



AMERICAN TOWER®
CORPORATION

Structural Analysis Report

Structure : 59 ft Monopole
ATC Site Name : DUTTON ROAD CA,CA
ATC Site Number : 411010
Engineering Number : 13672476_C3_01
Proposed Carrier : VERIZON WIRELESS
Carrier Site Name : SF DUTTON ROAD
Carrier Site Number : 115568
Site Location : 3001 Corby Avenue
Santa Rosa, CA 95407-7879
38.4038, -122.7184
County : Sonoma
Date : September 10, 2021
Max Usage : 94%
Result : Pass

Prepared By:

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Engineer Intern

Reviewed By:



Expires: 06/30/2022



Table of Contents

Introduction	3
Supporting Documents	3
Analysis	3
Conclusion	3
Existing and Reserved Equipment.....	4
Equipment to be Removed	4
Proposed Equipment	4
Structure Usages.....	5
Foundations	5
Deflection and Sway*	5
Standard Conditions	6
Calculations	Attached

Introduction

The purpose of this report is to summarize results of a structural analysis performed on the 59 ft Monopole to reflect the change in loading by VERIZON WIRELESS.

Supporting Documents

Tower Drawings	FWT Job #J031027003, dated March 1, 2004
Foundation Drawing	FWT Job #J031027003, dated March 1, 2004
Geotechnical Report	BMI Project #03S-207, dated September 8, 2003

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:	92 mph (3-second gust)
Basic Wind Speed w/ Ice:	No Ice Considered
Code:	ANSI/TIA-222-H / 2018 IBC / 2019 California Building Code
Exposure Category:	B
Risk Category:	II
Topographic Factor Procedure:	Method 1
Topographic Category:	1
Crest Height (H):	0 ft
Crest Length (L):	0 ft
Spectral Response:	$S_s = 1.99$, $S_i = 0.76$
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
59.0	1	Aviat Networks ODU 600	Flush	(1) 0.41" (10.3mm) CNT-400 (6) 7/8" Coax	VERIZON WIRELESS
	1	Commscope VHLP1-23			
58.0	1	VZW Unused Reserve (12738.92 sqin)			
50.0	3	Commscope SBNHH-1D65B (40.6 lbs)		(12) 7/8" Coax	
41.0	1	Generic TMO Incentive Reserve	Sector Frame	-	ATC RESERVED

Equipment to be Removed

Elev. ¹ (ft)	Qty	Equipment	Mount Type	Lines	Carrier
58.0	3	Commscope SBNHH-1D65B (40.6 lbs)	-	(6) 7/8" Coax	VERIZON WIRELESS

Proposed Equipment

Elev. ¹ (ft)	Qty	Equipment	Mount Type	Lines	Carrier
58.7	3	Ericsson AIR6449	Flush	(6) 7/8" Coax (1) 1 5/8" Hybriflex	VERIZON WIRELESS
58.0	3	Ericsson Radio 4449 - B13&B5			
	3	Ericsson 8843 Rev 2			
	1	Raycap RCMDC-6627-PF-48			
	3	Commscope NNHH-65B-R4			

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	53%	Pass
Shaft	91%	Pass
Base Plate	94%	Pass

Foundations

Reaction Component	Analysis Reactions	% of Usage
Moment (Kips-Ft)	278.8	27%
Axial (Kips)	8.1	5%
Shear (Kips)	5.6	33%

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) (°)
59.0	Commscope VHLP1-23	VERIZON WIRELESS	1.532	2.340
58.7	Ericsson AIR6449	VERIZON WIRELESS	1.520	2.340
58.0	Raycap RCMDC-6627-PF-48	VERIZON WIRELESS	1.491	2.340
	Ericsson 8843 Rev 2			
	Commscope NNHH-65B-R4			
	Ericsson Radio 4449 - B13&B5			

*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.

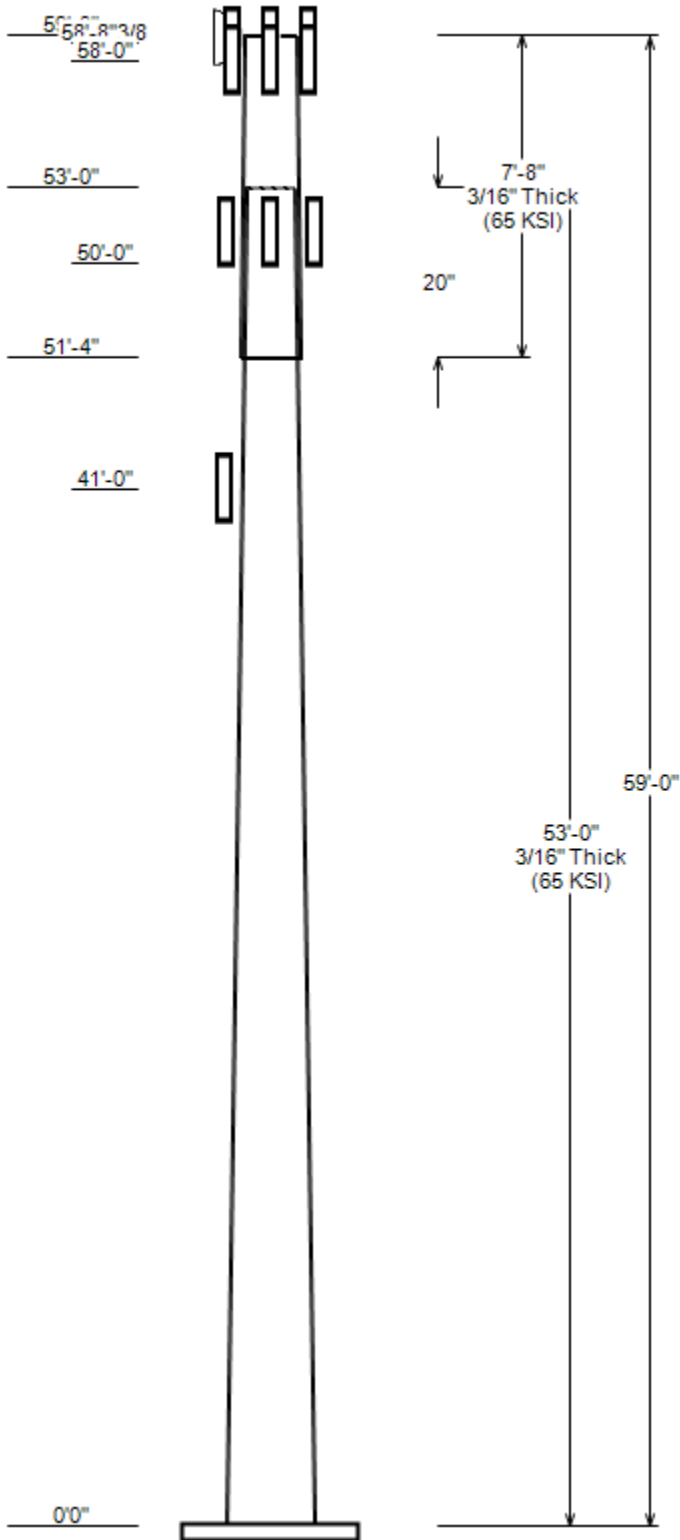
Unless explicitly agreed by both the client and ATC Tower Services LLC, all services will be performed in accordance with the current revision of ANSI/TIA-222.

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 : 411010, DUTTON ROAD CA
 Client : VERIZON WIRELESS
 Code : ANSI/TIA-222-H

Height : 59 ft
 Base Width : 18.705
 Shape : 18 Sides



SITE PARAMETERS

Base Elev (ft): 0.00 Structure Class: II
 Taper : 0.12000 (In/ft) Exposure : B
 Topographic Category : 1 Topographic Feature:
 Topo Method : Method 1

SECTION PROPERTIES

Shaft Section	Length (ft)	Diameter (in)		Thick (in)	Overlap Length (in)	Steel Grade (ksi)
		Across Flats Top	Across Flats Bottom			
1	53.000	12.34	18.70	0.188	0.000	65
2	7.667	12.00	12.92	0.188	20.000	65

DISCRETE APPURTENANCE

Attach Elev (ft)	Force Elev (ft)	Qty	Description
59.0	59.0	1	Aviat Networks ODU 600
59.0	59.0	1	Commscope VHL P1-23
58.7	58.7	3	Ericsson AIR6449
58.0	58.0	3	Ericsson Radio 4449 - B13&B5
58.0	58.0	3	Ericsson 8843 Rev 2
58.0	58.0	1	Raycap RCMDC-6627-PF-48
58.0	58.0	3	Commscope NNHH-65B-R4
58.0	58.0	1	VZW Unused Reserve (12738.92 s
50.0	51.9	3	Commscope SBNHH-1D65B (40.6 lb
41.0	41.0	1	Generic TMO Incentive Reserve

LINEAR APPURTENANCE

Elev From (ft)	Elev To (ft)	Description	Exp To Wind
0.0	59.0	0.41" (10.3mm) CNT-400	No
0.0	58.7	7/8" Coax	No
0.0	58.0	7/8" Coax	No
0.0	58.0	1 5/8" Hybriflex	No
0.0	50.0	7/8" Coax	No

LOAD CASES

1.2D + 1.0W	92 mph wind with no ice
0.9D + 1.0W	92 mph wind with no ice
1.2D + 1.0Di + 1.0Wi	30 mph wind with 0" 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	278.81	5.58	8.08
0.9D + 1.0W	273.65	5.57	6.05
1.2D + 1.0Di + 1.0Wi	31.18	0.65	6.92
1.2D + 1.0Ev + 1.0Eh	146.22	2.79	9.91
0.9D - 1.0Ev + 1.0Eh	138.18	2.77	3.79
1.0D + 1.0W	106.84	2.17	6.76

DISH DEFLECTIONS

Load Case	Attach Elev (ft)	Deflection (in)	Rotation (deg)
1.0D + 1.0W	59.00	18.384	2.342

ASSET: 411010, DUTTON ROAD CA
CUSTOMER: VERIZON WIRELESS

CODE: ANSI/TIA-222-H
ENG NO:

ANALYSIS PARAMETERS

Location:	Sonoma County, CA	Height:	59 ft
Type and Shape:	Taper, 18 Sides	Base Diameter:	18.71 in
Manufacturer:	FWT	Top Diameter:	12.00 in
K _d (non-service):	0.95	Taper:	0.1200 in/ft
K _e :	1.00	Rotation:	0.000°

ICE & WIND PARAMETERS

Exposure Category:	B	Design Wind Speed w/o Ice:	92 mph
Risk Category:	II	Design Wind Speed w/Ice:	30 mph
Topo Factor Procedure:	Method 1	Operational Wind Speed:	60 mph
Topographic Category:	1	Design Ice Thickness:	0.00 in
Crest Height:	0 ft	HMSL:	119.00 ft

SEISMIC PARAMETERS

Analysis Method:	Equivalent Lateral Force Method				
Site Class:	D - Stiff Soil	Period Based on Rayleigh Method (sec):	1.86		
T _L (sec):	8	P:	1	C _s :	0.408
S _s :	1.994	S ₁ :	0.765	C _s Max:	0.408
F _a :	1.200	F _v :	1.700	C _s Min:	0.408
S _{ds} :	1.595	S _{d1} :	0.867		

LOAD CASES

1.2D + 1.0W	92 mph wind with no ice
0.9D + 1.0W	92 mph wind with no ice
1.2D + 1.0Di + 1.0Wi	30 mph wind with 0" 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

ASSET: 411010, DUTTON ROAD CA
 CUSTOMER: VERIZON WIRELESS

CODE: ANSI/TIA-222-H
 ENG NO:

SHAFT SECTION PROPERTIES

Sect Info	Length (ft)	Thick (in)	Fy (ksi)	Joint Type	Slip 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 (in)	Area (in ²)	Ix (in ⁴)	W/t Ratio	D/t Ratio	Taper (in/ft)	
1-18	53.00	0.1875	65		0.00	1,646	18.70	0.000	11.02	477.4	15.83	99.76	12.34	53.00	7.23	135.1	9.85	65.84	0.1200	
2-18	7.67	0.1875	65	Slip	20.00	191	12.92	51.333	7.58	155.2	10.39	68.91	12.00	59.00	7.03	123.9	9.52	64.00	0.1200	
Shaft Weight						1,837														

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
59.00	Aviat Networks ODU 600	1	1.00	0.000	11.00	0.901	1.00	11.00	0.901	1.00
59.00	Commscope VHLP1-23	1	1.00	0.000	14.00	1.610	1.00	14.00	1.610	1.00
58.70	Ericsson AIR6449	3	1.00	0.000	81.60	4.028	0.65	81.60	4.028	0.65
58.00	VZW Unused Reserve (12738.92 s	1	1.00	0.000	807.50	88.465	0.90	807.50	88.465	0.90
58.00	Commscope NNHH-65B-R4	3	1.00	0.000	83.80	12.271	0.64	83.80	12.271	0.64
58.00	Ericsson 8843 Rev 2	3	1.00	0.000	75.00	1.650	0.50	75.00	1.650	0.50
58.00	Ericsson Radio 4449 - B13&B5	3	1.00	0.000	70.00	1.650	0.50	70.00	1.650	0.50
58.00	Raycap RCMDC-6627-PF-48	1	1.00	0.000	32.00	4.056	1.00	32.00	4.056	1.00
50.00	Commscope SBNHH-1D65B (40.6 lb	3	1.00	1.900	40.60	8.079	0.67	40.60	8.079	0.67
41.00	Generic TMO Incentive Reserve	1	0.80	0.000	2500.00	146.000	1.00	2500.00	146.000	1.00
Totals	Num Loadings: 10	20			4,417.50			4,417.50		

LINEAR APPURTENANCE PROPERTIES

Load Case Azimuth (deg) : 0.00_

Elev From (ft)	Elev To (ft)	Qty	Description	Coax Dia (in)	Coax Wt (lb/ft)	Max Flat	Coax/ Row	Dist Between Rows(in)	Dist Between Cols(in)	Azimuth (deg)	Dist From Face (in)	Exposed To Wind	Carrier
0.00	59.00	1	0.41" (10.3mm) CNT-40	0.41	0.07	N	0	0	0	0	0	N	VERIZON WIREL
0.00	58.70	6	7/8" Coax	1.09	0.33	N	0	0	0	0	0	N	VERIZON WIREL
0.00	58.00	6	7/8" Coax	1.09	0.33	N	0	0	0	0	0	N	VERIZON WIREL
0.00	58.00	1	1 5/8" Hybriflex	1.98	1.3	N	0	0	0	0	0	N	VERIZON WIREL
0.00	50.00	12	7/8" Coax	1.09	0.33	N	0	0	0	0	0	N	VERIZON WIREL

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		0.1875	18.705	11.020	477.40	15.83	99.76	82.6	50.3	0.0	0.0
5.00		0.1875	18.105	10.663	432.50	15.26	96.56	82.6	47.1	0.0	184.5
10.00		0.1875	17.505	10.306	390.50	14.70	93.36	82.6	43.9	0.0	178.4
15.00		0.1875	16.905	9.949	351.30	14.13	90.16	82.6	40.9	0.0	172.3
20.00		0.1875	16.305	9.592	314.80	13.57	86.96	82.6	38.0	0.0	166.2
25.00		0.1875	15.705	9.235	280.90	13.01	83.76	82.6	35.2	0.0	160.2
30.00		0.1875	15.105	8.877	249.60	12.44	80.56	82.6	32.5	0.0	154.1
35.00		0.1875	14.505	8.520	220.70	11.88	77.36	82.6	30.0	0.0	148.0
40.00		0.1875	13.905	8.163	194.10	11.31	74.16	82.6	27.5	0.0	141.9
41.00		0.1875	13.785	8.092	189.00	11.20	73.52	82.6	27.0	0.0	27.7
45.00		0.1875	13.305	7.806	169.70	10.75	70.96	82.6	25.1	0.0	108.2
50.00		0.1875	12.705	7.449	147.50	10.18	67.76	82.6	22.9	0.0	129.8
51.33	Bot - Section 2	0.1875	12.545	7.354	141.90	10.03	66.91	82.6	22.3	0.0	33.6
53.00	Top - Section 1	0.1875	12.720	7.458	148.00	10.20	67.84	82.6	22.9	0.0	84.0
55.00		0.1875	12.480	7.315	139.70	9.97	66.56	82.6	22.0	0.0	50.3
58.00		0.1875	12.120	7.101	127.70	9.63	64.64	82.6	20.8	0.0	73.6
58.70		0.1875	12.036	7.051	125.10	9.56	64.19	82.6	20.5	0.0	16.9
59.00		0.1875	12.000	7.030	123.90	9.52	64.00	82.6	20.3	0.0	7.2

Totals: 1,836.9

ASSET: 411010, DUTTON ROAD CA
 CUSTOMER: VERIZON WIRELESS

CODE: ANSI/TIA-222-H
 ENG NO:

Load Case: 1.2D + 1.0W	92 mph wind with no ice	26 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	-8.08	-5.58	0.00	-278.8	0.00	278.81	818.72	193.40	323.49	311.24	0	0	0.906
5.00	-7.72	-5.60	0.00	-250.9	0.00	250.89	792.19	187.13	302.87	291.30	0.42	-0.79	0.872
10.00	-7.38	-5.61	0.00	-222.9	0.00	222.88	765.66	180.87	282.93	272.02	1.67	-1.57	0.830
15.00	-7.05	-5.61	0.00	-194.8	0.00	194.84	739.13	174.60	263.67	253.40	3.72	-2.33	0.779
20.00	-6.73	-5.60	0.00	-166.8	0.00	166.79	712.61	168.33	245.08	235.44	6.55	-3.06	0.719
25.00	-6.42	-5.59	0.00	-138.8	0.00	138.77	686.08	162.07	227.18	218.14	10.13	-3.75	0.647
30.00	-6.13	-5.56	0.00	-110.8	0.00	110.84	659.55	155.80	209.95	201.50	14.4	-4.38	0.561
35.00	-5.85	-5.52	0.00	-83.0	0.00	83.05	633.02	149.53	193.41	185.52	19.29	-4.94	0.458
40.00	-5.61	-5.48	0.00	-55.5	0.00	55.46	606.49	143.27	177.54	170.20	24.71	-5.38	0.337
41.00	-2.76	-3.15	0.00	-50.0	0.00	49.98	601.19	142.01	174.45	167.22	25.84	-5.46	0.304
45.00	-2.58	-3.08	0.00	-37.4	0.00	37.37	579.97	137.00	162.35	155.54	30.52	-5.72	0.245
50.00	-2.26	-2.71	0.00	-21.4	0.00	21.38	553.44	130.73	147.84	141.54	36.65	-5.97	0.156
51.33	-2.21	-2.68	0.00	-17.8	0.00	17.77	546.36	129.06	144.09	137.92	38.32	-6.02	0.133
53.00	-2.10	-2.65	0.00	-13.3	0.00	13.30	554.10	130.89	148.20	141.88	40.43	-6.07	0.098
55.00	-2.03	-2.60	0.00	-8.0	0.00	8.00	543.49	128.38	142.58	136.46	42.98	-6.12	0.063
58.00	-0.33	-0.24	0.00	-0.2	0.00	0.19	527.57	124.62	134.35	128.53	46.83	-6.14	0.002
58.70	-0.03	-0.05	0.00	-0.0	0.00	0.02	523.86	123.75	132.46	126.71	47.73	-6.14	0.000
59.00	0.00	-0.05	0.00	0.0	0.00	0.00	522.27	123.37	131.66	125.94	48.11	-6.14	0.000

ASSET: 411010, DUTTON ROAD CA
 CUSTOMER: VERIZON WIRELESS

CODE: ANSI/TIA-222-H
 ENG NO:

Load Case: 0.9D + 1.0W	92 mph wind with no ice	26 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	-6.05	-5.57	0.00	-273.6	0.00	273.65	818.72	193.40	323.49	311.24	0	0	0.887
5.00	-5.77	-5.56	0.00	-245.8	0.00	245.80	792.19	187.13	302.87	291.30	0.41	-0.77	0.852
10.00	-5.49	-5.54	0.00	-218.0	0.00	218.01	765.66	180.87	282.93	272.02	1.63	-1.54	0.810
15.00	-5.23	-5.52	0.00	-190.3	0.00	190.31	739.13	174.60	263.67	253.40	3.64	-2.28	0.759
20.00	-4.98	-5.49	0.00	-162.7	0.00	162.71	712.61	168.33	245.08	235.44	6.42	-3	0.699
25.00	-4.73	-5.46	0.00	-135.3	0.00	135.26	686.08	162.07	227.18	218.14	9.92	-3.67	0.628
30.00	-4.50	-5.42	0.00	-108.0	0.00	107.97	659.55	155.80	209.95	201.50	14.09	-4.28	0.544
35.00	-4.29	-5.37	0.00	-80.9	0.00	80.88	633.02	149.53	193.41	185.52	18.87	-4.82	0.444
40.00	-4.10	-5.32	0.00	-54.0	0.00	54.05	606.49	143.27	177.54	170.20	24.16	-5.26	0.326
41.00	-2.01	-3.07	0.00	-48.7	0.00	48.73	601.19	142.01	174.45	167.22	25.27	-5.33	0.295
45.00	-1.87	-3.01	0.00	-36.4	0.00	36.43	579.97	137.00	162.35	155.54	29.84	-5.59	0.238
50.00	-1.63	-2.64	0.00	-20.8	0.00	20.84	553.44	130.73	147.84	141.54	35.82	-5.83	0.151
51.33	-1.60	-2.61	0.00	-17.3	0.00	17.32	546.36	129.06	144.09	137.92	37.46	-5.88	0.129
53.00	-1.51	-2.58	0.00	-13.0	0.00	12.96	554.10	130.89	148.20	141.88	39.52	-5.93	0.094
55.00	-1.46	-2.54	0.00	-7.8	0.00	7.80	543.49	128.38	142.58	136.46	42.01	-5.97	0.060
58.00	-0.24	-0.23	0.00	-0.2	0.00	0.18	527.57	124.62	134.35	128.53	45.76	-6	0.002
58.70	-0.02	-0.05	0.00	-0.0	0.00	0.02	523.86	123.75	132.46	126.71	46.64	-6	0.000
59.00	0.00	-0.05	0.00	0.0	0.00	0.00	522.27	123.37	131.66	125.94	47.02	-6	0.000

ASSET: 411010, DUTTON ROAD CA
 CUSTOMER: VERIZON WIRELESS

CODE: ANSI/TIA-222-H
 ENG NO:

Load Case: 1.2D + 1.0Di + 1.0Wi	30 mph wind with 0" radial ice			23 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	-6.92	-0.65	0.00	-31.2	0.00	31.18	818.72	193.40	323.49	311.24	0	0	0.109
5.00	-6.65	-0.65	0.00	-27.9	0.00	27.92	792.19	187.13	302.87	291.30	0.05	-0.09	0.104
10.00	-6.37	-0.64	0.00	-24.7	0.00	24.68	765.66	180.87	282.93	272.02	0.19	-0.17	0.099
15.00	-6.11	-0.63	0.00	-21.5	0.00	21.48	739.13	174.60	263.67	253.40	0.41	-0.26	0.093
20.00	-5.86	-0.63	0.00	-18.3	0.00	18.31	712.61	168.33	245.08	235.44	0.73	-0.34	0.086
25.00	-5.61	-0.62	0.00	-15.2	0.00	15.18	686.08	162.07	227.18	218.14	1.12	-0.41	0.078
30.00	-5.37	-0.61	0.00	-12.1	0.00	12.08	659.55	155.80	209.95	201.50	1.6	-0.48	0.068
35.00	-5.13	-0.60	0.00	-9.0	0.00	9.03	633.02	149.53	193.41	185.52	2.14	-0.54	0.057
40.00	-4.91	-0.59	0.00	-6.0	0.00	6.03	606.49	143.27	177.54	170.20	2.73	-0.59	0.044
41.00	-2.67	-0.35	0.00	-5.4	0.00	5.44	601.19	142.01	174.45	167.22	2.86	-0.6	0.037
45.00	-2.49	-0.34	0.00	-4.0	0.00	4.05	579.97	137.00	162.35	155.54	3.38	-0.63	0.030
50.00	-2.21	-0.29	0.00	-2.3	0.00	2.30	553.44	130.73	147.84	141.54	4.05	-0.66	0.020
51.33	-2.16	-0.29	0.00	-1.9	0.00	1.91	546.36	129.06	144.09	137.92	4.23	-0.66	0.018
53.00	-2.05	-0.28	0.00	-1.4	0.00	1.42	554.10	130.89	148.20	141.88	4.47	-0.67	0.014
55.00	-1.98	-0.28	0.00	-0.8	0.00	0.85	543.49	128.38	142.58	136.46	4.75	-0.67	0.010
58.00	-0.30	-0.03	0.00	-0.0	0.00	0.02	527.57	124.62	134.35	128.53	5.17	-0.67	0.001
58.70	-0.03	-0.01	0.00	0.0	0.00	0.00	523.86	123.75	132.46	126.71	5.27	-0.67	0.000
59.00	0.00	-0.01	0.00	0.0	0.00	0.00	522.27	123.37	131.66	125.94	5.31	-0.67	0.000

Load Case: 1.0D + 1.0W	60 mph Wind with No Ice	25 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	-6.76	-2.17	0.00	-106.8	0.00	106.84	818.72	193.40	323.49	311.24	0	0	0.352
5.00	-6.51	-2.17	0.00	-96.0	0.00	96.01	792.19	187.13	302.87	291.30	0.16	-0.3	0.338
10.00	-6.28	-2.16	0.00	-85.2	0.00	85.18	765.66	180.87	282.93	272.02	0.64	-0.6	0.321
15.00	-6.05	-2.16	0.00	-74.4	0.00	74.37	739.13	174.60	263.67	253.40	1.42	-0.89	0.302
20.00	-5.83	-2.15	0.00	-63.6	0.00	63.58	712.61	168.33	245.08	235.44	2.51	-1.17	0.278
25.00	-5.61	-2.14	0.00	-52.8	0.00	52.84	686.08	162.07	227.18	218.14	3.88	-1.43	0.251
30.00	-5.41	-2.12	0.00	-42.2	0.00	42.17	659.55	155.80	209.95	201.50	5.51	-1.67	0.218
35.00	-5.20	-2.10	0.00	-31.6	0.00	31.58	633.02	149.53	193.41	185.52	7.38	-1.88	0.179
40.00	-5.01	-2.08	0.00	-21.1	0.00	21.09	606.49	143.27	177.54	170.20	9.44	-2.05	0.132
41.00	-2.51	-1.21	0.00	-19.0	0.00	19.01	601.19	142.01	174.45	167.22	9.88	-2.08	0.118
45.00	-2.36	-1.17	0.00	-14.2	0.00	14.19	579.97	137.00	162.35	155.54	11.67	-2.18	0.095
50.00	-2.07	-1.03	0.00	-8.1	0.00	8.10	553.44	130.73	147.84	141.54	14.01	-2.28	0.061
51.33	-2.03	-1.02	0.00	-6.7	0.00	6.73	546.36	129.06	144.09	137.92	14.64	-2.3	0.053
53.00	-1.93	-1.00	0.00	-5.0	0.00	5.03	554.10	130.89	148.20	141.88	15.45	-2.32	0.039
55.00	-1.87	-0.98	0.00	-3.0	0.00	3.02	543.49	128.38	142.58	136.46	16.42	-2.33	0.026
58.00	-0.29	-0.09	0.00	-0.1	0.00	0.07	527.57	124.62	134.35	128.53	17.89	-2.34	0.001
58.70	-0.03	-0.02	0.00	-0.0	0.00	0.01	523.86	123.75	132.46	126.71	18.24	-2.34	0.000
59.00	0.00	-0.02	0.00	0.0	0.00	0.00	522.27	123.37	131.66	125.94	18.38	-2.34	0.000

EQUIVALENT LATERAL FORCES METHOD ANALYSIS
 (Based on ASCE7-16 Chapters 11, 12 and 15)

Spectral Response Acceleration for Short Period (S_S):	1.994
Spectral Response Acceleration at 1.0 Second Period (S_1):	0.765
Long-Period Transition Period (T_L – Seconds):	8
Importance Factor (I_a):	1.000
Site Coefficient F_a :	1.200
Site Coefficient F_v :	1.700
Response Modification Coefficient (R):	1.500
Design Spectral Response Acceleration at Short Period (S_{ds}):	1.595
Design Spectral Response Acceleration at 1.0 Second Period (S_{d1}):	0.867
Seismic Response Coefficient (C_s):	0.408
Upper Limit C_s :	0.408
Lower Limit C_s :	0.408
Period based on Rayleigh Method (sec):	1.860
Redundancy Factor (ρ):	1.000
Seismic Force Distribution Exponent (k):	1.680
Total Unfactored Dead Load:	6.760 k
Seismic Base Shear (E):	2.760 k

1.2D + 1.0Ev + 1.0Eh Seismic

Segment	Height Above Base (ft)	Weight (lb)	W_z (lb-ft)	C_{vx}	Horizontal Force (lb)	Vertical Force (lb)
17	58.85	7	7	0.002	5	11
16	58.35	18	17	0.004	12	28
15	56.5	90	79	0.021	57	136
14	54	61	50	0.013	36	93
13	52.1667	93	72	0.019	52	141
12	50.6667	41	30	0.008	22	62
11	47.5	176	116	0.031	84	268
10	43	145	81	0.021	59	221
9	40.5	37	19	0.005	14	56
8	37.5	188	83	0.022	61	286
7	32.5	194	68	0.018	49	295
6	27.5	201	53	0.014	38	305
5	22.5	207	39	0.010	28	314
4	17.5	213	26	0.007	19	323
3	12.5	219	15	0.004	11	332
2	7.5	225	7	0.002	5	342
1	2.5	231	1	0.000	1	351
Aviat Networks ODU 600	59	11	10	0.003	8	17
Commscope VHLP1-23	59	14	13	0.004	10	21
Ericsson AIR6449	58.7	245	230	0.061	167	372
Ericsson Radio 4449 - B13&B5	58	210	193	0.051	141	319
Ericsson 8843 Rev 2	58	225	207	0.055	151	342
Raycap RCMD-6627-PF-48	58	32	29	0.008	21	49
Commscope NNHH-65B-R4	58	251	232	0.061	168	382
VZW Unused Reserve (12738.92 sqin)	58	808	744	0.196	541	1,227
Commscope SBNHH-1D65B (40.6 lbs)	50	122	87	0.023	64	185
Generic TMO Incentive Reserve	41	2,500	1,285	0.339	935	3,798
		6,763	3,793	1.000	2,759	10,273

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

Segment	Height Above Base (ft)	Weight (lb)	W _z (lb-ft)	C _{vx}	Horizontal Force (lb)	Vertical Force (lb)
17	58.85	7	7	0.002	5	4
16	58.35	18	17	0.004	12	11
15	56.5	90	79	0.021	57	52
14	54	61	50	0.013	36	35
13	52.1667	93	72	0.019	52	54
12	50.6667	41	30	0.008	22	24
11	47.5	176	116	0.031	84	102
10	43	145	81	0.021	59	84
9	40.5	37	19	0.005	14	21
8	37.5	188	83	0.022	61	109
7	32.5	194	68	0.018	49	113
6	27.5	201	53	0.014	38	116
5	22.5	207	39	0.010	28	120
4	17.5	213	26	0.007	19	124
3	12.5	219	15	0.004	11	127
2	7.5	225	7	0.002	5	131
1	2.5	231	1	0.000	1	134
Aviat Networks ODU 600	59	11	10	0.003	8	6
Commscope VHLP1-23	59	14	13	0.004	10	8
Ericsson AIR6449	58.7	245	230	0.061	167	142
Ericsson Radio 4449 - B13&B5	58	210	193	0.051	141	122
Ericsson 8843 Rev 2	58	225	207	0.055	151	131
Raycap RCMDC-6627-PF-48	58	32	29	0.008	21	19
Commscope NNHH-65B-R4	58	251	232	0.061	168	146
VZW Unused Reserve (12738.92 sqin)	58	808	744	0.196	541	469
Commscope SBNHH-1D65B (40.6 lbs)	50	122	87	0.023	64	71
Generic TMO Incentive Reserve	41	2,500	1,285	0.339	935	1,452
		6,763	3,793	1.000	2,759	3,929

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	-9.91	-2.79	0.00	-146.22	0.00	146.22	818.72	193.40	323	311.24	0.00	0.00	0.48
5.00	-9.55	-2.86	0.00	-132.25	0.00	132.25	792.19	187.13	303	291.30	0.22	-0.41	0.47
10.00	-9.20	-2.91	0.00	-117.96	0.00	117.96	765.66	180.87	283	272.02	0.88	-0.83	0.45
15.00	-8.85	-2.94	0.00	-103.42	0.00	103.42	739.13	174.60	264	253.40	1.96	-1.23	0.42
20.00	-8.52	-2.97	0.00	-88.70	0.00	88.70	712.61	168.33	245	235.44	3.46	-1.62	0.39
25.00	-8.20	-2.97	0.00	-73.87	0.00	73.87	686.08	162.07	227	218.14	5.35	-1.99	0.35
30.00	-7.89	-2.95	0.00	-59.03	0.00	59.03	659.55	155.80	210	201.50	7.61	-2.32	0.31
35.00	-7.59	-2.91	0.00	-44.28	0.00	44.28	633.02	149.53	193	185.52	10.21	-2.62	0.25
40.00	-7.53	-2.91	0.00	-29.71	0.00	29.71	606.49	143.27	178	170.20	13.08	-2.86	0.19
41.00	-3.57	-1.73	0.00	-26.79	0.00	26.79	601.19	142.01	174	167.22	13.68	-2.90	0.17
45.00	-3.30	-1.64	0.00	-19.89	0.00	19.89	579.97	137.00	162	155.54	16.17	-3.04	0.13
50.00	-3.06	-1.54	0.00	-11.71	0.00	11.71	553.44	130.73	148	141.54	19.43	-3.17	0.09
51.33	-2.92	-1.48	0.00	-9.65	0.00	9.65	546.36	129.06	144	137.92	20.32	-3.20	0.08
53.00	-2.83	-1.44	0.00	-7.18	0.00	7.18	554.10	130.89	148	141.88	21.44	-3.23	0.06
55.00	-2.69	-1.38	0.00	-4.29	0.00	4.29	543.49	128.38	143	136.46	22.79	-3.25	0.04
58.00	-0.41	-0.21	0.00	-0.15	0.00	0.15	527.57	124.62	134	128.53	24.84	-3.26	0.00
58.70	-0.04	-0.02	0.00	-0.01	0.00	0.01	523.86	123.75	132	126.71	25.32	-3.26	0.00
59.00	0.00	-0.02	0.00	0.00	0.00	0.00	522.27	123.37	132	125.94	25.52	-3.26	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	-3.79	-2.77	0.00	-138.18	0.00	138.18	818.72	193.40	323	311.24	0.00	0.00	0.45
5.00	-3.64	-2.79	0.00	-124.32	0.00	124.32	792.19	187.13	303	291.30	0.21	-0.39	0.43

ASSET: 411010, DUTTON ROAD CA
 CUSTOMER: VERIZON WIRELESS

CODE: ANSI/TIA-222-H
 ENG NO:

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
10.00	-3.49	-2.80	0.00	-110.37	0.00	110.37	765.66	180.87	283	272.02	0.83	-0.78	0.41
15.00	-3.35	-2.80	0.00	-96.36	0.00	96.36	739.13	174.60	264	253.40	1.84	-1.15	0.39
20.00	-3.21	-2.79	0.00	-82.35	0.00	82.35	712.61	168.33	245	235.44	3.25	-1.52	0.36
25.00	-3.08	-2.77	0.00	-68.39	0.00	68.39	686.08	162.07	227	218.14	5.02	-1.86	0.32
30.00	-2.96	-2.73	0.00	-54.56	0.00	54.56	659.55	155.80	210	201.50	7.13	-2.17	0.28
35.00	-2.84	-2.68	0.00	-40.92	0.00	40.92	633.02	149.53	193	185.52	9.55	-2.44	0.23
40.00	-2.81	-2.67	0.00	-27.54	0.00	27.54	606.49	143.27	178	170.20	12.23	-2.66	0.17
41.00	-1.32	-1.61	0.00	-24.87	0.00	24.87	601.19	142.01	174	167.22	12.79	-2.70	0.15
45.00	-1.22	-1.52	0.00	-18.45	0.00	18.45	579.97	137.00	162	155.54	15.11	-2.83	0.12
50.00	-1.13	-1.43	0.00	-10.85	0.00	10.85	553.44	130.73	148	141.54	18.14	-2.95	0.08
51.33	-1.08	-1.38	0.00	-8.95	0.00	8.95	546.36	129.06	144	137.92	18.97	-2.98	0.07
53.00	-1.04	-1.34	0.00	-6.66	0.00	6.66	554.10	130.89	148	141.88	20.01	-3.00	0.05
55.00	-0.99	-1.28	0.00	-3.98	0.00	3.98	543.49	128.38	143	136.46	21.27	-3.03	0.03
58.00	-0.15	-0.20	0.00	-0.14	0.00	0.14	527.57	124.62	134	128.53	23.18	-3.04	0.00
58.70	-0.01	-0.02	0.00	-0.01	0.00	0.01	523.86	123.75	132	126.71	23.62	-3.04	0.00
59.00	0.00	-0.02	0.00	0.00	0.00	0.00	522.27	123.37	132	125.94	23.81	-3.04	0.00

ANALYSIS SUMMARY

Load Case	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	5.61	0.00	8.08	0.00	0.00	278.81	0.00	0.91
0.9D + 1.0W	5.57	0.00	6.05	0.00	0.00	273.65	0.00	0.89
1.2D + 1.0Di + 1.0Wi	0.65	0.00	6.92	0.00	0.00	31.18	0.00	0.11
1.2D + 1.0Ev + 1.0Eh	2.97	0.00	9.91	0.00	0.00	146.22	0.00	0.48
0.9D - 1.0Ev + 1.0Eh	2.80	0.00	3.79	0.00	0.00	138.18	0.00	0.45
1.0D + 1.0W	2.17	0.00	6.76	0.00	0.00	106.84	0.00	0.35



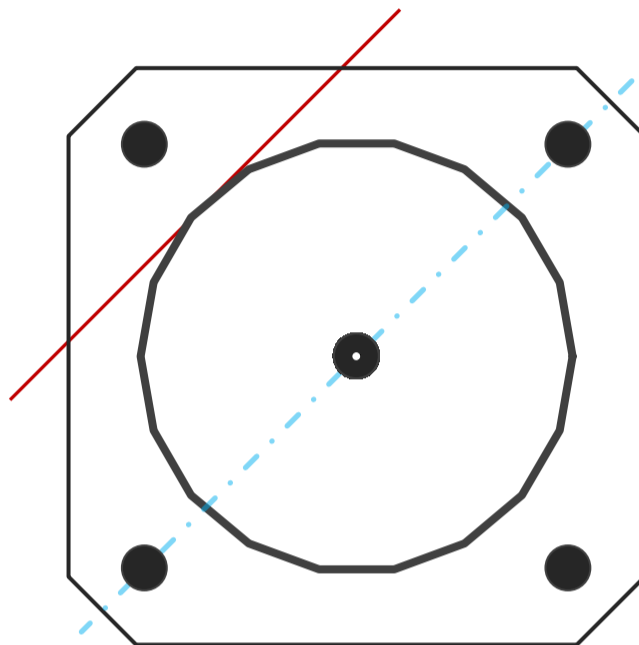
Base Plate & Anchor Rod Analysis

Pole Dimensions		
Number of Sides	18	-
Diameter	18.705	in
Thickness	3/16	in
Orientation Offset	0	°

Base Reactions		
Moment, Mu	278.8	k-ft
Axial, Pu	8.1	k
Shear, Vu	5.6	k
Neutral Axis	45	°

Report Capacities		
Component	Capacity	Result
Base Plate	94%	Pass
Anchor Rods	53%	Pass
Dwyidag	-	-

Base Plate		
Shape	Square	-
Width	25.5	in
Thickness	1 1/2	in
Grade	A633 Gr. E	
Yield Strength, Fy	60	ksi
Tensile Strength, Fu	80	ksi
Clip	3	in
Orientation Offset	0	°
Anchor Rod Detail	c	$\eta=0.55$
Clear Distance	N/A	in
Applied Moment, Mu	490.5	k
Bending Stress, ϕMn	523.4	k



Original Anchor Rods		
Arrangement	Cluster	-
Quantity	4	-
Diameter, ϕ	2 1/4	in
Bolt Circle	26.5	in
Grade	A615-75	
Yield Strength, Fy	75	ksi
Tensile Strength, Fu	100	ksi
Spacing	6.0	in
Orientation Offset	0	°
Applied Force, Pu	127.9	k
Anchor Rods, ϕPn	243.6	k

Calculations for Monopole Base Plate & Anchor Rod Analysis

Reaction Distribution

Reaction	Shear Vu	Moment Mu	Factor
-	k	k-ft	-
Base Forces	5.6	278.8	1.00
Anchor Rod Forces	5.6	278.8	1.00
Additional Bolt (Grp1) Forces	0.0	0.0	0.00
Additional Bolt (Grp2) Forces	0.0	0.0	0.00
Dywidag Forces	0.0	0.0	0.00
Stiffener Forces	0.0	0.0	0.00

Geometric Properties

Section	Gross Area	Net Area	Individual Inertia	Threads per Inch	Moment of Inertia
-	in ²	in ²	in ⁴	#	in ⁴
Pole	10.8524	0.6029	0.0071		465.29
Bolt	3.9761	3.2477	0.8393	4.5	1143.70
Bolt1	0.0000	0.0000	0.0000	0	0.00
Bolt2	0.0000	0.0000	0.0000	0	0.00
Dywidag	0.0000	0.0000	0.0000		0.00
Stiffener	0.0000	0.0000	0.0000		0.00

Base Plate

Shape	Square	-
Width, W	25.5	in
Thickness, t	1.5	in
Yield Strength, Fy	60	ksi
Tensile Strength, Fu	80	ksi
Base Plate Chord	17.331	in
Detail Type	c	-
Detail Factor	0.55	-
Clear Distance	N/A	-

Anchor Rods

Anchor Rod Quantity, N	4	-
Rod Diameter, d	2.25	in
Bolt Circle, BC	26.5	in
Yield Strength, Fy	75	ksi
Tensile Strength, Fu	100	ksi
Applied Axial, Pu	127.9	k
Applied Shear, Vu	0.0	k
Compressive Capacity, ϕP_n	243.6	k
Tensile Capacity, ϕR_n	0.525	OK
Interaction Capacity	0.525	OK

External Base Plate

Chord Length AA	17.232	in
Additional AA	0.000	in
Section Modulus, Z	9.693	in ³
Applied Moment, Mu	490.5	k-ft
Bending Capacity, ϕM_n	523.4	k-ft
Capacity, Mu/ ϕM_n	0.937	OK

Chord Length AB	16.942	in
Additional AB	0.000	in
Section Modulus, Z	9.530	in ³
Applied Moment, Mu	471.9	k-ft
Bending Capacity, ϕM_n	514.6	k-ft
Capacity, Mu/ ϕM_n	0.917	OK

Bend Line Length	0.000	in
Additional Bend Line	0.000	in
Section Modulus, Z	0.000	in ³
Applied Moment, Mu	0.0	k-ft
Bending Capacity, ϕM_n	0.0	k-ft
Capacity, Mu/ ϕM_n		

Internal Base Plate

Arc Length	0.000	in
Section Modulus, Z	0.000	in ³
Moment Arm	0.000	in
Applied Moment, Mu	0.0	k-ft
Bending Capacity, ϕM_n	0.0	k-ft
Capacity, Mu/ ϕM_n		

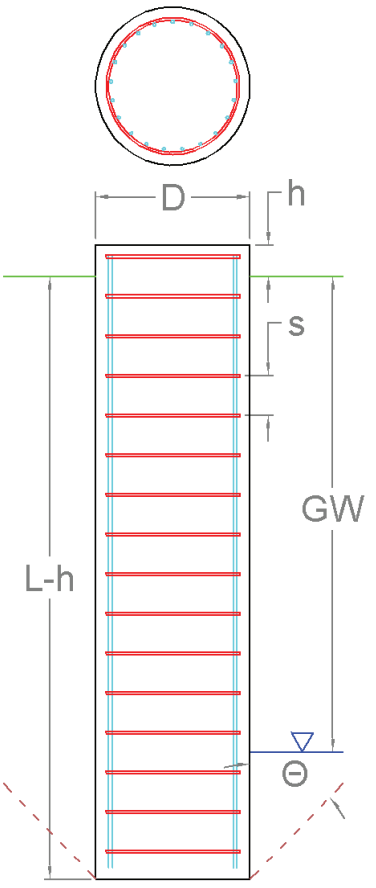
Pier Foundation Analysis (ANSI/TIA-222-H)

Foundation Analysis Parameters			
Pier Diameter	D	4.00	ft
Pier Embedment	$L-h$	13.0	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		0.880	

Reactions		
Moment, M_u	278.8	k-ft
Shear, V_u	5.6	k
Axial, P_u	8.1	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	124	0	33	474	0
5.0	12.0	131	1,817	38	1,072	0
12.0	17.0	120	0	0	834	17,230

Soil Strength Capacities		
Volume of Concrete	169.6	ft ³
Weight of Concrete [Buoyancy Considered]	25.4	k
Average Soil Unit Weight	124.5	pcf
Skin Friction Resistance	122.6	k
Compressive Bearing Resistance	216.5	k
Pullout Weight [Minus Concrete Weight]	171.9	k
Compressive Force, P_u	13.1	k
Nominal Compressive Capacity, $\phi_s P_n$	254.4	k
$P_u / \phi_s P_n$	5.1%	
Total Lateral Resistance	1,085.0	k
Inflection Point [BGL]	8.6	ft
Moment at Inflection Point, M_D	330.1	k-ft
Nominal Moment Capacity, $\phi_s M_n$	1,551.9	k-ft
$M_D / \phi_s M_n$	21.3%	



Pier Strength Capacities		
Concrete Compressive Strength, f_c	3,000	psi
Rebar Size #	11	
Rebar Area (Single)	1.56	in ²
Rebar Quantity	8	
Rebar Yield Strength, F_y	60	ksi
Vertical Rebar Clear Cover	4	in
Tie Rebar Size #	4	
Tie Rebar Area (Single)	0.20	in ²
Tie Rebar Spacing	8.0	in
Tie Rebar Yield Strength, F_y	40	ksi
Rebar Cage Diameter	37.59	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	282.0	k-ft
Moment Capacity, $\phi_B M_n$	1,051.1	k-ft
$M_u / \phi_B M_n$	26.8%	
Design Shear, V_u	67.5	k
Shear Capacity, $\phi_V V_n$	206.6	k
$V_u / \phi_V V_n$	32.7%	
Design Compression, P_u	13.1	k
Compression Capacity, $\phi_P P_n$	2,772.3	k
$P_u / \phi_P P_n$	0.5%	
Bending Reinforcement Ratio	0.007	

