0.242	
R =		1.5	(Table 15.4-2)
$I_e =$		1.00	(Table 1.5-1 & Table 1.5-2)
W =		1.071 kips	

Vertical Distribution:

$F_x =$	$C_{vx} * V$		(Eq. 12.8-11)
$C_{vx} =$	$(w_x * h_x^k) / \sum(w_i * h_i^k)$		(Eq. 12.8-12)
k =		1.887	(§12.8.3)

Deflections:

$\delta_x =$	$C_d * \delta_{xe} / I_e$		(Eq. 12.8-15)
$C_d =$		1.5	(Table 15.4-2)

3. Light Fixtures & Other Attachments

$F_p =$	$0.4 * a_p * S_{DS} * W_p / (R_p / I_p) * (1 + 2 * z / h)$		(Eq. 13.3-1)
$F_{p,max} =$	$1.6 * S_{DS} * I_p * W_p$		(Eq. 13.3-2)
$F_{p,min} =$	$0.3 * S_{DS} * I_p * W_p$		(Eq. 13.3-3)
$a_p =$		1.0	(Table 13.6-1 for Light fixture)
$R_p =$		1.50	(Table 13.6-1 for Light fixture)
$I_p =$		1.0	(§13.1.3)

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

SEISMIC DESIGN PARAMETERS, CONTINUED

REFER ASCE 7-16:

4. Seismic Load Effect

$E = E_{mh} \text{ or } E_h \pm E_v$ (Eq. 12.4-1, 12.4-2, 12.4-5, 12.4-6)

Pole Shaft:

$E_{mh} = \Omega_o * Q_E$ (Eq. 12.4-7)

$\Omega_o = 1.5$ (Table 15.4-2)

Light Fixtures & Other Attachments:

$E_h = \rho * Q_E$ (Eq. 12.4-3)

$\rho = 1.0$ (§12.3.4.1)

$E_v = 0.2 * S_{DS} * D$ (Eq. 12.4-4a)

$Q_E = V \text{ or } F_p$ (§12.4.2.1)

DEAD & SEISMIC LOAD CASES - POLE TOP LUMINAIRES & ECE'S						
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _e (ft-lbs)	V _e (lbs)	P _e (lbs)	T _e (ft-lbs)
69.594	0	211	0	171	43	275
67.136	0	211	0	167	43	268
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
10.000	0	160	0	49	33	0

DEAD & SEISMIC LOAD CASES - OTHER ATTACHMENTS						
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _e (ft-lbs)	V _e (lbs)	P _e (lbs)	T _e (ft-lbs)
NA	NA	NA	NA	NA	NA	NA
15.500	0	92	0	35	19	25
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

POLE INFORMATION

Seismic loading in accordance with: IBC 2018 (ASCE 7-16)
 Analysis in accordance with: AASHTO Standard, 2013 Edition (LTS-6)

Light Structure Catalog No. = LSS70A
 Number of Fixtures = 10
 Fixture Arrangement = (4+4)
 Platforms = NA
 Weight of Dressed Pole = 1,745 lb
 Pole Natural Frequency = 0.440 Hz
 Allowable Stress Increase, ASI = 1.00
 Importance Factor = 1.00

Seismic Analysis Procedure: Equivalent Lateral Force Analysis
 Basic Seismic Force Resisting System: Pole Concrete/Steel
 Total Seismic Base Shear = 811 lb

Light Structure Data: F_y
 (ksi)
 Mounting Section 38
 Extension No. 3 NA
 Extension No. 2 NA
 Extension No. 1 NA
 Top Section 55
 Bottom Section 55

Special Concentrated Loads (When Present):

Load No.	Elev.* (ft)	Quantity	Description	a_p	R_p	Weight (lbs)
1	NA	NA	NA	NA	NA	NA
2	15.50	2	LED-BTF	1.0	1.50	35
3	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA	NA

* Elevation listed is relative to local grade.

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Element Forces (D+0.7E)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
70.094	0.000	0.000	0.000	0.000
70.000	0.000	0.001	0.001	0.000
69.000	0.100	0.127	0.249	0.193
68.000	0.280	0.134	0.256	0.193
67.000	0.508	0.257	0.505	0.380
66.000	0.869	0.265	0.514	0.380
65.000	1.243	0.277	0.529	0.380
64.000	1.627	0.284	0.537	0.380
63.000	2.018	0.290	0.545	0.380
62.000	2.415	0.296	0.553	0.380
61.000	2.817	0.302	0.561	0.380
60.000	3.226	0.308	0.569	0.380
59.000	3.640	0.314	0.578	0.380
58.000	4.060	0.320	0.587	0.380
57.000	4.484	0.326	0.596	0.380
56.000	4.914	0.332	0.605	0.380
55.000	5.349	0.338	0.615	0.380
54.000	5.788	0.343	0.624	0.380
53.000	6.232	0.349	0.634	0.380
52.000	6.681	0.355	0.644	0.380
51.000	7.134	0.360	0.655	0.380
50.000	7.591	0.365	0.665	0.380
49.000	8.053	0.371	0.676	0.380
48.000	8.518	0.376	0.687	0.380
47.000	8.987	0.381	0.698	0.380
46.000	9.459	0.386	0.710	0.380
45.000	9.935	0.391	0.721	0.380
44.000	10.414	0.395	0.733	0.380
43.000	10.896	0.400	0.746	0.380
42.000	11.381	0.405	0.758	0.380
41.000	11.869	0.409	0.770	0.380
40.000	12.359	0.413	0.783	0.380
39.000	12.852	0.417	0.796	0.380
38.000	13.346	0.421	0.809	0.380
37.000	13.843	0.425	0.823	0.380
36.000	14.342	0.429	0.836	0.380
35.000	14.842	0.433	0.850	0.380
34.000	15.344	0.437	0.869	0.380
33.000	15.852	0.446	0.904	0.380
32.000	16.366	0.453	0.939	0.380

Deflection	
Elev. (ft)	δ (in)
70.094	53.0
70.000	52.8
69.000	51.2
68.000	49.5
67.000	47.9
66.000	46.3
65.000	44.7
64.000	43.0
63.000	41.5
62.000	39.9
61.000	38.4
60.000	36.9
59.000	35.4
58.000	33.9
57.000	32.5
56.000	31.1
55.000	29.8
54.000	28.4
53.000	27.2
52.000	25.9
51.000	24.7
50.000	23.5
49.000	22.3
48.000	21.2
47.000	20.1
46.000	19.1
45.000	18.1
44.000	17.1
43.000	16.2
42.000	15.2
41.000	14.4
40.000	13.5
39.000	12.7
38.000	11.9
37.000	11.2
36.000	10.5
35.000	9.8
34.000	9.2
33.000	8.5
32.000	8.0

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Element Forces (D+0.7E)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
31.000	16.886	0.458	0.960	0.380
30.000	17.408	0.462	0.981	0.380
29.000	17.933	0.466	1.003	0.380
28.000	18.460	0.470	1.025	0.380
27.000	18.990	0.473	1.047	0.380
26.000	19.521	0.476	1.069	0.380
25.000	20.055	0.480	1.092	0.380
24.000	20.590	0.483	1.115	0.380
23.000	21.126	0.485	1.139	0.380
22.000	21.664	0.488	1.162	0.380
21.000	22.202	0.491	1.187	0.380
20.000	22.740	0.493	1.211	0.380
19.000	23.279	0.495	1.236	0.380
18.000	23.818	0.497	1.261	0.380
17.000	24.356	0.499	1.286	0.380
16.000	24.894	0.500	1.312	0.380
15.000	25.446	0.526	1.444	0.398
14.000	26.009	0.527	1.470	0.398
13.000	26.572	0.529	1.497	0.398
12.000	27.133	0.530	1.524	0.398
11.000	27.692	0.530	1.551	0.398
10.000	28.251	0.565	1.761	0.398
9.000	28.843	0.566	1.789	0.398
8.000	29.432	0.566	1.818	0.398
7.000	30.018	0.567	1.846	0.398
6.000	30.601	0.567	1.875	0.398
5.000	31.181	0.567	1.905	0.398
4.000	31.758	0.568	1.934	0.398
3.000	32.331	0.568	1.964	0.398
2.000	32.901	0.568	1.994	0.398

Deflection	
Elev. (ft)	δ (in)
31.000	7.4
30.000	6.9
29.000	6.4
28.000	5.9
27.000	5.4
26.000	5.0
25.000	4.5
24.000	4.1
23.000	3.7
22.000	3.4
21.000	3.0
20.000	2.7
19.000	2.4
18.000	2.1
17.000	1.9
16.000	1.6
15.000	1.4
14.000	1.2
13.000	1.0
12.000	0.8
11.000	0.7
10.000	0.5
9.000	0.4
8.000	0.3
7.000	0.2
6.000	0.1
5.000	0.1
4.000	0.0
3.000	0.0
2.000	0.0

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Actual & Allowable Stresses								(D+0.7E)
Elev. (ft)	f _a (ksi)	F _a (ksi)	F _{a-csr} (ksi)	f _b (ksi)	F _b (ksi)	f _v (ksi)	F _v (ksi)	CSR/ ASI
70.094	0.000	0.505	22.800	0.000	25.080	0.000	12.540	0.000
70.000	0.000	0.505	22.800	0.000	25.080	0.001	12.540	0.000
69.000	0.140	0.505	22.800	0.590	25.080	0.671	12.540	0.033
68.000	0.143	0.505	22.800	1.612	25.080	0.663	12.540	0.073
67.000	0.277	0.505	22.800	2.847	25.080	1.273	12.540	0.136
66.000	0.279	0.505	22.800	4.744	25.080	1.253	12.540	0.211
65.000	0.283	0.505	22.800	6.606	25.080	1.239	12.540	0.286
64.000	0.295	0.505	33.000	9.086	36.300	1.301	18.150	0.264
63.000	0.291	0.505	33.000	10.638	36.300	1.245	18.150	0.307
62.000	0.287	0.505	33.000	12.037	36.300	1.193	18.150	0.345
61.000	0.284	0.505	33.000	13.300	36.300	1.146	18.150	0.379
60.000	0.281	0.505	33.000	14.441	36.300	1.102	18.150	0.410
59.000	0.278	0.505	33.000	15.474	36.300	1.061	18.150	0.438
58.000	0.275	0.505	33.000	16.408	36.300	1.023	18.150	0.464
57.000	0.273	0.505	33.000	17.255	36.300	0.987	18.150	0.487
56.000	0.270	0.505	33.000	18.023	36.300	0.954	18.150	0.507
55.000	0.268	0.505	33.000	18.719	36.300	0.923	18.150	0.526
54.000	0.266	0.505	33.000	19.350	36.300	0.894	18.150	0.544
53.000	0.265	0.505	33.000	19.923	36.300	0.866	18.150	0.559
52.000	0.263	0.505	33.000	20.442	36.300	0.841	18.150	0.573
51.000	0.262	0.505	33.000	20.912	36.300	0.816	18.150	0.586
50.000	0.260	0.505	33.000	21.338	36.300	0.793	18.150	0.598
49.000	0.259	0.505	33.000	21.723	36.300	0.772	18.150	0.608
48.000	0.258	0.505	33.000	22.071	36.300	0.751	18.150	0.618
47.000	0.257	0.505	33.000	22.385	36.300	0.732	18.150	0.626
46.000	0.257	0.505	33.000	22.667	36.300	0.713	18.150	0.634
45.000	0.256	0.505	33.000	22.920	36.300	0.696	18.150	0.641
44.000	0.255	0.505	33.000	23.146	36.300	0.679	18.150	0.647
43.000	0.255	0.505	33.000	23.348	36.300	0.663	18.150	0.652
42.000	0.255	0.505	33.000	23.526	36.300	0.648	18.150	0.657
41.000	0.254	0.505	33.000	23.684	36.300	0.633	18.150	0.661
40.000	0.254	0.505	33.000	23.821	36.084	0.619	18.150	0.669
39.000	0.254	0.505	33.000	23.940	35.842	0.606	18.150	0.677
38.000	0.254	0.505	33.000	24.042	35.607	0.593	18.150	0.684
37.000	0.254	0.505	33.000	24.128	35.380	0.581	18.150	0.691
36.000	0.254	0.505	33.000	24.199	35.161	0.569	18.150	0.697
35.000	0.254	0.505	33.000	24.257	34.948	0.558	18.150	0.703
34.000	0.256	0.505	33.000	24.302	34.742	0.547	17.742	0.708
33.000	0.262	0.505	33.000	24.341	34.542	0.539	17.343	0.714
32.000	0.268	0.505	33.000	24.377	34.347	0.532	16.958	0.719

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

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 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Actual & Allowable Stresses								(D+0.7E)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
31.000	0.186	0.505	33.000	17.475	36.300	0.363	18.150	0.487
30.000	0.187	0.505	33.000	17.472	36.300	0.357	18.150	0.487
29.000	0.189	0.505	33.000	17.465	36.300	0.350	18.150	0.487
28.000	0.190	0.505	33.000	17.452	36.300	0.344	18.150	0.487
27.000	0.191	0.505	33.000	17.435	36.300	0.338	18.150	0.486
26.000	0.193	0.505	33.000	17.414	36.300	0.332	18.150	0.486
25.000	0.194	0.505	33.000	17.388	36.300	0.327	18.150	0.485
24.000	0.195	0.505	33.000	17.358	36.300	0.321	18.150	0.484
23.000	0.197	0.505	33.000	17.325	36.300	0.316	18.150	0.484
22.000	0.198	0.505	33.000	17.287	36.300	0.311	18.150	0.483
21.000	0.199	0.505	33.000	17.246	36.300	0.305	18.150	0.481
20.000	0.201	0.505	33.000	17.202	36.300	0.300	18.150	0.480
19.000	0.202	0.505	33.000	17.154	36.300	0.296	18.150	0.479
18.000	0.204	0.505	33.000	17.103	36.300	0.291	18.150	0.478
17.000	0.205	0.505	33.000	17.049	36.300	0.286	18.150	0.476
16.000	0.207	0.505	33.000	16.992	36.300	0.282	18.150	0.475
15.000	0.225	0.505	33.000	16.941	36.300	0.290	18.150	0.474
14.000	0.226	0.505	33.000	16.895	36.300	0.286	18.150	0.473
13.000	0.227	0.505	33.000	16.846	36.300	0.281	18.150	0.471
12.000	0.229	0.505	33.000	16.794	36.300	0.277	18.150	0.470
11.000	0.230	0.505	33.000	16.738	36.300	0.272	18.150	0.468
10.000	0.258	0.505	33.000	16.681	36.300	0.278	18.150	0.468
9.000	0.260	0.505	33.000	16.640	36.145	0.274	18.150	0.468
8.000	0.261	0.505	33.000	16.595	35.981	0.270	18.150	0.469
7.000	0.262	0.505	33.000	16.547	35.821	0.266	18.150	0.470
6.000	0.263	0.505	33.000	16.495	35.664	0.262	18.150	0.471
5.000	0.264	0.505	33.000	16.440	35.511	0.258	18.150	0.471
4.000	0.265	0.505	33.000	16.381	35.361	0.254	18.150	0.471
3.000	0.267	0.505	33.000	16.319	35.214	0.250	18.150	0.472
2.000	0.268	0.505	33.000	16.255	35.070	0.247	18.150	0.472

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC
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 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Reaction Forces & Structural Adequacy			(D+0.6W)
1. Reaction Forces			
Load Combination D+0.6W			
Moment	M =	48.734 ft-k	
Shear	V =	1.039 kips	
Axial	P =	1.745 kips	
Torque	T =	0.520 ft-k	
Component Forces: D			
Moment	$M_d =$	3.625 ft-k	
Including P-delta	$M_{d-pd} =$	3.625 ft-k	
Axial	$P_d =$	1.745 kips	
Component Forces: W			
Moment	$M_w =$	75.182 ft-k	
Shear	$V_w =$	1.732 kips	
Torque	$T_w =$	0.867 ft-k	
2. Pole Adequacy			
Maximum Combined Stress Ratio	CSR =	0.897	
w/ Allowable Stress Increase	CSR/ASI =	0.897	OK
Pole Top Deflection	$\delta_{max} =$	49 in	
Allowable Deflection (0.15 x h)	$\delta_{all} =$	123 in	OK

Second-order analysis completed using the deflected shape of the pole resulting from the applied forces magnified by 1.45 per AASHTO §4.8.2

STRUCTURAL ENGINEERS, PC

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: F4; LSS70A 10 (4+4)

Reaction Forces & Structural Adequacy			(D+0.7E)
1. Reaction Forces			
Load Combination D+0.7E			
Moment	M =	34.036 ft-k	
Shear	V =	0.568 kips	
Axial	P =	1.994 kips	
Torque	T =	0.398 ft-k	
Component Forces: D			
Moment	$M_d =$	3.886 ft-k	
Including P-delta	$M_{d-pd} =$	3.886 ft-k	
Axial	$P_d =$	1.745 kips	
Component Forces: E (E_h & E_v)			
Moment (E_h)	$M_{eh} =$	42.279 ft-k	
Shear (E_h)	$V_{eh} =$	0.811 kips	
Torque (E_h)	$T_{eh} =$	0.568 ft-k	
Moment (E_v)	$M_{ev} =$	0.793	
Including P-delta	$M_{ev-pd} =$	0.793	
Axial (E_v)	$P_{ev} =$	0.356	
2. Pole Adequacy			
Maximum Combined Stress Ratio	CSR =	0.719	
w/ Allowable Stress Increase	CSR/ASI =	0.719	OK
Pole Top Deflection	$\delta_{max} =$	53 in	
Allowable Deflection (0.15 x h)	$\delta_{all} =$	123 in	OK

Second-order analysis completed using the deflected shape of the pole resulting from the applied forces magnified by 1.45 per AASHTO §4.8.2

STRUCTURAL ENGINEERS, PC

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POLE DESCRIPTION: F4; LSS70A 10 (4+4)

PRECAST BASE

REFERENCE: ICC-ES REPORT ESR-3765

TABLE 1 - PRESTRESSED CONCRETE BASES						
BOTTOM DIAMETER (inches)	TOP DIAMETER (inches)	BASE LENGTH (ft)	TAPER LENGTH (in)	PROJ. ABOVE GR. (inches)	DESIGN MOM. STR. (ft-kips)	DESIGN AXIAL STR. (kips)
13.375	12.250	20.000	100	96	114	274
For combined moment loads and axial loads: $m_a / M_a + a_a / A_a \leq 1$						
Where: m_a = Actual moment. a_a = Actual axial load. M_a = Design moment strength. A_a = Design axial strength.						

Precast Base Adequacy:

From Table 1	ϕM_n (ft-k)	ϕP_n (kips)				
Design Strength	114	274				
Load Combination	M_u (ft-k)	$M_u / \phi M_n$	P_u (kips)	$P_u / \phi P_n$	Combined	
1.2D+1.0W	83.0	0.731	3.6	0.013	0.744	OK
1.2D+1.0E	49.4	0.434	3.9	0.014	0.449	OK

Note: Precast Base critical forces calculated at 2.0 ft below grade.

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DRILLED PIER FOUNDATION DESIGN

GEOTECHNICAL REFERENCE: Report No. 092-08048 by Krazan & Associates, Inc.

APPLIED LOADS:

V = 1.04 kips
 M = 48.73 ft-k Ignored Depth = 2.0 ft
 M_{adj} = 50.81 ft-k Equivalent Moment Arm, h = 48.9 ft

Input Soil Profile Information for Each Zone				
Soil Zone No.	Depth to Top of Zone (ft)	Diameter b (ft)	Allowable Pressure, S (ksf/ft)	Zone Thickness (ft)
1	2.0	2.50	0.200	

Solve NONCONSTRAINED Depth of Embedment Formula for Each Zone:						
Soil Zone No.	Test d (ft)	Pressure @ d/3, S_1 (ksf)	Parameter A (ft)	Solve d (ft)	Percent Contributed	Depth Contributed (ft)
1	9.72	0.648	1.500	9.72	1.000	9.724
Sum					1.000	9.724

Total Embedment Depth Required:
 D = 11.724 (ft)

PIER DETAILS
 Diameter = 30 in
 Embedment Depth = 12.0 ft

EQUATION REFERENCE:
 Section 1807.3.2.1
 $A = (2.34 * V) / (S_1 * b)$
 $d = 0.5A * (1 + \sqrt{1 + 4.36 * h / A})$

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DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

INDEX FOR POLE(S) P1 - P3:

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

WIND DESIGN PARAMETERS

REFER ASCE 7-16:

Code: IBC 2018 (ASCE 7-16)
 Wind Category: V = 100 mph
 Exposure Category C

Wind Design Pressures:

Elev. (ft)	K_z	q_z (psf)	G_f	C_f	F / A_f (psf)
0.0-15.0	0.849	20.64	1.27	0.70	18.30
20.0	0.902	21.93	1.27	0.70	19.45
25.0	0.945	22.99	1.27	0.70	20.38
30.0	0.982	23.89	1.27	0.70	21.18
40.0	1.044	25.38	1.27	0.70	22.50
50.0	1.094	26.60	1.27	0.70	23.58
60.0	1.137	27.64	1.27	1.20	42.01
70.0	1.174	28.55	1.27	1.20	43.40
70.1	1.174	28.56	1.27	1.20	43.41
80.0	1.208	29.37			
90.0	1.238	30.10			
100.0	1.266	30.78			
120.0	1.315	31.98			
140.0	1.359	33.04			
160.0	1.397	33.98			
180.0	1.432	34.83			

$q_z = 0.00256 * K_z * K_{zt} * K_d * K_e * V^2$ (Eq. 26.10-1)

$K_z =$ As listed above. (§26.10.1 & Table 26.10-1)

$K_{zt} = 1.00$ (§26.8.2 & Fig. 26.8-1)

$K_d = 0.95$ (pole) (§26.6 & Table 26.6-1)
 0.85 (attachments)

$K_e = 1.00$ (Table 26.9-1)

Risk Category: II (Table 1.5-1)

$F = q_z * G_f * C_f * A_f$ (Eq. 29.4-1)

$G_f = 1.27$ (Eq. 26.11-10)

$C_f =$ As listed above for pole. (For Pole, Fig. 29.4-1)
 1.00 (For Fixtures - included in EPA)

STRUCTURAL ENGINEERS, PC

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DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES

REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

WIND DESIGN PARAMETERS, CONTINUED

DEAD & WIND LOAD CASES - POLE TOP LUMINAIRES & ECE's					
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _w (ft-lbs)	V _w (lbs)	T _w (ft-lbs)
69.594	0	409	0	445	1,139
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
10.000	0	120	0	0	0

DEAD & WIND LOAD CASES - OTHER ATTACHMENTS					
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _w (ft-lbs)	V _w (lbs)	T _w (ft-lbs)
NA	NA	NA	NA	NA	NA
15.500	0	92	0	94	67
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

NATURAL FREQUENCY

REFER AASHTO 2009:

First Modal Frequency (with Luminaire Mass), $f_{n1} = n_1 = 1.732 / 2\pi * \sqrt{(E * I * g / (W * L^3 + 0.236 * w * L^4))}$
 $f_{n1} = n_1 =$ 0.444 Hz (Eq. C11-3)

$E =$ 29000 ksi
 $I =$ 83.708 in⁴ (average of top and bottom pole sections) (Eq. C11-4)
 $g =$ 386 in/s²
 $W =$ 0.409 kips
 $L =$ 817 in
 $w =$ 0.001 k/in

Fundamental Period, $T = 1 / f_{n1}$
 $T =$ 2.252 s

GUST-EFFECT FACTOR

REFER ASCE 7-16:

Gust-Effect Factor, $G_f = 0.925 * (1 + 1.7 * I_z * \sqrt{(g_Q^2 * Q^2 + g_R^2 * R^2)}) / (1 + 1.7 * g_v * I_z)$
 $G_f =$ 1.27 (Eq. 26.11-10)

$z^- =$ 42.1 ft (§26.11.4)
 $I_z =$ 0.1921 (Eq. 26.11-7)
 $L_z =$ 525 ft (Eq. 26.11-9)
 $Q =$ 0.921 (Eq. 26.11-8)
 $g_Q =$ 3.40 (§26.11.5)
 $g_v =$ 3.40 (§26.11.5)
 $g_R =$ 3.99 (Eq. 26.11-11)
 $V_z^- =$ 99.0 ft/s (Eq. 26.11-16)
 $N_1 =$ 2.36 (Eq. 26.11-14)
 $R_n =$ 0.0809 (Eq. 26.11-13)
 $\eta_h =$ 1.45 (§26.11.5)
 $R_h =$ 0.465 (Eq. 26.11-15)
 $\eta_B =$ 0.008 (§26.11.5)
 $R_B =$ 0.995 (Eq. 26.11-15)
 $\eta_L =$ 0.027 (§26.11.5)
 $R_L =$ 0.982 (Eq. 26.11-15)
 $R =$ 1.219 (Eq. 26.11-12)

Exposure Parameters Exposure: C (Table 26.11-1)

$\alpha =$ 9.5 $b^- =$ 0.65
 $z_g =$ 900 ft $c =$ 0.20
 $a^{\wedge} =$ 0.11 $\ell =$ 500 ft
 $b^{\wedge} =$ 1.00 $\epsilon^- =$ 0.20
 $\alpha^- =$ 0.15 $z_{min} =$ 15 ft

STRUCTURAL ENGINEERS, PC

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 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

POLE INFORMATION

Wind loading in accordance with: IBC 2018 (ASCE 7-16)
 Analysis in accordance with: AASHTO Standard, 2013 Edition (LTS-6)

Light Structure Catalog No. = LSS70A
 Number of Fixtures = 8
 Fixture Arrangement = (6)
 Platforms = NA
 EPA of Fixtures & Accessories = 17.8 sq ft
 Weight of Dressed Pole = 1,692 lb
 Pole Natural Frequency = 0.444 Hz
 Pole Damping Ratio = 0.025
 Allowable Stress Increase, ASI = 1.00
 Wind Speed = 100 mph
 Exposure Category = C
 Risk Category = II
 Topographic Factor = 1.00

Light Structure Data: F_y
 (ksi)
 Mounting Section 38
 Extension No. 3 NA
 Extension No. 2 NA
 Extension No. 1 NA
 Top Section 55
 Bottom Section 55

Special Concentrated Loads (When Present):

Load No.	Elev.* (ft)	Quantity	Description	EPA (sq ft)	Weight (lbs)
1	NA	NA	NA	NA	NA
2	15.50	2	LED-BTF	1.80	35
3	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA

* Elevation listed is relative to local grade.

STRUCTURAL ENGINEERS, PC

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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Element Forces (D+0.6W)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
70.094	0.000	0.000	0.000	0.000
70.000	0.000	0.001	0.001	0.000
69.000	0.201	0.279	0.416	0.683
68.000	0.558	0.289	0.422	0.683
67.000	0.927	0.300	0.429	0.683
66.000	1.306	0.310	0.437	0.683
65.000	1.698	0.321	0.450	0.683
64.000	2.102	0.332	0.457	0.683
63.000	2.516	0.343	0.464	0.683
62.000	2.941	0.353	0.471	0.683
61.000	3.377	0.365	0.478	0.683
60.000	3.824	0.376	0.485	0.683
59.000	4.283	0.388	0.493	0.683
58.000	4.752	0.397	0.501	0.683
57.000	5.228	0.404	0.509	0.683
56.000	5.711	0.412	0.517	0.683
55.000	6.201	0.419	0.525	0.683
54.000	6.698	0.427	0.533	0.683
53.000	7.202	0.434	0.542	0.683
52.000	7.713	0.442	0.551	0.683
51.000	8.231	0.450	0.560	0.683
50.000	8.756	0.458	0.569	0.683
49.000	9.289	0.466	0.579	0.683
48.000	9.829	0.475	0.588	0.683
47.000	10.376	0.483	0.598	0.683
46.000	10.931	0.492	0.608	0.683
45.000	11.494	0.501	0.619	0.683
44.000	12.064	0.509	0.629	0.683
43.000	12.642	0.518	0.640	0.683
42.000	13.228	0.528	0.650	0.683
41.000	13.821	0.537	0.661	0.683
40.000	14.423	0.546	0.672	0.683
39.000	15.033	0.555	0.684	0.683
38.000	15.651	0.565	0.695	0.683
37.000	16.277	0.575	0.707	0.683
36.000	16.912	0.584	0.719	0.683
35.000	17.554	0.594	0.731	0.683
34.000	18.205	0.604	0.748	0.683
33.000	18.866	0.614	0.778	0.683
32.000	19.536	0.624	0.809	0.683

Deflection	
Elev. (ft)	δ (in)
70.094	47.0
70.000	46.9
69.000	45.4
68.000	44.0
67.000	42.5
66.000	41.1
65.000	39.7
64.000	38.3
63.000	36.9
62.000	35.5
61.000	34.2
60.000	32.9
59.000	31.6
58.000	30.3
57.000	29.0
56.000	27.8
55.000	26.6
54.000	25.5
53.000	24.4
52.000	23.3
51.000	22.2
50.000	21.2
49.000	20.1
48.000	19.2
47.000	18.2
46.000	17.3
45.000	16.4
44.000	15.5
43.000	14.7
42.000	13.9
41.000	13.1
40.000	12.4
39.000	11.6
38.000	10.9
37.000	10.3
36.000	9.6
35.000	9.0
34.000	8.4
33.000	7.9
32.000	7.4

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Element Forces (D+0.6W)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
31.000	20.215	0.634	0.827	0.683
30.000	20.903	0.644	0.846	0.683
29.000	21.600	0.654	0.865	0.683
28.000	22.306	0.664	0.884	0.683
27.000	23.022	0.675	0.903	0.683
26.000	23.746	0.685	0.923	0.683
25.000	24.480	0.695	0.943	0.683
24.000	25.223	0.706	0.963	0.683
23.000	25.976	0.716	0.984	0.683
22.000	26.737	0.727	1.004	0.683
21.000	27.508	0.737	1.025	0.683
20.000	28.288	0.748	1.047	0.683
19.000	29.077	0.758	1.069	0.683
18.000	29.875	0.769	1.090	0.683
17.000	30.682	0.779	1.113	0.683
16.000	31.498	0.790	1.135	0.683
15.000	32.353	0.857	1.250	0.723
14.000	33.246	0.868	1.273	0.723
13.000	34.147	0.879	1.297	0.723
12.000	35.057	0.890	1.320	0.723
11.000	35.977	0.901	1.344	0.723
10.000	36.906	0.912	1.489	0.723
9.000	37.844	0.923	1.513	0.723
8.000	38.792	0.935	1.538	0.723
7.000	39.748	0.946	1.563	0.723
6.000	40.713	0.958	1.588	0.723
5.000	41.687	0.970	1.614	0.723
4.000	42.670	0.982	1.640	0.723
3.000	43.663	0.994	1.666	0.723
2.000	44.664	1.006	1.692	0.723

Deflection	
Elev. (ft)	δ (in)
31.000	6.8
30.000	6.4
29.000	5.9
28.000	5.5
27.000	5.0
26.000	4.6
25.000	4.2
24.000	3.9
23.000	3.5
22.000	3.2
21.000	2.9
20.000	2.6
19.000	2.3
18.000	2.0
17.000	1.8
16.000	1.5
15.000	1.3
14.000	1.1
13.000	0.9
12.000	0.8
11.000	0.6
10.000	0.5
9.000	0.4
8.000	0.3
7.000	0.2
6.000	0.1
5.000	0.1
4.000	0.0
3.000	0.0
2.000	0.0

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Actual & Allowable Stresses								(D+0.6W)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
70.094	0.000	0.505	22.800	0.000	25.080	0.000	12.540	0.000
70.000	0.000	0.505	22.800	0.000	25.080	0.001	12.540	0.000
69.000	0.235	0.505	22.800	1.190	25.080	2.187	12.540	0.088
68.000	0.235	0.505	22.800	3.211	25.080	2.147	12.540	0.168
67.000	0.236	0.505	22.800	5.190	25.080	2.108	12.540	0.246
66.000	0.237	0.505	22.800	7.128	25.080	2.071	12.540	0.322
65.000	0.241	0.505	22.800	9.028	25.080	2.035	12.540	0.397
64.000	0.252	0.505	33.000	11.739	36.300	2.139	18.150	0.345
63.000	0.248	0.505	33.000	13.265	36.300	2.044	18.150	0.386
62.000	0.245	0.505	33.000	14.662	36.300	1.957	18.150	0.423
61.000	0.242	0.505	33.000	15.942	36.300	1.877	18.150	0.457
60.000	0.239	0.505	33.000	17.120	36.300	1.803	18.150	0.489
59.000	0.237	0.505	33.000	18.206	36.300	1.735	18.150	0.518
58.000	0.235	0.505	33.000	19.205	36.300	1.670	18.150	0.545
57.000	0.233	0.505	33.000	20.118	36.300	1.607	18.150	0.569
56.000	0.231	0.505	33.000	20.947	36.300	1.548	18.150	0.591
55.000	0.229	0.505	33.000	21.703	36.300	1.494	18.150	0.612
54.000	0.228	0.505	33.000	22.393	36.300	1.443	18.150	0.630
53.000	0.226	0.505	33.000	23.023	36.300	1.395	18.150	0.647
52.000	0.225	0.505	33.000	23.599	36.300	1.351	18.150	0.662
51.000	0.224	0.505	33.000	24.128	36.300	1.309	18.150	0.677
50.000	0.223	0.505	33.000	24.613	36.300	1.270	18.150	0.690
49.000	0.222	0.505	33.000	25.058	36.300	1.233	18.150	0.702
48.000	0.221	0.505	33.000	25.468	36.300	1.199	18.150	0.713
47.000	0.221	0.505	33.000	25.846	36.300	1.166	18.150	0.723
46.000	0.220	0.505	33.000	26.194	36.300	1.136	18.150	0.732
45.000	0.219	0.505	33.000	26.516	36.300	1.107	18.150	0.741
44.000	0.219	0.505	33.000	26.813	36.300	1.080	18.150	0.749
43.000	0.219	0.505	33.000	27.088	36.300	1.054	18.150	0.756
42.000	0.219	0.505	33.000	27.343	36.300	1.030	18.150	0.763
41.000	0.218	0.505	33.000	27.580	36.300	1.007	18.150	0.769
40.000	0.218	0.505	33.000	27.800	36.084	0.985	18.150	0.780
39.000	0.218	0.505	33.000	28.004	35.842	0.964	18.150	0.791
38.000	0.218	0.505	33.000	28.194	35.607	0.945	18.150	0.801
37.000	0.218	0.505	33.000	28.371	35.380	0.926	18.150	0.811
36.000	0.218	0.505	33.000	28.536	35.161	0.909	18.150	0.821
35.000	0.219	0.505	33.000	28.690	34.948	0.892	18.150	0.830
34.000	0.220	0.505	33.000	28.834	34.742	0.876	17.742	0.839
33.000	0.226	0.505	33.000	28.969	34.542	0.861	17.343	0.848
32.000	0.231	0.505	33.000	29.098	34.347	0.846	16.958	0.857

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Actual & Allowable Stresses								(D+0.6W)
Elev. (ft)	f _a (ksi)	F _a (ksi)	F _{a-csr} (ksi)	f _b (ksi)	F _b (ksi)	f _v (ksi)	F _v (ksi)	CSR/ ASI
31.000	0.160	0.505	33.000	20.920	36.300	0.579	18.150	0.582
30.000	0.161	0.505	33.000	20.980	36.300	0.570	18.150	0.584
29.000	0.163	0.505	33.000	21.036	36.300	0.561	18.150	0.585
28.000	0.164	0.505	33.000	21.088	36.300	0.552	18.150	0.587
27.000	0.165	0.505	33.000	21.137	36.300	0.543	18.150	0.588
26.000	0.166	0.505	33.000	21.182	36.300	0.535	18.150	0.589
25.000	0.167	0.505	33.000	21.225	36.300	0.528	18.150	0.591
24.000	0.169	0.505	33.000	21.264	36.300	0.520	18.150	0.592
23.000	0.170	0.505	33.000	21.301	36.300	0.513	18.150	0.593
22.000	0.171	0.505	33.000	21.336	36.300	0.507	18.150	0.594
21.000	0.172	0.505	33.000	21.368	36.300	0.500	18.150	0.595
20.000	0.174	0.505	33.000	21.398	36.300	0.494	18.150	0.595
19.000	0.175	0.505	33.000	21.426	36.300	0.488	18.150	0.596
18.000	0.176	0.505	33.000	21.452	36.300	0.482	18.150	0.597
17.000	0.178	0.505	33.000	21.477	36.300	0.477	18.150	0.598
16.000	0.179	0.505	33.000	21.499	36.300	0.472	18.150	0.598
15.000	0.195	0.505	33.000	21.539	36.300	0.497	18.150	0.600
14.000	0.196	0.505	33.000	21.596	36.300	0.491	18.150	0.602
13.000	0.197	0.505	33.000	21.649	36.300	0.486	18.150	0.603
12.000	0.198	0.505	33.000	21.699	36.300	0.481	18.150	0.604
11.000	0.200	0.505	33.000	21.746	36.300	0.476	18.150	0.606
10.000	0.218	0.505	33.000	21.791	36.300	0.472	18.150	0.608
9.000	0.219	0.505	33.000	21.833	36.145	0.468	18.150	0.611
8.000	0.221	0.505	33.000	21.873	35.981	0.463	18.150	0.615
7.000	0.222	0.505	33.000	21.911	35.821	0.459	18.150	0.619
6.000	0.223	0.505	33.000	21.946	35.664	0.456	18.150	0.623
5.000	0.224	0.505	33.000	21.979	35.511	0.452	18.150	0.626
4.000	0.225	0.505	33.000	22.010	35.361	0.448	18.150	0.630
3.000	0.226	0.505	33.000	22.039	35.214	0.445	18.150	0.633
2.000	0.227	0.505	33.000	22.066	35.070	0.442	18.150	0.637

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

SEISMIC DESIGN PARAMETERS

REFER ASCE 7-16:

1. Seismic Ground Motion Values

$S_S =$	1.270 g	$S_1 =$	0.440 g	(Fig. 22-1ff.)
Site Class:		DEFAULT (D)		(§11.4.3)
Seismic Design Category:		D		(Tables 11.6-1 & 11.6-2)
See §11.4.8, Exception #2				
$S_{DS} =$	1.020 g	$S_{D1} =$	0.550 g	(Eq. 11.4-3 & 11.4-4)
T =	2.252 s	$T_L =$	6.0 s	(Fig. 22-12ff.)
$T_0 =$	0.108 s	$T_S =$	0.539 s	(§11.4.6)

2. Pole Shaft

V =	$C_s * W =$	0.262 kips	(Eq. 12.8-1)
$C_{s,basic} =$	$S_{DS} / (R / I)$	0.680	(Eq. 12.8-2)
$C_{s,max} =$	Includes 1.5x factor	0.244	(Eq. 12.8-3 & 12.8-4)
$C_{s,min1} =$		0.045	(Eq. 15.4-1)
$C_{s,min2} =$		NA	(Eq. 15.4-2)
$C_s =$		0.244	
R =		1.5	(Table 15.4-2)
$I_e =$		1.00	(Table 1.5-1 & Table 1.5-2)
W =		1.071 kips	

Vertical Distribution:

$F_x =$	$C_{vx} * V$		(Eq. 12.8-11)
$C_{vx} =$	$(w_x * h_x^k) / \sum(w_i * h_i^k)$		(Eq. 12.8-12)
k =		1.876	(§12.8.3)

Deflections:

$\delta_x =$	$C_d * \delta_{xe} / I_e$		(Eq. 12.8-15)
$C_d =$		1.5	(Table 15.4-2)

3. Light Fixtures & Other Attachments

$F_p =$	$0.4 * a_p * S_{DS} * W_p / (R_p / I_p) * (1 + 2 * z / h)$		(Eq. 13.3-1)
$F_{p,max} =$	$1.6 * S_{DS} * I_p * W_p$		(Eq. 13.3-2)
$F_{p,min} =$	$0.3 * S_{DS} * I_p * W_p$		(Eq. 13.3-3)
$a_p =$		1.0	(Table 13.6-1 for Light fixture)
$R_p =$		1.50	(Table 13.6-1 for Light fixture)
$I_p =$		1.0	(§13.1.3)

STRUCTURAL ENGINEERS, PC
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 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

SEISMIC DESIGN PARAMETERS, CONTINUED

REFER ASCE 7-16:

4. Seismic Load Effect

$E = E_{mh} \text{ or } E_h \pm E_v$ (Eq. 12.4-1, 12.4-2, 12.4-5, 12.4-6)

Pole Shaft:

$E_{mh} = \Omega_o * Q_E$ (Eq. 12.4-7)

$\Omega_o = 1.5$ (Table 15.4-2)

Light Fixtures & Other Attachments:

$E_h = \rho * Q_E$ (Eq. 12.4-3)

$\rho = 1.0$ (§12.3.4.1)

$E_v = 0.2 * S_{DS} * D$ (Eq. 12.4-4a)

$Q_E = V \text{ or } F_p$ (§12.4.2.1)

DEAD & SEISMIC LOAD CASES - POLE TOP LUMINAIRES & ECE'S						
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _e (ft-lbs)	V _e (lbs)	P _e (lbs)	T _e (ft-lbs)
69.594	0	409	0	332	83	849
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
10.000	0	120	0	37	24	0

DEAD & SEISMIC LOAD CASES - OTHER ATTACHMENTS						
Elev. (ft)	M _d (ft-lbs)	P _d (lbs)	M _e (ft-lbs)	V _e (lbs)	P _e (lbs)	T _e (ft-lbs)
NA	NA	NA	NA	NA	NA	NA
15.500	0	92	0	35	19	25
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

POLE INFORMATION

Seismic loading in accordance with: IBC 2018 (ASCE 7-16)
 Analysis in accordance with: AASHTO Standard, 2013 Edition (LTS-6)

Light Structure Catalog No. = LSS70A
 Number of Fixtures = 8
 Fixture Arrangement = (6)
 Platforms = NA
 Weight of Dressed Pole = 1,692 lb
 Pole Natural Frequency = 0.444 Hz
 Allowable Stress Increase, ASI = 1.00
 Importance Factor = 1.00

Seismic Analysis Procedure: Equivalent Lateral Force Analysis
 Basic Seismic Force Resisting System: Pole Concrete/Steel
 Total Seismic Base Shear = 796 lb

Light Structure Data: F_y
 (ksi)
 Mounting Section 38
 Extension No. 3 NA
 Extension No. 2 NA
 Extension No. 1 NA
 Top Section 55
 Bottom Section 55

Special Concentrated Loads (When Present):

Load No.	Elev.* (ft)	Quantity	Description	a_p	R_p	Weight (lbs)
1	NA	NA	NA	NA	NA	NA
2	15.50	2	LED-BTF	1.0	1.50	35
3	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA	NA

* Elevation listed is relative to local grade.

STRUCTURAL ENGINEERS, PC

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 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Element Forces (D+0.7E)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
70.094	0.000	0.000	0.000	0.000
70.000	0.000	0.001	0.001	0.000
69.000	0.191	0.240	0.475	0.594
68.000	0.533	0.246	0.482	0.594
67.000	0.882	0.253	0.490	0.594
66.000	1.240	0.261	0.499	0.594
65.000	1.610	0.273	0.514	0.594
64.000	1.990	0.280	0.523	0.594
63.000	2.377	0.286	0.530	0.594
62.000	2.770	0.292	0.538	0.594
61.000	3.169	0.298	0.546	0.594
60.000	3.573	0.304	0.555	0.594
59.000	3.983	0.310	0.563	0.594
58.000	4.398	0.316	0.572	0.594
57.000	4.818	0.322	0.581	0.594
56.000	5.244	0.328	0.591	0.594
55.000	5.674	0.334	0.600	0.594
54.000	6.109	0.340	0.610	0.594
53.000	6.549	0.345	0.620	0.594
52.000	6.993	0.351	0.630	0.594
51.000	7.441	0.356	0.640	0.594
50.000	7.894	0.362	0.651	0.594
49.000	8.351	0.367	0.661	0.594
48.000	8.812	0.372	0.672	0.594
47.000	9.276	0.377	0.684	0.594
46.000	9.744	0.382	0.695	0.594
45.000	10.216	0.387	0.707	0.594
44.000	10.691	0.392	0.719	0.594
43.000	11.169	0.397	0.731	0.594
42.000	11.649	0.401	0.743	0.594
41.000	12.133	0.406	0.756	0.594
40.000	12.619	0.410	0.768	0.594
39.000	13.108	0.414	0.781	0.594
38.000	13.599	0.418	0.795	0.594
37.000	14.092	0.422	0.808	0.594
36.000	14.587	0.426	0.822	0.594
35.000	15.083	0.430	0.836	0.594
34.000	15.582	0.434	0.855	0.594
33.000	16.086	0.443	0.889	0.594
32.000	16.597	0.451	0.924	0.594

Deflection	
Elev. (ft)	δ (in)
70.094	53.9
70.000	53.8
69.000	52.1
68.000	50.4
67.000	48.7
66.000	47.0
65.000	45.3
64.000	43.7
63.000	42.0
62.000	40.4
61.000	38.8
60.000	37.3
59.000	35.8
58.000	34.3
57.000	32.8
56.000	31.4
55.000	30.0
54.000	28.7
53.000	27.4
52.000	26.1
51.000	24.9
50.000	23.7
49.000	22.5
48.000	21.4
47.000	20.3
46.000	19.2
45.000	18.2
44.000	17.2
43.000	16.3
42.000	15.3
41.000	14.5
40.000	13.6
39.000	12.8
38.000	12.0
37.000	11.3
36.000	10.5
35.000	9.9
34.000	9.2
33.000	8.6
32.000	8.0

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Element Forces (D+0.7E)				
Elev. (ft)	M (ft-k)	V (kips)	P (kips)	T (ft-k)
31.000	17.113	0.455	0.945	0.594
30.000	17.632	0.459	0.966	0.594
29.000	18.153	0.463	0.988	0.594
28.000	18.678	0.467	1.010	0.594
27.000	19.205	0.471	1.032	0.594
26.000	19.733	0.474	1.055	0.594
25.000	20.264	0.477	1.077	0.594
24.000	20.796	0.480	1.101	0.594
23.000	21.330	0.483	1.124	0.594
22.000	21.864	0.486	1.148	0.594
21.000	22.400	0.488	1.172	0.594
20.000	22.936	0.491	1.196	0.594
19.000	23.472	0.493	1.221	0.594
18.000	24.009	0.495	1.246	0.594
17.000	24.545	0.497	1.272	0.594
16.000	25.081	0.498	1.297	0.594
15.000	25.630	0.524	1.429	0.611
14.000	26.191	0.525	1.455	0.611
13.000	26.752	0.527	1.482	0.611
12.000	27.310	0.528	1.509	0.611
11.000	27.867	0.529	1.536	0.611
10.000	28.424	0.555	1.701	0.611
9.000	29.004	0.556	1.729	0.611
8.000	29.582	0.556	1.757	0.611
7.000	30.158	0.556	1.786	0.611
6.000	30.730	0.557	1.815	0.611
5.000	31.299	0.557	1.844	0.611
4.000	31.865	0.557	1.874	0.611
3.000	32.428	0.557	1.904	0.611
2.000	32.987	0.557	1.934	0.611

Deflection	
Elev. (ft)	δ (in)
31.000	7.4
30.000	6.9
29.000	6.4
28.000	5.9
27.000	5.4
26.000	5.0
25.000	4.6
24.000	4.1
23.000	3.8
22.000	3.4
21.000	3.1
20.000	2.7
19.000	2.4
18.000	2.1
17.000	1.9
16.000	1.6
15.000	1.4
14.000	1.2
13.000	1.0
12.000	0.8
11.000	0.7
10.000	0.5
9.000	0.4
8.000	0.3
7.000	0.2
6.000	0.1
5.000	0.1
4.000	0.0
3.000	0.0
2.000	0.0

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Actual & Allowable Stresses								(D+0.7E)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
70.094	0.000	0.505	22.800	0.000	25.080	0.000	12.540	0.000
70.000	0.000	0.505	22.800	0.000	25.080	0.001	12.540	0.000
69.000	0.268	0.505	22.800	1.130	25.080	1.899	12.540	0.080
68.000	0.269	0.505	22.800	3.066	25.080	1.861	12.540	0.156
67.000	0.269	0.505	22.800	4.943	25.080	1.825	12.540	0.230
66.000	0.271	0.505	22.800	6.766	25.080	1.791	12.540	0.302
65.000	0.275	0.505	22.800	8.557	25.080	1.763	12.540	0.373
64.000	0.287	0.505	33.000	11.115	36.300	1.851	18.150	0.325
63.000	0.283	0.505	33.000	12.533	36.300	1.766	18.150	0.363
62.000	0.280	0.505	33.000	13.809	36.300	1.686	18.150	0.398
61.000	0.277	0.505	33.000	14.958	36.300	1.613	18.150	0.428
60.000	0.273	0.505	33.000	15.995	36.300	1.546	18.150	0.456
59.000	0.271	0.505	33.000	16.931	36.300	1.483	18.150	0.481
58.000	0.268	0.505	33.000	17.776	36.300	1.425	18.150	0.504
57.000	0.266	0.505	33.000	18.540	36.300	1.371	18.150	0.525
56.000	0.264	0.505	33.000	19.231	36.300	1.320	18.150	0.543
55.000	0.262	0.505	33.000	19.857	36.300	1.272	18.150	0.560
54.000	0.260	0.505	33.000	20.422	36.300	1.228	18.150	0.575
53.000	0.258	0.505	33.000	20.933	36.300	1.186	18.150	0.589
52.000	0.257	0.505	33.000	21.395	36.300	1.147	18.150	0.601
51.000	0.256	0.505	33.000	21.813	36.300	1.111	18.150	0.612
50.000	0.255	0.505	33.000	22.189	36.300	1.076	18.150	0.622
49.000	0.254	0.505	33.000	22.528	36.300	1.043	18.150	0.632
48.000	0.253	0.505	33.000	22.833	36.300	1.012	18.150	0.640
47.000	0.252	0.505	33.000	23.106	36.300	0.983	18.150	0.647
46.000	0.251	0.505	33.000	23.350	36.300	0.955	18.150	0.654
45.000	0.251	0.505	33.000	23.568	36.300	0.929	18.150	0.659
44.000	0.250	0.505	33.000	23.761	36.300	0.904	18.150	0.665
43.000	0.250	0.505	33.000	23.932	36.300	0.880	18.150	0.669
42.000	0.250	0.505	33.000	24.081	36.300	0.857	18.150	0.673
41.000	0.250	0.505	33.000	24.211	36.300	0.835	18.150	0.677
40.000	0.249	0.505	33.000	24.323	36.084	0.815	18.150	0.684
39.000	0.249	0.505	33.000	24.418	35.842	0.795	18.150	0.691
38.000	0.249	0.505	33.000	24.497	35.607	0.776	18.150	0.697
37.000	0.250	0.505	33.000	24.562	35.380	0.758	18.150	0.704
36.000	0.250	0.505	33.000	24.613	35.161	0.740	18.150	0.709
35.000	0.250	0.505	33.000	24.651	34.948	0.724	18.150	0.715
34.000	0.252	0.505	33.000	24.678	34.742	0.708	17.742	0.720
33.000	0.258	0.505	33.000	24.700	34.542	0.696	17.343	0.725
32.000	0.264	0.505	33.000	24.721	34.347	0.683	16.958	0.729

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Actual & Allowable Stresses								(D+0.7E)
Elev. (ft)	f_a (ksi)	F_a (ksi)	F_{a-csr} (ksi)	f_b (ksi)	F_b (ksi)	f_v (ksi)	F_v (ksi)	CSR/ ASI
31.000	0.183	0.505	33.000	17.710	36.300	0.467	18.150	0.494
30.000	0.184	0.505	33.000	17.697	36.300	0.457	18.150	0.494
29.000	0.186	0.505	33.000	17.680	36.300	0.448	18.150	0.493
28.000	0.187	0.505	33.000	17.658	36.300	0.439	18.150	0.493
27.000	0.188	0.505	33.000	17.632	36.300	0.430	18.150	0.492
26.000	0.190	0.505	33.000	17.603	36.300	0.422	18.150	0.491
25.000	0.191	0.505	33.000	17.569	36.300	0.414	18.150	0.490
24.000	0.193	0.505	33.000	17.532	36.300	0.406	18.150	0.489
23.000	0.194	0.505	33.000	17.492	36.300	0.398	18.150	0.488
22.000	0.196	0.505	33.000	17.448	36.300	0.391	18.150	0.487
21.000	0.197	0.505	33.000	17.400	36.300	0.384	18.150	0.486
20.000	0.198	0.505	33.000	17.350	36.300	0.377	18.150	0.484
19.000	0.200	0.505	33.000	17.296	36.300	0.370	18.150	0.483
18.000	0.201	0.505	33.000	17.240	36.300	0.363	18.150	0.481
17.000	0.203	0.505	33.000	17.181	36.300	0.357	18.150	0.480
16.000	0.205	0.505	33.000	17.119	36.300	0.350	18.150	0.478
15.000	0.223	0.505	33.000	17.063	36.300	0.358	18.150	0.477
14.000	0.224	0.505	33.000	17.013	36.300	0.351	18.150	0.476
13.000	0.225	0.505	33.000	16.960	36.300	0.345	18.150	0.474
12.000	0.227	0.505	33.000	16.904	36.300	0.339	18.150	0.473
11.000	0.228	0.505	33.000	16.844	36.300	0.334	18.150	0.471
10.000	0.250	0.505	33.000	16.783	36.300	0.336	18.150	0.470
9.000	0.251	0.505	33.000	16.733	36.145	0.330	18.150	0.471
8.000	0.252	0.505	33.000	16.680	35.981	0.325	18.150	0.472
7.000	0.253	0.505	33.000	16.624	35.821	0.319	18.150	0.472
6.000	0.254	0.505	33.000	16.565	35.664	0.314	18.150	0.472
5.000	0.256	0.505	33.000	16.502	35.511	0.309	18.150	0.473
4.000	0.257	0.505	33.000	16.436	35.361	0.304	18.150	0.473
3.000	0.258	0.505	33.000	16.368	35.214	0.299	18.150	0.473
2.000	0.260	0.505	33.000	16.297	35.070	0.295	18.150	0.473

Analysis in accordance with AASHTO Standard, 2013 Edition (LTS-6)

STRUCTURAL ENGINEERS, PC
 CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Reaction Forces & Structural Adequacy			(D+0.6W)
1. Reaction Forces			
Load Combination D+0.6W			
Moment	M =	46.676 ft-k	
Shear	V =	1.006 kips	
Axial	P =	1.692 kips	
Torque	T =	0.723 ft-k	
Component Forces: D			
Moment	$M_d =$	3.471 ft-k	
Including P-delta	$M_{d-pd} =$	3.471 ft-k	
Axial	$P_d =$	1.692 kips	
Component Forces: W			
Moment	$M_w =$	72.008 ft-k	
Shear	$V_w =$	1.677 kips	
Torque	$T_w =$	1.205 ft-k	
2. Pole Adequacy			
Maximum Combined Stress Ratio	CSR =	0.857	
w/ Allowable Stress Increase	CSR/ASI =	0.857	OK
Pole Top Deflection	$\delta_{max} =$	47 in	
Allowable Deflection (0.15 x h)	$\delta_{all} =$	123 in	OK

Second-order analysis completed using the deflected shape of the pole resulting from the applied forces magnified by 1.45 per AASHTO §4.8.2

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

Reaction Forces & Structural Adequacy			(D+0.7E)
1. Reaction Forces			
Load Combination D+0.7E			
Moment	M =	34.102 ft-k	
Shear	V =	0.557 kips	
Axial	P =	1.934 kips	
Torque	T =	0.611 ft-k	
Component Forces: D			
Moment	M _d =	3.945 ft-k	
Including P-delta	M _{d-pd} =	3.945 ft-k	
Axial	P _d =	1.692 kips	
Component Forces: E (E _h & E _v)			
Moment (E _h)	M _{eh} =	42.277 ft-k	
Shear (E _h)	V _{eh} =	0.796 kips	
Torque (E _h)	T _{eh} =	0.874 ft-k	
Moment (E _v)	M _{ev} =	0.805	
Including P-delta	M _{ev-pd} =	0.805	
Axial (E _v)	P _{ev} =	0.345	
2. Pole Adequacy			
Maximum Combined Stress Ratio	CSR =	0.729	
w/ Allowable Stress Increase	CSR/ASI =	0.729	OK
Pole Top Deflection	δ _{max} =	54 in	
Allowable Deflection (0.15 x h)	δ _{all} =	123 in	OK

Second-order analysis completed using the deflected shape of the pole resulting from the applied forces magnified by 1.45 per AASHTO §4.8.2

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

PRECAST BASE

REFERENCE: ICC-ES REPORT ESR-3765

TABLE 1 - PRESTRESSED CONCRETE BASES						
BOTTOM DIAMETER (inches)	TOP DIAMETER (inches)	BASE LENGTH (ft)	TAPER LENGTH (in)	PROJ. ABOVE GR. (inches)	DESIGN MOM. STR. (ft-kips)	DESIGN AXIAL STR. (kips)
13.375	12.250	20.000	100	96	114	274
For combined moment loads and axial loads: $m_a / M_a + a_a / A_a \leq 1$						
Where:		m_a = Actual moment.		a_a = Actual axial load.		
		M_a = Design moment strength.		A_a = Design axial strength.		

Precast Base Adequacy:

From Table 1	ϕM_n (ft-k)	ϕP_n (kips)				
Design Strength	114	274				
Load Combination	M_u (ft-k)	$M_u / \phi M_n$	P_u (kips)	$P_u / \phi P_n$	Combined	
1.2D+1.0W	79.5	0.700	3.5	0.013	0.713	OK
1.2D+1.0E	49.4	0.435	3.9	0.014	0.449	OK

Note: Precast Base critical forces calculated at 2.0 ft below grade.

STRUCTURAL ENGINEERS, PC

CLIENT: MUSCO SPORTS LIGHTING, LLC
 PROJECT: CASCADE CHRISTIAN; PUYALLUP, WA (217954)
 DESCRIPTION: LIGHT STRUCTURE POLE AND FOUNDATION, LS SERIES
 REFERENCE: INTERNATIONAL BUILDING CODE 2018

POLE DESCRIPTION: P1 - P3; LSS70A 8 (6)

DRILLED PIER FOUNDATION DESIGN

GEOTECHNICAL REFERENCE: Report No. 092-08048 by Krazan & Associates, Inc.

APPLIED LOADS:

V = 1.01 kips
 M = 46.68 ft-k Ignored Depth = 2.0 ft
 M_{adj} = 48.69 ft-k Equivalent Moment Arm, h = 48.4 ft

Input Soil Profile Information for Each Zone				
Soil Zone No.	Depth to Top of Zone (ft)	Diameter b (ft)	Allowable Pressure, S (ksf/ft)	Zone Thickness (ft)
1	2.0	2.50	0.200	

Solve NONCONSTRAINED Depth of Embedment Formula for Each Zone:						
Soil Zone No.	Test d (ft)	Pressure @ d/3, S ₁ (ksf)	Parameter A (ft)	Solve d (ft)	Percent Contributed	Depth Contributed (ft)
1	9.58	0.639	1.474	9.58	1.000	9.585
Sum					1.000	9.585

Total Embedment Depth Required:
 D = 11.585 (ft)

PIER DETAILS
 Diameter = 30 in
 Embedment Depth = 12.0 ft

EQUATION REFERENCE:
 Section 1807.3.2.1
 $A = (2.34 * V) / (S_1 * b)$
 $d = 0.5A * (1 + \sqrt{1 + 4.36 * h / A})$