REVIEWED
FOR
CODE
COMPLIANCE
12/12/2022

AMERICAN TOWER®
CORPORATION

Structural Analysis Report

Structure	:	**39 ft Monopole**
ATC Site Name	:	**Hwy 40 and Hwy 131,CO**
ATC Site Number	:	**205626**
Engineering Number	:	**14095953_C3_01**
Proposed Carrier	:	**AT&T MOBILITY**
Carrier Site Name	:	**HWY 40 AND HWY 131**
Carrier Site Number	:	**COU4213**
Site Location	:	**30700 County Road 14B** **Steamboat Springs, CO 80487** **40.3412, -106.8539**
County	:	**Routt**
Date	:	**May 20, 2022**
Max Usage	:	**30%**
Result	:	**Pass**

Prepared By:

Michael Imbimbo
Structural Engineer

Michael Imbimbo

Reviewed By:

COLORADO LICENSED
BRYAN K. LANIER
PE.0048739
PROFESSIONAL ENGINEER

Authorized by "EOR"
20 May 2022 10:45:01 cosign

Table of Contents

Introduction

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

Supporting Documents

Tower Drawings	Valmont Order #201977, dated December 27, 2012
Foundation Drawing	Valmont Drawing #B-136022, dated December 27, 2012
Geotechnical Report	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:	ANSI/TIA-222-H / 2015 IBC
Exposure Category:	C
Risk Category:	II
Topographic Factor Procedure:	Method 2
Crest Height (H):	141 ft
Crest Length (L):	705 ft
Spectral Response:	Ss = 0.60, S_1 = 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 contact American Tower via email at Engineering@americantower.com. Please include the American Tower site name, site number, and engineering number in the subject line for any questions.

Existing and Reserved Equipment

Elev.[1] (ft)	Qty	Equipment	Mount Type	Lines	Carrier
36.0	3	Andrew E15S09P78	T-Arm	(6) 7/8" Coax	AT&T MOBILITY
	6	KMW AM-X-CD-17-65-00T-RET (96" Height)			
	1	Raycap DC6-48-60-18-8F(32.8 lbs)			

Equipment to be Removed

Elev.[1] (ft)	Qty	Equipment	Mount Type	Lines	Carrier
36.0	3	Alcatel-Lucent RRH2x40W-07L (700)	-	(2) 0.45" x 0.41" Power Cable (TFL492325) (1) 0.51" (13mm) Hybrid	AT&T MOBILITY
	3	KMW ET-X-UW-70-16-70-18-iR-AT			
	3	Alcatel-Lucent RRH2X40-AWS+RDEM			

Proposed Equipment

Elev.[1] (ft)	Qty	Equipment	Mount Type	Lines	Carrier
36.0	3	Nokia AHLBBA	T-Arm	(1) 0.39" (10mm) Fiber Trunk (2) 0.78" (19.7mm) 8 AWG 6 (3) 7/8" Coax	AT&T MOBILITY
	3	Nokia AirScale Dual RRH 4T4R B25/66 320W AHFIB			
	3	KMW EPBQ-654L8H8-L2-EPI-02			

[1] Contracted elevations are shown for appurtenances within contracted installation tolerances. Appurtenances outside of contract limits are shown at installed elevations.

Install proposed lines inside the pole shaft.

Structure Usages

Structural Component	Controlling Usage	Pass/Fail
Anchor Bolts	21%	Pass
Shaft	30%	Pass
Base Plate	9%	Pass

Foundations

Reaction Component	Analysis Reactions	% of Usage
Moment (Kips-Ft)	157.7	10%
Shear (Kips)	5.0	5%
Axial (Kips)	7.2	3%

The structure base reactions resulting from this analysis were found to be acceptable through analysis based on geotechnical and foundation information, therefore no modification or reinforcement of the foundation will be required.

Deflection and Sway*

Antenna Elevation (ft)	Antenna	Carrier	Deflection (ft)	Sway (Rotation) (°)
36.0	Nokia AHLBBA KMW EPBQ-654L8H8-L2-EPI-02 Nokia AirScale Dual RRH 4T4R B25/66 320W AHFIB	AT&T MOBILITY	0.048	0.110

***Deflection and Sway was evaluated considering a design wind speed of 60 mph (3-Second Gust) per ANSI/TIA-222-H**

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.

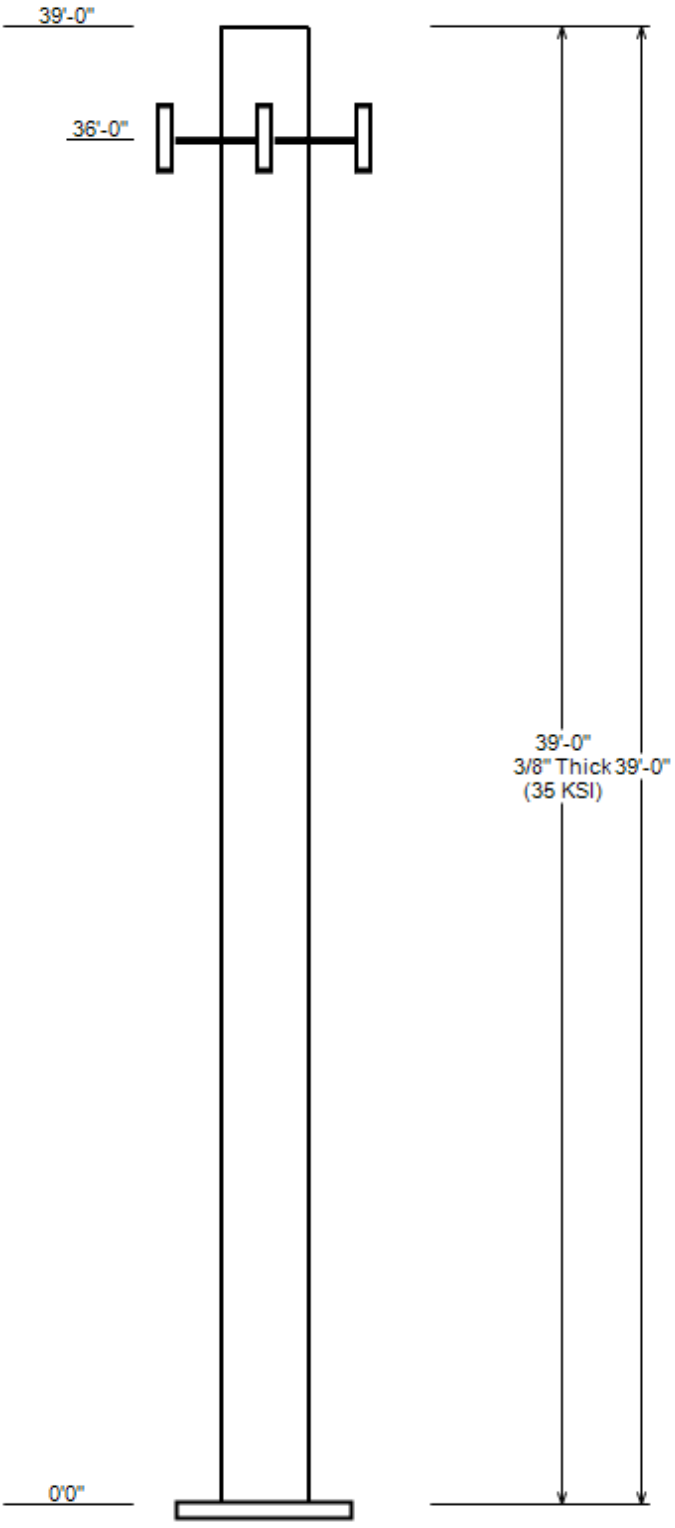
All assets of American Tower Corporation, its affiliates, and subsidiaries (collectively "American Tower") are inspected at regular intervals. Based upon these inspections and in the absence of information to the contrary, American Tower assumes that all structures were constructed in accordance with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

JOB INFORMATION

Asset :	205626, Hwy 40 and Hwy 131	Height :	39 ft
Client :	AT&T MOBILITY	Base Width :	24
Code :	ANSI/TIA-222-H	Shape :	Round



SITE PARAMETERS

Nominal Wind: 105 mph wind with no ice **Topo Category:** 0

Ice Wind: 50 mph wind with 0.25" rad **Topo Method:** Method 2

Base Elev (ft): 0.00 **Taper :** 0.00000(In/ft) **Topo Feature:** Hill

Structure Class: II **Exposure :** C **S_s :** 0.605 **S_1** : 0.104

SECTION PROPERTIES

Shaft Section	Length (ft)	Diameter (in) Across Flats Top	Diameter (in) Across Flats Bottom	Thick (in)	Joint Type	Overlap Length (in)	Shape	Steel Grade (ksi)
1	39.000	24.00	24.00	0.375		0.000	Round	35

DISCRETE APPURTENANCE

Attach Elev (ft)	Force Elev (ft)	Qty	Description
36.0	36.0	3	Andrew E15S09P78
36.0	38.0	1	Raycap DC6-48-60-18-8F(32.8 lb
36.0	36.0	3	Nokia AHLBBA
36.0	36.0	3	Nokia AirScale Dual RRH 4T4R B
36.0	36.0	3	Generic Round T-Arm
36.0	36.0	6	KMW AM-X-CD-17-65-00T-RET (96"
36.0	36.0	3	KMW EPBQ-654L8H8-L2-EPI-02

LINEAR APPURTENANCE

Elev From (ft)	Elev To (ft)	Description	Exp To Wind
0.0	36.0	7/8" Coax	No
0.0	36.0	7/8" Coax	No
0.0	36.0	0.78" (19.7mm) 8 AWG 6	No
0.0	36.0	0.39" (10mm) Fiber Trunk	No

LOAD CASES

1.2D + 1.0W	105 mph wind with no ice
0.9D + 1.0W	105 mph wind with no ice
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

REACTIONS

Load Case	Moment (kip-ft)	Shear (Kip)	Axial (Kip)
1.2D + 1.0W	157.67	5.05	7.23
0.9D + 1.0W	157.46	5.05	5.42
1.2D + 1.0Di + 1.0Wi	45.84	1.59	7.66
1.2D + 1.0Ev + 1.0Eh	47.62	1.57	7.22
0.9D - 1.0Ev + 1.0Eh	47.53	1.57	4.39
1.0D + 1.0W	46.02	1.47	6.02

DISH DEFLECTIONS

Load Case	Attach Elev (ft)	Deflection (in)	Rotation (deg)

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

Exposure Category:	C	**Design Wind Speed w/o Ice:**	105 mph
Risk Category:	II	**Design Wind Speed w/Ice:**	50 mph
Topo Factor Procedure:	Method 2	**Operational Wind Speed:**	60 mph
		Design Ice Thickness:	0.25 in
		HMSL:	7133.00 ft
Crest Height(H):	141 ft	**Distance from Apex (x):**	0 ft
Crest Length(L):	705 ft	**Upwind/Downwind:**	Upwind
Feature:	Hill		

SEISMIC PARAMETERS

Analysis Method:	Equivalent Lateral Force Method				
Site Class:	D - Stiff Soil			**Period Based on Rayleigh Method (sec):**	0.42
T_L (sec):	4	**P:**	1	**$C_{s:}$**	0.263
$S_{s:}$	0.605	**$S_{1:}$**	0.104	**C_s Max:**	0.263
$F_{a:}$	1.316	**$F_{v:}$**	2.392	**C_s Min:**	0.030
$S_{ds:}$	0.531	**$S_{d1:}$**	0.166		

LOAD CASES

1.2D + 1.0W	105 mph wind with no ice
0.9D + 1.0W	105 mph wind with no ice
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

							Bottom						Top						
Sect Info	Length (ft)	Thick (in)	Fy (ksi)	Joint Type	Slip Joint len (in)	Weight (lb)	Dia (in)	Elev (ft)	Area (in^2)	Ix (in^4)	W/t Ratio	D/t Ratio	Dia (in)	Elev (in)	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
				Shaft Weight		3,694													

DISCRETE APPURTENANCE PROPERTIES

Attach Elev (ft)	Description	Qty	Ka	Vert Ecc (ft)	No Ice Weight (lb)	No Ice EPAa (sf)	No Ice Orientation Factor	Ice Weight (lb)	Ice EPAa (sf)	Ice Orientation Factor
36.00	Andrew E15S09P78	3	0.80	0.000	17.40	0.747	0.50	20.98	0.847	0.50
36.00	Raycap DC6-48-60-18-8F(32.8 lb	1	0.80	2.000	32.80	1.470	0.50	43.42	1.590	0.50
36.00	Nokia AHLBBA	3	0.80	0.000	94.80	2.820	0.67	108.09	3.016	0.67
36.00	KMW EPBQ-654L8H8-L2-EPI-02	3	0.80	0.000	83.80	18.089	0.61	139.73	18.725	0.61
36.00	Generic Round T-Arm	3	0.75	0.000	312.50	9.700	0.67	357.48	11.120	0.67
36.00	KMW AM-X-CD-17-65-00T-RET (96"	6	0.80	0.000	59.50	11.310	0.68	96.32	11.865	0.68
36.00	Nokia AirScale Dual RRH 4T4R B	3	0.80	0.000	88.20	3.683	0.68	105.94	3.909	0.68
Totals	Num Loadings: 7	22			2,179.90			2,818.00		

LINEAR APPURTENANCE PROPERTIES

Load Case Azimuth (deg) : _

Elev From (ft)	Elev To (ft)	Qty	Description	Coax Dia (in)	Coax Wt (lb/ft)	Flat	Max Coax/ Row	Dist Between Rows(in)	Dist Between Cols(in)	Azimuth (deg)	Dist 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	3	7/8" Coax	1.09	0.33	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

(Max Len: 5.ft)

Seg Top Elev (ft)	Description	Thick (in)	Flat Dia (in)	Area (in^2)	Ix (in^4)	W/t Ratio	D/t Ratio	F'y (ksi)	S (in^3)	Z (in^3)	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
35.00		0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	473.5
36.00		0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	94.7
39.00		0.3750	24.000	27.833	1,943.30	0.00	64.00	35	161.9	209.3	284.1
								Totals:			3,693.3

Load Case: 1.2D + 1.0W 105 mph wind with no ice 12 Iterations
Gust Response Factor: 1.10
Dead load Factor: 1.20
Wind Load Factor: 1.00

CALCULATED FORCES

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	-7.23	-5.05	0.00	-157.7	0.00	157.67	876.73	263.02	546.31	539.02	0	0	0.301
5.00	-6.62	-4.83	0.00	-132.4	0.00	132.42	876.73	263.02	546.31	539.02	0.06	-0.11	0.254
10.00	-6.02	-4.62	0.00	-108.3	0.00	108.26	876.73	263.02	546.31	539.02	0.22	-0.19	0.208
15.00	-5.43	-4.40	0.00	-85.2	0.00	85.17	876.73	263.02	546.31	539.02	0.46	-0.27	0.164
20.00	-4.83	-4.18	0.00	-63.2	0.00	63.15	876.73	263.02	546.31	539.02	0.77	-0.32	0.123
25.00	-4.24	-3.96	0.00	-42.2	0.00	42.23	876.73	263.02	546.31	539.02	1.12	-0.36	0.083
30.00	-3.64	-3.73	0.00	-22.4	0.00	22.44	876.73	263.02	546.31	539.02	1.51	-0.38	0.046
35.00	-3.05	-3.59	0.00	-3.8	0.00	3.79	876.73	263.02	546.31	539.02	1.92	-0.39	0.011
36.00	-0.34	-0.05	0.00	-0.2	0.00	0.16	876.73	263.02	546.31	539.02	2	-0.39	0.001
39.00	0.00	-0.05	0.00	0.0	0.00	0.00	876.73	263.02	546.31	539.02	2.25	-0.39	0.000

Load Case: 0.9D + 1.0W 105 mph wind with no ice 12 Iterations
Gust Response Factor: 1.10
Dead load Factor: 0.90
Wind Load Factor: 1.00

CALCULATED FORCES

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	-5.42	-5.05	0.00	-157.5	0.00	157.46	876.73	263.02	546.31	539.02	0	0	0.299
5.00	-4.96	-4.83	0.00	-132.2	0.00	132.22	876.73	263.02	546.31	539.02	0.06	-0.11	0.251
10.00	-4.51	-4.61	0.00	-108.1	0.00	108.09	876.73	263.02	546.31	539.02	0.22	-0.19	0.206
15.00	-4.06	-4.40	0.00	-85.0	0.00	85.03	876.73	263.02	546.31	539.02	0.46	-0.26	0.163
20.00	-3.62	-4.18	0.00	-63.0	0.00	63.04	876.73	263.02	546.31	539.02	0.77	-0.32	0.121
25.00	-3.17	-3.95	0.00	-42.2	0.00	42.16	876.73	263.02	546.31	539.02	1.12	-0.36	0.082
30.00	-2.73	-3.72	0.00	-22.4	0.00	22.40	876.73	263.02	546.31	539.02	1.51	-0.38	0.045
35.00	-2.28	-3.58	0.00	-3.8	0.00	3.79	876.73	263.02	546.31	539.02	1.92	-0.39	0.010
36.00	-0.26	-0.05	0.00	-0.2	0.00	0.16	876.73	263.02	546.31	539.02	2	-0.39	0.001
39.00	0.00	-0.05	0.00	0.0	0.00	0.00	876.73	263.02	546.31	539.02	2.24	-0.39	0.000

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				

CALCULATED FORCES

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	-7.66	-1.59	0.00	-45.8	0.00	45.84	876.73	263.02	546.31	539.02	0	0	0.094
5.00	-7.03	-1.48	0.00	-37.9	0.00	37.91	876.73	263.02	546.31	539.02	0.02	-0.03	0.078
10.00	-6.40	-1.38	0.00	-30.5	0.00	30.48	876.73	263.02	546.31	539.02	0.06	-0.06	0.064
15.00	-5.76	-1.28	0.00	-23.6	0.00	23.57	876.73	263.02	546.31	539.02	0.13	-0.08	0.050
20.00	-5.13	-1.18	0.00	-17.2	0.00	17.15	876.73	263.02	546.31	539.02	0.22	-0.09	0.038
25.00	-4.49	-1.08	0.00	-11.2	0.00	11.24	876.73	263.02	546.31	539.02	0.32	-0.1	0.026
30.00	-3.85	-0.97	0.00	-5.9	0.00	5.86	876.73	263.02	546.31	539.02	0.43	-0.11	0.015
35.00	-3.22	-0.91	0.00	-1.0	0.00	1.01	876.73	263.02	546.31	539.02	0.54	-0.11	0.006
36.00	-0.37	-0.03	0.00	-0.1	0.00	0.09	876.73	263.02	546.31	539.02	0.57	-0.11	0.001
39.00	0.00	-0.03	0.00	0.0	0.00	0.00	876.73	263.02	546.31	539.02	0.64	-0.11	0.000

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

CALCULATED FORCES

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	-6.02	-1.47	0.00	-46.0	0.00	46.02	876.73	263.02	546.31	539.02	0	0	0.092
5.00	-5.53	-1.41	0.00	-38.6	0.00	38.65	876.73	263.02	546.31	539.02	0.02	-0.03	0.078
10.00	-5.03	-1.35	0.00	-31.6	0.00	31.60	876.73	263.02	546.31	539.02	0.06	-0.06	0.064
15.00	-4.54	-1.29	0.00	-24.9	0.00	24.86	876.73	263.02	546.31	539.02	0.13	-0.08	0.051
20.00	-4.04	-1.22	0.00	-18.4	0.00	18.43	876.73	263.02	546.31	539.02	0.22	-0.09	0.039
25.00	-3.55	-1.16	0.00	-12.3	0.00	12.32	876.73	263.02	546.31	539.02	0.33	-0.1	0.027
30.00	-3.06	-1.09	0.00	-6.6	0.00	6.55	876.73	263.02	546.31	539.02	0.44	-0.11	0.016
35.00	-2.56	-1.05	0.00	-1.1	0.00	1.11	876.73	263.02	546.31	539.02	0.56	-0.11	0.005
36.00	-0.28	-0.02	0.00	-0.0	0.00	0.05	876.73	263.02	546.31	539.02	0.58	-0.11	0.000
39.00	0.00	-0.02	0.00	0.0	0.00	0.00	876.73	263.02	546.31	539.02	0.66	-0.11	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):	0.263
Upper Limit C_S:	0.263
Lower Limit C_S:	0.030
Period based on Rayleigh Method (sec):	0.420
Redundancy Factor (p):	1.000
Seismic Force Distribution Exponent (k):	1.000
Total Unfactored Dead Load:	6.030 k
Seismic Base Shear (E):	1.580 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	-7.22	-1.57	0.00	-47.62	0.00	47.62	876.73	263.02	546	539.02	0.00	0.00	0.10
5.00	-6.58	-1.54	0.00	-39.76	0.00	39.76	876.73	263.02	546	539.02	0.02	-0.03	0.08
10.00	-5.93	-1.48	0.00	-32.07	0.00	32.07	876.73	263.02	546	539.02	0.07	-0.06	0.07
15.00	-5.28	-1.39	0.00	-24.70	0.00	24.70	876.73	263.02	546	539.02	0.14	-0.08	0.05
20.00	-4.64	-1.27	0.00	-17.76	0.00	17.76	876.73	263.02	546	539.02	0.23	-0.09	0.04
25.00	-3.99	-1.13	0.00	-11.40	0.00	11.40	876.73	263.02	546	539.02	0.33	-0.11	0.03
30.00	-3.35	-0.96	0.00	-5.75	0.00	5.75	876.73	263.02	546	539.02	0.45	-0.11	0.01
35.00	-3.22	-0.93	0.00	-0.93	0.00	0.93	876.73	263.02	546	539.02	0.57	-0.11	0.01
36.00	0.00	0.00	0.00	0.00	0.00	0.00	876.73	263.02	546	539.02	0.59	-0.11	0.00
39.00	0.00	0.00	0.00	0.00	0.00	0.00	876.73	263.02	546	539.02	0.66	-0.11	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	-4.39	-1.57	0.00	-47.53	0.00	47.53	876.73	263.02	546	539.02	0.00	0.00	0.09
5.00	-4.00	-1.54	0.00	-39.67	0.00	39.67	876.73	263.02	546	539.02	0.02	-0.03	0.08
10.00	-3.60	-1.47	0.00	-32.00	0.00	32.00	876.73	263.02	546	539.02	0.07	-0.06	0.06
15.00	-3.21	-1.38	0.00	-24.63	0.00	24.63	876.73	263.02	546	539.02	0.14	-0.08	0.05
20.00	-2.82	-1.27	0.00	-17.72	0.00	17.72	876.73	263.02	546	539.02	0.23	-0.09	0.04
25.00	-2.43	-1.13	0.00	-11.37	0.00	11.37	876.73	263.02	546	539.02	0.33	-0.11	0.02
30.00	-2.03	-0.96	0.00	-5.73	0.00	5.73	876.73	263.02	546	539.02	0.45	-0.11	0.01
35.00	-1.95	-0.92	0.00	-0.92	0.00	0.92	876.73	263.02	546	539.02	0.57	-0.11	0.00
36.00	0.00	0.00	0.00	0.00	0.00	0.00	876.73	263.02	546	539.02	0.59	-0.11	0.00
39.00	0.00	0.00	0.00	0.00	0.00	0.00	876.73	263.02	546	539.02	0.66	-0.11	0.00

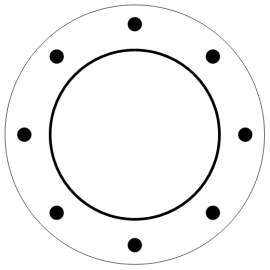
ANALYSIS SUMMARY

	Reactions						Max Usage	
Load Case	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	5.05	0.00	7.23	0.00	0.00	157.67	0.00	0.3
0.9D + 1.0W	5.05	0.00	5.42	0.00	0.00	157.46	0.00	0.3
1.2D + 1.0Di + 1.0Wi	1.59	0.00	7.66	0.00	0.00	45.84	0.00	0.09
1.2D + 1.0Ev + 1.0Eh	1.57	0.00	7.22	0.00	0.00	47.62	0.00	0.1
0.9D - 1.0Ev + 1.0Eh	1.57	0.00	4.39	0.00	0.00	47.53	0.00	0.09
1.0D + 1.0W	1.47	0.00	6.02	0.00	0.00	46.02	0.00	0.09

BASE PLATE ANALYSIS @ 0 FT

PLATE PARAMETERS (ID# 18470)

Diameter:	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:	292	°



ANCHOR ROD PARAMETERS

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

ANCHOR ROD GEOMETRY AND APPLIED LOADS --- ORIGINAL (8) 2"ø [ID 18936]

Position	Radians	X (in)	Y (in)	Moment Arm (in)	Inertia (in^4)	Axial Load (k)	Shear Load (k)
1	0.785	10.96	10.96	13.203	436.018	27.05	0.38
2	1.571	0.00	15.50	5.373	72.625	27.05	0.90
3	2.356	-10.96	10.96	-5.605	78.968	-23.43	0.89
4	3.142	-15.50	0.00	-13.299	442.361	-23.43	0.36
5	3.927	-10.96	-10.96	-13.203	436.018	-23.43	0.38
6	4.712	0.00	-15.50	-5.373	72.625	-23.43	0.90
7	5.498	10.96	-10.96	5.605	78.968	27.05	0.89
8	6.283	15.50	0.00	13.299	442.361	27.05	0.36

REACTION DISTRIBUTION

Component	ID	Moment Mu (k-ft)	Axial Load Pu (k)	Shear Vu (k)	Moment Factor
Pole	24"ø x 0.375" (Round)	157.7	7.23	5.05	1.000
Bolt Group	Original (8) 2"ø	157.7	-	5.05	1.000
	TOTALS	**157.67**	**7.23**	**5.05**	

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

EXTERNAL BASE PLATE BEND LINE ANALYSIS @ 0 FT

POLE PROPERTIES

Flat-to-Flat Diameter:	24.12	in
Point-to-Point Diameter:	24.12	in
Flat Width:	0.211	in
Flat Radians:	0.017	rad

PLATE PROPERTIES

Neutral Axis:	292	°
Bend Line Lower Limit:	5.798	rad
Bend Line Upper Limit:	1.271	rad

Bend Line	Chord Length (in)	Additional Length (in)	Section Modulus (in^3)	Applied Moment Mu (k-in)	Moment Capacity ϕMn (k-in)	Ratio
Flat	23.993	0.00	23.993	74.5	1079.7	0.069
Corner	23.993	0.00	23.993	74.5	1079.7	0.069
Circumferential	35.356	0.00	35.356	142.9	1591.0	0.090

PLASTIC ANCHOR ROD ANALYSIS

Class	Group Quantity	Rod Diameter (in)	Applied Axial Load Pu (k)	Applied Shear Load Vu (k)	Compressive Capacity ϕPn (k)	Ratio
Original	8	2	27.0	0.9	140.5	0.205

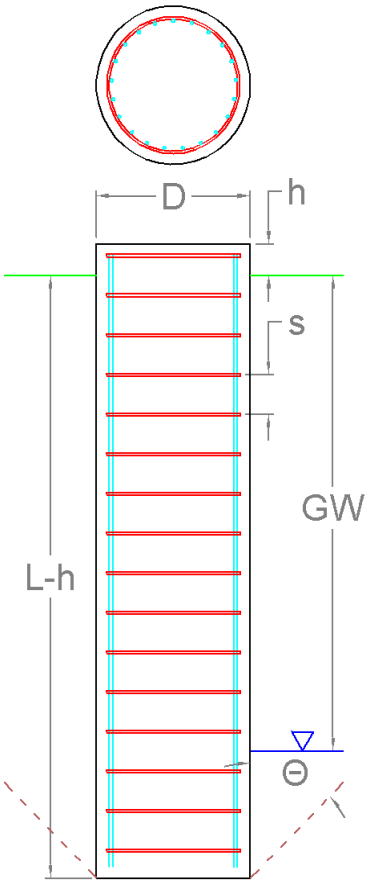
Pier Foundation Analysis (ANSI/TIA-222-H)

Foundation Analysis Parameters			
Pier Diameter	*D*	5.00	ft
Pier Embedment	*L-h*	22.5	ft
Pier Height above Ground	*H*	0.50	ft
Water Table Depth [BGL]	*GW*	99	ft
Pullout Angle	Θ	30	°
Unit Weight of Concrete		150	pcf
Uplift Skin Friction Factor		1.000	

Reactions		
Moment, M_u	157.7	k-ft
Shear, V_u	5.0	k
Axial, P_u	7.2	k
Uplift, T_u	0.0	k

Soil Properties

Layer Depth (ft)		Unit Weight	Cohesion	Friction Angle	Ultimate Skin Friction	Ultimate Bearing Pressure
TOP	BTM	pcf	psf	°	psf	psf
0.0	2.0	105	0	0	0	0
2.0	5.0	121	3,273	0	0	0
5.0	9.0	126	0	36	904	0
9.0	14.0	139	0	40	1,419	0
14.0	19.0	126	0	36	1,904	0
19.0	24.0	130	4,390	0	2,109	36,132



Soil Strength Capacities		
Volume of Concrete	451.6	ft^3
Weight of Concrete [Buoyancy Considered]	67.7	k
Average Soil Unit Weight	127.0	pcf
Skin Friction Resistance	433.7	k
Compressive Bearing Resistance	709.4	k
Pullout Weight [Minus Concrete Weight]	796.4	k
Compressive Force, P_u	19.4	k
Nominal Compressive Capacity, $\phi_s P_n$	857.4	k
$P_u / \phi_s P_n$	2.3%	
Total Lateral Resistance	1,998.5	k
Inflection Point [BGL]	14.7	ft
Moment at Inflection Point, M_D	234.5	k-ft
Nominal Moment Capacity, $\phi_s M_n$	7,993.7	k-ft
$M_D / \phi_s M_n$	2.9%	

Pier Strength Capacities			
Concrete Compressive Strength, f'_c		3,000	psi
Rebar Size #		8	
Rebar Area (Single)		0.79	in^2
Rebar Quantity		18	
Rebar Yield Strength, F_y		60	ksi
Vertical Rebar Clear Cover		3	in
Tie Rebar Size #		4	
Tie Rebar Area (Single)		0.20	in^2
Tie Rebar Spacing	*s*	12.0	in
Tie Rebar Yield Strength, F_y		60	ksi
Rebar Cage Diameter		52.00	in
Strength Bending/Tension Reduction Factor, ϕ_B		0.90	
Strength Shear Reduction Factor, ϕ_V		0.75	
Strength Compression Reduction Factor, ϕ_C		0.65	
Steel Elastic Modulus		29,000	ksi
Design Moment, M_u		160.2	k-ft
Moment Capacity, $\phi_B M_n$		1,628.8	k-ft
$M_u / \phi_B M_n$		**9.8%**	
Design Shear, V_u		14.5	k
Shear Capacity, $\phi_V V_n$		304.6	k
$V_u / \phi_V V_n$		**4.8%**	
Design Compression, P_u		19.4	k
Compression Capacity, $\phi_P P_n$		4,174.0	k
$P_u / \phi_P P_n$		**0.5%**	
Bending Reinforcement Ratio		0.005	