



Structural Analysis Report

Structure : 39 ft Monopole
ATC Asset Name : Hwy 40 and Hwy 131
ATC Asset Number : 205626
Engineering Number : 14758496_C3_01
Proposed Carrier : AT&T MOBILITY
Carrier Site Name : HWY 40 & HWY 131
Carrier Site Number : COL04213
Site Location : 30700 County Road 14B
Steamboat Springs, CO 80487
40.3412° N, 106.8539° W
County : Routt
Date : June 1, 2024
Max Usage : 19%
Analysis Result : Pass



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Introduction

The purpose of this report is to summarize results of a structural analysis performed on the 39 ft Monopole tower to reflect the change in loading by AT&T MOBILITY.

Supporting Documents

Tower:	Valmont Order #201977, dated December 27, 2012
Foundation:	Valmont Drawing #B-136022, dated December 27, 2012
Geotechnical:	Terracon Project #25125099, dated December 21, 2012

Analysis

The tower was analyzed using American Tower Corporation's tower analysis software. This program considers an elastic three-dimensional model and second-order effects per ANSI/TIA-222.

Basic Wind Speed:	105 mph (3-second gust)
Basic Wind Speed w/ Ice:	50 mph (3-second gust) w/ 0.25" radial ice concurrent
Code(s):	ANSI/TIA-222-H / 2015 IBC
Exposure Category:	C
Risk Category:	II
Topographic Factor Procedure:	Method 1
Topographic Category:	1
Spectral Response:	$S_s = 0.60$, $S_i = 0.10$
Site Class:	D - Stiff Soil - Default

Conclusion

Based on the analysis results, the structure meets the requirements per the applicable codes listed above. The tower and foundation can support the equipment as described in this report.

If you have any questions or require additional information, please reach out to your American Tower contact. If you do not have an American Tower contact and have an Engineering question, please contact Engineering@americantower.com. Please include the American Tower asset name, asset number, and engineering number in the subject line for any questions.

Structure Usages

Structural Component	Usage	Control	Result
Pole Shaft	19.3%	1.2D + 1.0W	Pass
Serviceability Usage	2.9%	1.0D + 1.0W	Pass
Base Plate @ 0.0 ft	13.5%	Rods	Pass
Pier	6.2%	Flexure [Steel]	Pass

Maximum Reactions

Foundation	Moment (k-ft)	Axial (k)	Shear (k)
Monopole Base	98.9	8.3	3.1

**Reactions shown reflect the results from the Load Case with maximum Moment*

Structure base reactions were analyzed using available geotechnical and foundation information.

AT&T MOBILITY Final Loading

Elev (ft)	Qty	Equipment	Lines
38.0	3	Ericsson AIR 6419 B77D	-
36.0	1	Raycap DC6-48-60-18-8F(32.8 lbs)	(1) 0.39" (10mm) Fiber Trunk (2) 0.78" (19.7mm) 8 AWG 6 (3) 0.96" (24.3mm) Cable (4) 2" conduit (6) 7/8" Coax
	1	Raycap DC9-48-60-24-8C-EV (Enclosure)	
	3	Ericsson RRUS 4490	
	3	Ericsson RRUS 4890	
	3	Ericsson Radio 4494 44B14 20B29 M01	
	3	T-Arm	
	6	Commscope NNH4-65C-R6-V4	
34.0	3	Ericsson AIR 6419 B77G	-

Install proposed lines inside the pole shaft.

Other Existing/Reserved Loading

No loading was considered in addition to the AT&T MOBILITY Final Loading.



Standard Conditions

All engineering services performed by ATC Tower Services LLC are prepared on the basis that the information used is current and correct. This information may consist of, but is not limited to the following:

- Information supplied by the client regarding antenna, mounts, and feed line loading
- Information from drawings, design and analysis documents, and field notes in the possession of ATC Tower Services LLC

It is the responsibility of the client to ensure that the information provided to ATC Tower Services LLC and used in the performance of our engineering services is correct and complete.

All assets of American Tower Corporation, its affiliates, and subsidiaries (collectively "American Tower") are inspected at regular intervals. Based upon these inspections and in the absence of information to the contrary, American Tower assumes that all structures were constructed in accordance with the drawings and specifications.

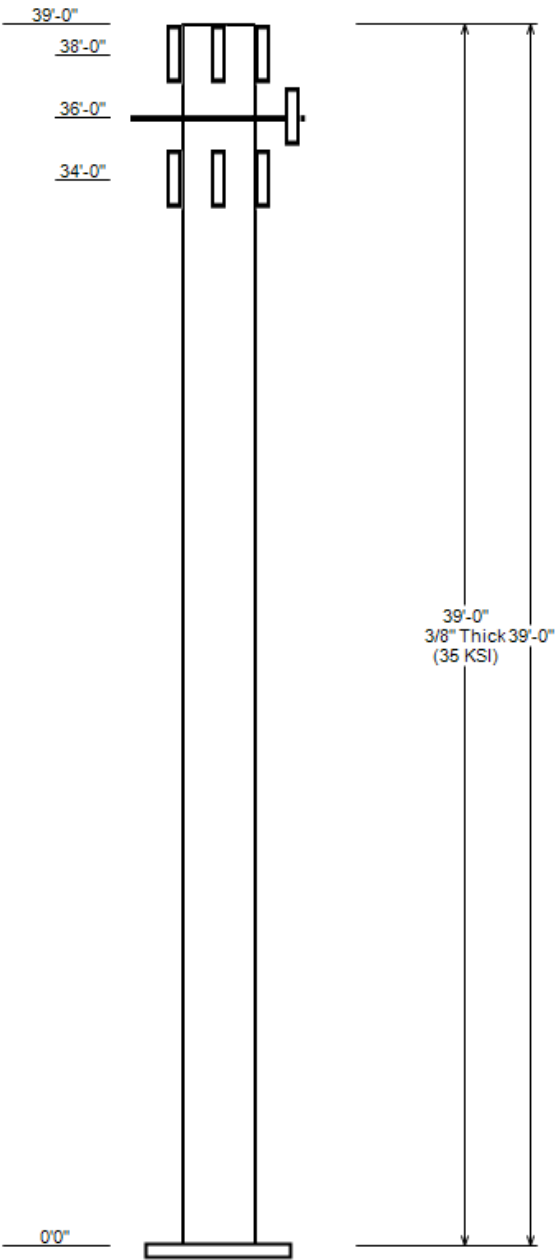
Unless explicitly agreed by both the client and ATC Tower Services LLC, all services will be performed in accordance with the current revision of ANSI/TIA-222.

All services are performed, results obtained, and recommendations made in accordance with generally accepted engineering principles and practices. ATC Tower Services LLC is not responsible for the conclusions, opinions and recommendations made by others based on the information supplied herein.

ANALYSIS PARAMETERS			
Nominal Wind:	105 mph	Ice Wind:	50 mph w/ 0.25" ice
Risk Category:	II	Exposure:	C
Topo Category:	1	Topo Factor:	Method 1
Structure Height:	39 ft	Base Elevation:	0.00 ft
Base Diameter:	24 in	Base Rotation:	0°
Service Wind:	60 mph	S _s :	0.605
		S _i :	0.104
Topo Feature:		Structure Type:	Stepped
Taper:			0.0000 (in/ft)

POLE SECTION PROPERTIES						
Section	Length (ft)	Flat Diameter (in)		Thick (in)	Joint Type	Yield Strength (ksi)
		Top	Bottom			
1	39.000	24.00	24.00	0.375	0.000	35

DISCRETE APPURTENANCE			LINEAR APPURTENANCE		
Elev (ft)	Description		Elev To (ft)	Description	
38.0	(3)	Ericsson AIR 6419 B77D	36.0	(6)	7/8" Coax
36.0	(1)	Raycap DC6-48-60-18-8F(32.8 lb	36.0	(4)	2" conduit
36.0	(3)	Ericsson Radio 4494 44B14 20B2	36.0	(3)	0.96" (24.3mm) Cable
36.0	(1)	Raycap DC9-48-60-24-8C-EV (Enc	36.0	(2)	0.78" (19.7mm) 8 AWG 6
36.0	(3)	Ericsson RRUS 4890	36.0	(1)	0.39" (10mm) Fiber Trunk
36.0	(3)	Ericsson RRUS 4490			
36.0	(3)	Generic Round T-Arm			
36.0	(6)	Commscope NNH4-65C-R6-V4			
34.0	(3)	Ericsson AIR 6419 B77G			



GLOBAL BASE REACTIONS			
Load Case	Moment (kip-ft)	Axial (kip)	Shear (kip)
1.2D + 1.0W	98.87	8.34	3.10
0.9D + 1.0W	98.72	6.26	3.10
1.2D + 1.0Di + 1.0Wi	28.11	8.62	0.95
1.2D + 1.0Ev + 1.0Eh	51.84	8.33	1.71
0.9D - 1.0Ev + 1.0Eh	51.72	5.06	1.71
1.0D + 1.0W	28.85	6.95	0.91

ASSET: 205626, Hwy 40 and Hwy 131
CUSTOMER: AT&T MOBILITY

CODE: ANSI/TIA-222-H
PROJECT: 14758496_C3_01

ANALYSIS PARAMETERS

Location:	Routt County,CO	Height:	39 ft
Type and Shape:	Stepped, Round	Base Diameter:	24.00 in
Manufacturer:	Valmont	Top Diameter:	24.00 in
K _d (non-service):	0.95	Taper:	0.0000 in/ft
K _e :	0.77	Rotation:	0.000°

ICE & WIND PARAMETERS

Risk Category:	II	Design Wind Speed:	105 mph
Exposure Category:	C	Design Wind Speed w/ Ice:	50 mph
Topo Factor Procedure:	Method 1	Design Ice Thickness:	0.25 in
Topographic Category:	1	Service Wind Speed:	60 mph
Crest Height:	0 ft	HMSL:	7139.00 ft

SEISMIC PARAMETERS

Analysis Method:	Equivalent Lateral Force Method		
Site Class:	D - Stiff Soil	Period Based on Rayleigh Method (sec):	0.45
T _L (sec):	4	P:	1
S _s :	0.605	S ₁ :	0.104
F _a :	1.316	F _v :	2.392
S _{ds} :	0.531	S _{d1} :	0.166
		C _s :	0.247
		C _s Max:	0.247
		C _s Min:	0.030

LOAD CASES

1.2D + 1.0W	105 mph Wind with No Ice
0.9D + 1.0W	105 mph Wind with No Ice (Reduced DL)
1.2D + 1.0Di + 1.0Wi	50 mph Wind with 0.25" Radial Ice
1.2D + 1.0Ev + 1.0Eh	Seismic
0.9D - 1.0Ev + 1.0Eh	Seismic (Reduced DL)
1.0D + 1.0W	60 mph Wind with No Ice

SHAFT SECTION PROPERTIES																			
Section	Length (ft)	Thick (in)	Fy (ksi)	Joint Type	Joint Len (in)	Bottom						Top							
						Weight (lb)	Dia (in)	Elev (ft)	Area (in ²)	Ix (in ⁴)	W/t Ratio	D/t Ratio	Dia (in)	Elev (ft)	Area (in ²)	Ix (in ⁴)	W/t Ratio	D/t Ratio	Taper (in/ft)
1-R	39.00	0.3750	35		0.00	3,694	24.00	0.000	27.83	1,943.3	0.00	64.00	24.00	39.00	27.83	1,943.3	0.00	64.00	0.0000
Total Shaft Weight						3,694													

DISCRETE APPURTENANCE PROPERTIES										
Attach Elev (ft)	Description	Qty	Ka	Vert Ecc (ft)	No Ice			Ice		
					Weight (lb)	EPAA (sf)	Orientation Factor	Weight (lb)	EPAA (sf)	Orientation Factor
38.00	Ericsson AIR 6419 B77D	3	0.80	0.000	63.10	4.186	0.67	79.29	4.390	0.67
36.00	Ericsson Radio 4494 44B14 20B2	3	0.80	0.000	57.30	2.202	0.67	65.25	2.343	0.67
36.00	Raycap DC9-48-60-24-8C-EV (Enc	1	0.80	0.000	18.50	2.676	1.00	30.61	2.841	1.00
36.00	Raycap DC6-48-60-18-8F(32.8 lb	1	0.80	2.000	32.80	1.470	0.50	41.72	1.571	0.50
36.00	Ericsson RRUS 4890	3	0.80	0.000	69.50	2.695	0.67	79.77	2.852	0.67
36.00	Ericsson RRUS 4490	3	0.80	0.000	68.40	2.695	0.67	78.55	2.852	0.67
36.00	Generic Round T-Arm	3	0.75	0.000	312.50	9.700	0.67	350.27	10.892	0.67
36.00	Commscope NNH4-65C-R6-V4	6	0.80	0.000	93.70	17.073	0.64	141.07	17.606	0.64
34.00	Ericsson AIR 6419 B77G	3	0.80	0.000	66.10	3.797	0.65	79.98	3.986	0.65
Totals	Row Count: 9	26			2,524.20			3,118.08		

LINEAR APPURTENANCE PROPERTIES													
Load Case Azimuth (deg): 0.00													
Elev From (ft)	Elev To (ft)	Qty	Description	Diameter (in)	Weight (lb/ft)	Flat	Max/ Row	Distance Between Rows(in)	Distance Between Cols(in)	Azimuth (deg)	Distance From Face (in)	Exposed To Wind	Carrier
0.00	36.00	6	7/8" Coax	1.09	0.33	N	0	0	0	0	0	N	AT&T MOBILITY
0.00	36.00	4	2" conduit	2.38	3.65	N	0	0	0	0	0	N	AT&T MOBILITY
0.00	36.00	3	0.96" (24.3mm) Cable	0.96	0.88	N	0	0	0	0	0	N	AT&T MOBILITY
0.00	36.00	2	0.78" (19.7mm) 8 AWG	0.78	0.59	N	0	0	0	0	0	N	AT&T MOBILITY
0.00	36.00	1	0.39" (10mm) Fiber Tr	0.39	0.06	N	0	0	0	0	0	N	AT&T MOBILITY

SEGMENT PROPERTIES												
Seg Top Elev (ft)	Description	(Max Length: 5 ft)	Thick (in)	Flat Dia (in)	Area (in²)	Ix (in⁴)	W/t Ratio	D/t Ratio	F'y (ksi)	S (in³)	Z (in³)	Weight (lb)
0.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	0.0
5.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	473.5
10.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	473.5
15.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	473.5
20.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	473.5
25.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	473.5
30.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	473.5
34.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	378.8
35.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	94.7
36.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	94.7
38.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	189.4
39.00			0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	94.7
Total:												3,693.3

CALCULATED FORCES													
Load Case: 1.2D + 1.0W			105 mph Wind with No Ice									13 Iterations	
Gust Response Factor:		1.10											
Dead load Factor:		1.20											
Wind Load Factor:		1.00											
Seg	Pu	Vu	Tu	Mu	Mu	Resultant	Phi	Phi	Phi	Phi	Total	Rotation	
Elev	FY (-)	FX (-)	MY	MZ	MX	Moment	Pn	Vn	Tn	Mn	Deflect	(deg)	Ratio
(ft)	(kips)	(kips)	(ft-kips)	(ft-kips)	(ft-kips)	(ft-kips)	(kips)	(kips)	(ft-kips)	(ft-kips)	(in)		
0.00	-8.34	-3.10	0.00	-98.9	0.00	98.87	876.73	263.02	546.31	539.02	0	0	0.193
5.00	-7.65	-2.99	0.00	-83.4	0.00	83.36	876.73	263.02	546.31	539.02	0.04	-0.07	0.164
10.00	-6.96	-2.88	0.00	-68.4	0.00	68.39	876.73	263.02	546.31	539.02	0.14	-0.12	0.135
15.00	-6.26	-2.77	0.00	-54.0	0.00	53.98	876.73	263.02	546.31	539.02	0.29	-0.17	0.107

ASSET: 205626, Hwy 40 and Hwy 131
CUSTOMER: AT&T MOBILITY

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CALCULATED FORCES													
20.00	-5.57	-2.64	0.00	-40.2	0.00	40.15	876.73	263.02	546.31	539.02	0.48	-0.2	0.081
25.00	-4.88	-2.51	0.00	-26.9	0.00	26.93	876.73	263.02	546.31	539.02	0.71	-0.23	0.056
30.00	-4.19	-2.39	0.00	-14.4	0.00	14.35	876.73	263.02	546.31	539.02	0.95	-0.24	0.031
34.00	-3.40	-2.18	0.00	-4.8	0.00	4.79	876.73	263.02	546.31	539.02	1.16	-0.25	0.013
35.00	-3.26	-2.16	0.00	-2.6	0.00	2.60	876.73	263.02	546.31	539.02	1.21	-0.25	0.009
36.00	-0.57	-0.20	0.00	-0.4	0.00	0.42	876.73	263.02	546.31	539.02	1.26	-0.25	0.001
38.00	-0.11	-0.01	0.00	-0.0	0.00	0.01	876.73	263.02	546.31	539.02	1.37	-0.25	0.000
39.00	0.00	-0.01	0.00	0.0	0.00	0.00	876.73	263.02	546.31	539.02	1.42	-0.25	0.000

CALCULATED FORCES													
Load Case: 0.9D + 1.0W			105 mph Wind with No Ice (Reduced DL)										13 Iterations
Gust Response Factor:		1.10											
Dead load Factor:		0.90											
Wind Load Factor:		1.00											
Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (ft-kips)	Phi Mn (ft-kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-6.26	-3.10	0.00	-98.7	0.00	98.72	876.73	263.02	546.31	539.02	0	0	0.190
5.00	-5.74	-2.99	0.00	-83.2	0.00	83.22	876.73	263.02	546.31	539.02	0.04	-0.07	0.161
10.00	-5.22	-2.88	0.00	-68.3	0.00	68.27	876.73	263.02	546.31	539.02	0.14	-0.12	0.133
15.00	-4.70	-2.76	0.00	-53.9	0.00	53.88	876.73	263.02	546.31	539.02	0.29	-0.17	0.105
20.00	-4.18	-2.64	0.00	-40.1	0.00	40.07	876.73	263.02	546.31	539.02	0.48	-0.2	0.079
25.00	-3.66	-2.51	0.00	-26.9	0.00	26.87	876.73	263.02	546.31	539.02	0.71	-0.23	0.054
30.00	-3.14	-2.39	0.00	-14.3	0.00	14.33	876.73	263.02	546.31	539.02	0.95	-0.24	0.030
34.00	-2.55	-2.18	0.00	-4.8	0.00	4.78	876.73	263.02	546.31	539.02	1.16	-0.25	0.012
35.00	-2.44	-2.15	0.00	-2.6	0.00	2.60	876.73	263.02	546.31	539.02	1.21	-0.25	0.008
36.00	-0.43	-0.20	0.00	-0.4	0.00	0.42	876.73	263.02	546.31	539.02	1.26	-0.25	0.001
38.00	-0.09	-0.01	0.00	-0.0	0.00	0.01	876.73	263.02	546.31	539.02	1.36	-0.25	0.000
39.00	0.00	-0.01	0.00	0.0	0.00	0.00	876.73	263.02	546.31	539.02	1.42	-0.25	0.000

CALCULATED FORCES														
Load Case: 1.2D + 1.0Di + 1.0Wi			50 mph Wind with 0.25" Radial Ice									12 Iterations		
Gust Response Factor:		1.10	Ice Dead Load Factor		1.00									
Dead load Factor:		1.20										Ice Importance Factor		1.00
Wind Load Factor:		1.00												
Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (ft-kips)	Phi Mn (ft-kips)	Total Deflect (in)	Rotation (deg)	Ratio	
0.00	-8.62	-0.95	0.00	-28.1	0.00	28.11	876.73	263.02	546.31	539.02	0	0	0.062	
5.00	-7.90	-0.90	0.00	-23.4	0.00	23.37	876.73	263.02	546.31	539.02	0.01	-0.02	0.052	
10.00	-7.17	-0.84	0.00	-18.9	0.00	18.89	876.73	263.02	546.31	539.02	0.04	-0.03	0.043	
15.00	-6.45	-0.79	0.00	-14.7	0.00	14.68	876.73	263.02	546.31	539.02	0.08	-0.05	0.035	
20.00	-5.72	-0.73	0.00	-10.7	0.00	10.73	876.73	263.02	546.31	539.02	0.14	-0.06	0.026	
25.00	-5.00	-0.67	0.00	-7.1	0.00	7.06	876.73	263.02	546.31	539.02	0.2	-0.06	0.019	
30.00	-4.27	-0.62	0.00	-3.7	0.00	3.70	876.73	263.02	546.31	539.02	0.27	-0.07	0.012	
34.00	-3.45	-0.55	0.00	-1.2	0.00	1.23	876.73	263.02	546.31	539.02	0.32	-0.07	0.006	
35.00	-3.30	-0.54	0.00	-0.7	0.00	0.68	876.73	263.02	546.31	539.02	0.34	-0.07	0.005	
36.00	-0.59	-0.06	0.00	-0.1	0.00	0.13	876.73	263.02	546.31	539.02	0.35	-0.07	0.001	
38.00	-0.12	-0.01	0.00	-0.0	0.00	0.01	876.73	263.02	546.31	539.02	0.38	-0.07	0.000	
39.00	0.00	-0.01	0.00	0.0	0.00	0.00	876.73	263.02	546.31	539.02	0.39	-0.07	0.000	

CALCULATED FORCES													
Load Case: 1.0D + 1.0W			60 mph Wind with No Ice										12 Iterations
Gust Response Factor:		1.10											
Dead load Factor:		1.00											
Wind Load Factor:		1.00											
Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (ft-kips)	Phi Mn (ft-kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-6.95	-0.91	0.00	-28.8	0.00	28.85	876.73	263.02	546.31	539.02	0	0	0.061
5.00	-6.38	-0.87	0.00	-24.3	0.00	24.32	876.73	263.02	546.31	539.02	0.01	-0.02	0.052
10.00	-5.80	-0.84	0.00	-20.0	0.00	19.95	876.73	263.02	546.31	539.02	0.04	-0.04	0.044
15.00	-5.23	-0.81	0.00	-15.8	0.00	15.75	876.73	263.02	546.31	539.02	0.08	-0.05	0.035
20.00	-4.65	-0.77	0.00	-11.7	0.00	11.71	876.73	263.02	546.31	539.02	0.14	-0.06	0.027
25.00	-4.07	-0.73	0.00	-7.8	0.00	7.85	876.73	263.02	546.31	539.02	0.21	-0.07	0.019
30.00	-3.50	-0.70	0.00	-4.2	0.00	4.19	876.73	263.02	546.31	539.02	0.28	-0.07	0.012
34.00	-2.84	-0.64	0.00	-1.4	0.00	1.40	876.73	263.02	546.31	539.02	0.34	-0.07	0.006
35.00	-2.72	-0.63	0.00	-0.8	0.00	0.76	876.73	263.02	546.31	539.02	0.35	-0.07	0.005
36.00	-0.47	-0.06	0.00	-0.1	0.00	0.12	876.73	263.02	546.31	539.02	0.37	-0.07	0.001
38.00	-0.09	0.00	0.00	0.0	0.00	0.00	876.73	263.02	546.31	539.02	0.4	-0.07	0.000
39.00	0.00	0.00	0.00	0.0	0.00	0.00	876.73	263.02	546.31	539.02	0.41	-0.07	0.000

EQUIVALENT LATERAL FORCES METHOD ANALYSIS

(Based on ASCE7-16 Chapters 11, 12 and 15)

Spectral Response Acceleration for Short Period (S_s):	0.605
Spectral Response Acceleration at 1.0 Second Period (S_1):	0.104
Long-Period Transition Period (T_L – Seconds):	4
Importance Factor (I_e):	1.000
Site Coefficient F_a :	1.316
Site Coefficient F_v :	2.392
Response Modification Coefficient (R):	1.500
Design Spectral Response Acceleration at Short Period (S_{ds}):	0.531
Design Spectral Response Acceleration at 1.0 Second Period (S_{d1}):	0.166
Seismic Response Coefficient (C_s):	0.247
Upper Limit C_s :	0.247
Lower Limit C_s :	0.030
Period based on Rayleigh Method (sec):	0.450
Redundancy Factor (p):	1.000
Seismic Force Distribution Exponent (k):	1.000
Total Unfactored Dead Load:	6.950 k
Seismic Base Shear (E):	1.720 k

1.2D + 1.0Ev + 1.0Eh Seismic

CALCULATED FORCES

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (fr-kips)	Mu Mx (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (kips)	Phi Mn (kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-8.33	-1.71	0.00	-51.84	0.00	51.84	876.73	263.02	546	539.02	0.00	0.00	0.11
5.00	-7.58	-1.67	0.00	-43.30	0.00	43.30	876.73	263.02	546	539.02	0.02	-0.03	0.09
10.00	-6.82	-1.60	0.00	-34.95	0.00	34.95	876.73	263.02	546	539.02	0.07	-0.06	0.07
15.00	-6.07	-1.50	0.00	-26.95	0.00	26.95	876.73	263.02	546	539.02	0.15	-0.09	0.06
20.00	-5.32	-1.38	0.00	-19.43	0.00	19.43	876.73	263.02	546	539.02	0.25	-0.10	0.04
25.00	-4.57	-1.22	0.00	-12.54	0.00	12.54	876.73	263.02	546	539.02	0.36	-0.11	0.03
30.00	-3.97	-1.08	0.00	-6.43	0.00	6.43	876.73	263.02	546	539.02	0.49	-0.12	0.02
34.00	-3.56	-0.97	0.00	-2.12	0.00	2.12	876.73	263.02	546	539.02	0.59	-0.12	0.01
35.00	-3.41	-0.93	0.00	-1.14	0.00	1.14	876.73	263.02	546	539.02	0.62	-0.12	0.01
36.00	-0.37	-0.11	0.00	-0.21	0.00	0.21	876.73	263.02	546	539.02	0.64	-0.12	0.00
38.00	0.00	0.00	0.00	0.00	0.00	0.00	876.73	263.02	546	539.02	0.70	-0.12	0.00
39.00	0.00	0.00	0.00	0.00	0.00	0.00	876.73	263.02	546	539.02	0.72	-0.12	0.00

0.9D - 1.0Ev + 1.0Eh Seismic (Reduced DL)

CALCULATED FORCES

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (fr-kips)	Mu Mx (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (kips)	Phi Mn (kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-5.06	-1.71	0.00	-51.72	0.00	51.72	876.73	263.02	546	539.02	0.00	0.00	0.10
5.00	-4.60	-1.67	0.00	-43.19	0.00	43.19	876.73	263.02	546	539.02	0.02	-0.03	0.09
10.00	-4.15	-1.60	0.00	-34.86	0.00	34.86	876.73	263.02	546	539.02	0.07	-0.06	0.07
15.00	-3.69	-1.50	0.00	-26.87	0.00	26.87	876.73	263.02	546	539.02	0.15	-0.09	0.05
20.00	-3.23	-1.37	0.00	-19.37	0.00	19.37	876.73	263.02	546	539.02	0.25	-0.10	0.04
25.00	-2.78	-1.22	0.00	-12.50	0.00	12.50	876.73	263.02	546	539.02	0.36	-0.11	0.03
30.00	-2.41	-1.07	0.00	-6.41	0.00	6.41	876.73	263.02	546	539.02	0.49	-0.12	0.02
34.00	-2.16	-0.97	0.00	-2.11	0.00	2.11	876.73	263.02	546	539.02	0.59	-0.12	0.01
35.00	-2.07	-0.93	0.00	-1.14	0.00	1.14	876.73	263.02	546	539.02	0.62	-0.12	0.00
36.00	-0.23	-0.11	0.00	-0.21	0.00	0.21	876.73	263.02	546	539.02	0.64	-0.12	0.00
38.00	0.00	0.00	0.00	0.00	0.00	0.00	876.73	263.02	546	539.02	0.70	-0.12	0.00
39.00	0.00	0.00	0.00	0.00	0.00	0.00	876.73	263.02	546	539.02	0.72	-0.12	0.00

ANALYSIS SUMMARY

Load Case	Base Reactions						Max Usage	
	Shear FX (kips)	Shear FZ (kips)	Axial FY (kips)	Moment MX (ft-kips)	Moment MY (ft-kips)	Moment MZ (ft-kips)	Elev (ft)	Interaction Ratio
1.2D + 1.0W	3.10	0.00	8.34	0.00	0.00	98.87	0.00	0.19
0.9D + 1.0W	3.10	0.00	6.26	0.00	0.00	98.72	0.00	0.19
1.2D + 1.0Di + 1.0Wi	0.95	0.00	8.62	0.00	0.00	28.11	0.00	0.06
1.2D + 1.0Ev + 1.0Eh	1.71	0.00	8.33	0.00	0.00	51.84	0.00	0.11
0.9D - 1.0Ev + 1.0Eh	1.71	0.00	5.06	0.00	0.00	51.72	0.00	0.1
1.0D + 1.0W	0.91	0.00	6.95	0.00	0.00	28.85	0.00	0.06

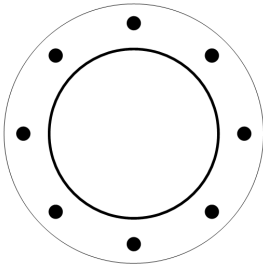
BASE PLATE ANALYSIS @ 0 FT

APPLIED REACTIONS

Moment (k-ft)	Axial (k)	Shear (k)
98.87	8.34	3.1

PLATE PARAMETERS (ID# 18470)

Width:	36.41	in
Shape:	Round	
Thickness:	2	in
Grade:	A572-50	
Yield Strength:	50	ksi
Tensile Strength:	65	ksi
Rod Detail Type:	d	
Clear Distance	2.5	in
Base Weld Size:	0.125	in
Orientation Offset:	-	°
Analysis Type:	Plastic	
Neutral Axis:	23	°



ANCHOR ROD PARAMETERS

Class	Arrangement	Quantity	Diameter (in)	Circle (in)	Grade	F _y (ksi)	F _u (ksi)	Spacing (in)	Offset (°)
Original [ID#18936]	Radial	8	2	31	F1554 Gr. 55	55	75	-	-

COMPONENT PROPERTIES

Component	ID	Gross Area (in ²)	Net Area (in ²)	Individual Inertia (in ⁴)	Moment of Inertia (in ⁴)	Threads/in
Pole	24"Ø x 0.375" (Round)	27.8322	-	-	1943.10	-
Bolt Group	Original (8) 2"Ø	3.1416	2.4982	0.4967	2059.94	4.5

REACTION DISTRIBUTION

Component	ID	Moment M _u (k-ft)	Axial Load P _u (k)	Shear V _u (k)	Moment Factor
Pole	24"Ø x 0.375" (Round)	98.9	8.34	3.10	1.000
Bolt Group	Original (8) 2"Ø	98.9	-	3.10	1.000

BASE PLATE BEND LINE ANALYSIS @ 0 FT

POLE PROPERTIES					PLATE PROPERTIES		
Flat-to-Flat Diameter:	24.12	in	Flat Width:	0.211	in	Neutral Axis:	23 °
Point-to-Point Diameter:	24.12	in	Flat Radians:	0.017	rad	Bend Line Limits:	1.086 to 2.841 rad
Orientation Offset:	-	°					
Bend Line	Chord Length (in)	Additional Length (in)	Section Modulus (in ³)	Applied Moment M _u (k-in)	Moment Capacity ΦM _n (k-in)	Flexure Result M _u /ΦM _n	
Flats	23.993	0.00	23.993	47.8	1079.7	4.4%	✓
Corners	23.993	0.00	23.993	47.8	1079.7	4.4%	✓
Circumferential	35.356	0.00	35.356	91.7	1591.0	5.8%	✓

PLASTIC ANCHOR ROD ANALYSIS

Class	Group Quantity	Rod Diameter (in)	Applied Axial Load P _u (k)	Applied Shear Load V _u (k)	Compressive Capacity ΦP _n (k)	Interaction Result
Original	8	2	17.8	0.5	140.5	13.5% ✓

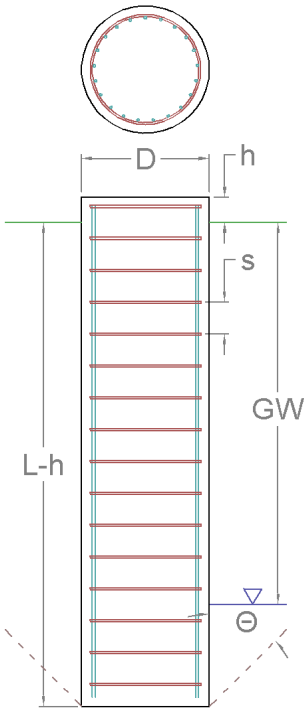
PIER FOUNDATION ANALYSIS

GLOBAL REACTIONS

Moment (k-ft)	Axial (k)	Shear (k)
98.87	8.34	3.10

FOUNDATION PARAMETERS

Pier Diameter:	D	5.00	ft
Pier Embedment Depth:	L-h	22.5	ft
Pier Height above Grade:	h	0.50	ft
Concrete Compressive Strength:		3,000	psi
Vertical Rebar:		(18) #8 bars [60 ksi]	
Tie Rebar:	s	#4 bars @ 12.0" c/c [60 ksi]	
Rebar Clear Cover:		3.00	in



SOIL PARAMETERS

Water Table Depth [BGL]:		GW	-	ft		
Layer Depth (ft)	Unit Weight	Cohesion	Friction Angle	Ultimate Skin	Ultimate Net	
Top	Bottom	pcf	psf	°	psf	Bearing
						psf
0	2	105	0	0	0	0
2	5	121	3,273	0	0	0
5	9	126	0	36	904	0
9	14	139	0	40	1,419	0
14	19	126	0	36	1,904	0
19	24	130	4,390	0	2,109	36,132

SOIL STRENGTH ANALYSIS

Volume of Concrete (ft³)	Buoyant Weight of Concrete (k)	Skin Friction Resistance (k)	Inflection Point [BGL] (ft)
451.60	67.74	433.74	14.71

SOIL MOMENT ANALYSIS

Total Lateral Resistance (k)	Moment at Inflection Point, M _u (k-ft)	Additional Resistance (k-ft)	Nominal Moment Capacity, ΦM _n (k-ft)	Soil Moment Usage, M _u / ΦM _n
1,998.52	146.03	0.00	7,993.73	1.8%



SOIL COMPRESSION ANALYSIS

Compressive Bearing Resistance (k)	Compressive Force, P _u (k)	Additional Resistance (k)	Nominal Compressive Capacity, ΦP _n (k)	Soil Compressive Usage, P _u / ΦP _n
709.45	20.55	0.00	857.39	2.4%



REINFORCING STEEL STRENGTH ANALYSIS

Rebar Cage Diameter (in)	Steel Elastic Modulus, E (ksi)	Strength Bending/Tension Reduction Factor, Φ_b	Strength Shear Reduction Factor, Φ_v	Strength Compression Reduction Factor, Φ_c
52	29,000	0.9	0.75	0.65

PIER REINFORCING MOMENT ANALYSIS

Design Moment, M_u (k-ft)	Nominal Moment Capacity, $\Phi_b M_n$ (k-ft)	Bending Reinforcement Ratio	Pier Rebar Flexure Usage, $M_u / \Phi_b M_n$
100.43	1,628.75	0.01	6.2%



PIER REINFORCING COMPRESSION ANALYSIS

Buoyant Weight of Concrete (k)	Design Compression, P_u (k)	Nominal Compressive Capacity, $\Phi_p P_n$ (k)	Pier Rebar Compressive Usage, $P_u / \Phi_p P_n$
67.74	20.55	4,173.98	0.5%



PIER REINFORCING SHEAR ANALYSIS

Design Shear, V_u (k)	Nominal Shear Capacity, $\Phi_v V_n$ (k)	Pier Rebar Shear Usage, $V_u / \Phi_v V_n$
9.11	304.64	3.0%

