



Date: **August 23, 2024**

Telamon  
319 Chapanoke Rd, Sute 118  
Raleigh, NC 27603  
(405) 348-5460

**Subject:** **Structural Analysis Report**

**Carrier Designation:** **Verizon Wireless Co-Locate**  
**Site Number:** 5000195854  
**Site Name:** ASHLAND\_2\_MA

**Crown Castle Designation:** **BU Number:** 822823  
**Site Name:** BS538/Dept.ofPubWks  
**JDE Job Number:** 2102706  
**Work Order Number:** 2323131  
**Order Number:** 658034 Rev. 2

**Engineering Firm Designation:** **Telamon Project Number:** 42285-822823-2323131-01-STR

**Site Data:** **Ponderosa Road, Ashland, Middlesex County, MA**  
**Latitude 42° 15' 49.50", Longitude -71° 28' 29.80"**  
**149.08 Foot - Monopole Tower**

Telamon is pleased to submit this “**Structural Analysis Report**” to determine the structural integrity of the above mentioned tower.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC5: Proposed Equipment Configuration

**Sufficient Capacity**

This analysis utilizes an ultimate 3-second gust wind speed of 127 mph as required by the 2015 International Building Code as amended by the Massachusetts State Building Code, Ninth Edition. Applicable standard references and design criteria are listed in Section 2 - Analysis Criteria.

Structural analysis prepared by: Niharika Bodanki

Respectfully submitted by:

David Chickering, P.E.  
Director of Business Process Improvement



David Chickering  
PE # 57456 Exp. 06/30/2026

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## 1) INTRODUCTION

This tower is a 149.08 ft Monopole tower designed by PIROD MANUFACTURES INC..

## 2) ANALYSIS CRITERIA

<b>TIA-222 Revision:</b>	TIA-222-H
<b>Risk Category:</b>	II
<b>Wind Speed:</b>	127 mph
<b>Exposure Category:</b>	B
<b>Topographic Factor:</b>	1
<b>Ice Thickness:</b>	1.5 in
<b>Wind Speed with Ice:</b>	50 mph
<b>Service Wind Speed:</b>	60 mph

**Table 1 - Proposed Equipment Configuration**

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
123.0	123.0	4	commscope	NHH-45B-R2B w/ Mount Pipe	2	1-5/8
		4	commscope	NHH-65B-R2B w/ Mount Pipe		
		1	raycap	RVZDC-6627-PF-48_CCIV2		
		3	samsung telecommunications	MT6413-77A w/ Mount Pipe		
		4	samsung telecommunications	RF4439D-25A		
		4	samsung telecommunications	RF4461D-13A		
		1	perfect vision	PV-SLPP12U-HR-16-9 Platform Mount		

**Table 2 - Other Considered Equipment**

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
147.0	148.0	3	ericsson	RADIO 4449 B71/B85A	6 4	7/8 1-5/8
		3	ericsson	AIR6449 B41 w/ Mount Pipe		
	147.0	3	rfs celwave	APXVAALL24_43-U-NA20 w/ Mount Pipe		
		3	rfs celwave	ATMAA1412D-1A20		
		1	tower mounts	Platform Mount [LP 303-1_HR-1]		
	146.0	3	ericsson	AIR 32 B2A B66AA w/ Mount Pipe		
		3	ericsson	ERICSSON AIR 21 B2A B4P w/ Mount Pipe		

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	
134.0	136.0	1	alcatel lucent	800MHZ 2X50W RRH	3 1	1-1/4 7/8	
		1	alcatel lucent	800MHz 2X50W RRH W/FILTER			
		2	alcatel lucent	TD-RRH8X20-25			
	135.0	1	alcatel lucent	1900MHZ 4X40W RRH			
		1	alcatel lucent	800MHZ 2X50W RRH			
		1	alcatel lucent	800MHz 2X50W RRH W/FILTER			
	134.0	134.0	3	kmw communications			ETCR-654L12H6 w/ Mount Pipe
			1	tower mounts			Platform Mount [LP 303-1]
	132.0	132.0	2	alcatel lucent			1900MHZ 4X40W RRH
			1	alcatel lucent			800MHZ 2X50W RRH
			1	alcatel lucent			800MHz 2X50W RRH W/FILTER
			2	alcatel lucent			TD-RRH8X20-25

### 3) ANALYSIS PROCEDURE

**Table 3 - Documents Provided**

Document	Reference	Source
4-GEOTECHNICAL REPORTS	3477155	CCISITES
4-TOWER MANUFACTURER DRAWINGS	3756456	CCISITES

#### 3.1) Analysis Method

tnxTower (version 8.2.4.3), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A. When applicable, Crown Castle has calculated and provided the effective area for panel antennas using approved methods following the intent of the TIA-222 standard.

#### 3.2) Assumptions

- 1) Tower and structures were maintained in accordance with the TIA-222 Standard.
- 2) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
- 3) Base plate design methodology of the manufacturer has been reviewed and found to be an acceptable means of designing to resist the full capacity of the bolts and shaft.

This analysis may be affected if any assumptions are not valid or have been made in error. Telamon should be notified to determine the effect on the structural integrity of the tower

#### 4) ANALYSIS RESULTS

**Table 4 - Section Capacity (Summary)**

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	149.08 - 136.5	Pole	TP25.1985x22.25x0.25	1	-5.18	1216.01	6.3	Pass
L2	136.5 - 133.08	Pole	TP26x25.1985x0.25	2	-5.31	1073.89	7.9	Pass
L3	133.08 - 102.077	Pole	TP32.9948x24.9922x0.3125	3	-18.43	1991.20	29.1	Pass
L4	102.077 - 97.7467	Pole	TP34.0625x32.9948x0.3125	4	-18.69	1758.37	33.7	Pass
L5	97.7467 - 68.2552	Pole	TP40.4738x32.7376x0.375	5	-26.05	2931.66	36.2	Pass
L6	68.2552 - 63.0852	Pole	TP41.75x40.4738x0.375	6	-26.46	2563.74	41.6	Pass
L7	63.0852 - 35.0644	Pole	TP47.5881x40.1412x0.375	7	-35.17	3451.80	44.7	Pass
L8	35.0644 - 29.0644	Pole	TP49.0625x47.5881x0.375	8	-35.70	3014.65	50.9	Pass
L9	29.0644 - 0	Pole	TP56.125x47.3078x0.375	9	-46.44	4075.94	49.9	Pass
							Summary	
						Pole (L8)	50.9	Pass
						Rating =	50.9	Pass

**Table 5 - Tower Component Stresses vs. Capacity - LC5**

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	51.7	Pass
2	Base Plate	0	OK	Pass
1	Base Foundation (Structure)	0	46.4	Pass
1	Base Foundation (Soil Interaction)	0	47.4	Pass

<b>Structure Rating (max from all components) =</b>	<b>51.7%</b>
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Notes:

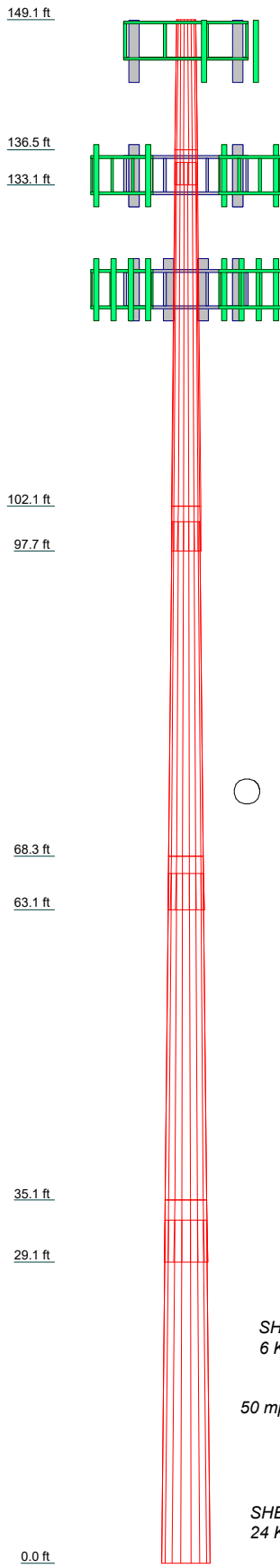
- 1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity. Rating per TIA-222-H Section 15.5.
- 2) Base plate is assumed to have the same capacity as their respective splice bolts.

#### 4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the proposed load configuration. No modifications are required at this time.

**APPENDIX A**  
**TNXTOWER OUTPUT**

Section	1	2	3	4	5	6	7	8	9
Length (ft)	12.98	3.42	33.17	4.33	32.33	5.17	31.50	8.00	33.15
Number of Sides	18	18	18	18	18	18	18	18	18
Thickness (in)	0.2500	0.2500	0.3125	0.3125	0.3750	0.3750	0.3750	0.3750	0.3750
Socket Length (ft)		2.17		2.84		3.48		4.09	
Top Dia (in)	22.2500	25.1965	24.9922	32.9948	32.7376	40.4738	40.1412	47.5881	47.3078
Bot Dia (in)	25.1985	26.0000	32.9948	34.0625	40.4738	41.7500	47.5881	49.0625	56.1250
Grade	A572-65	Fy=56.735	A572-65	Fy=56.761	A572-65	Fy=56.257	A572-65	Fy=56.209	A572-65
Weight (K)	0.8	0.2	3.2	0.5	4.7	0.9	5.5	1.2	6.9

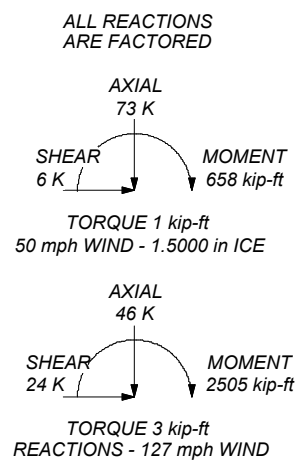


**MATERIAL STRENGTH**

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi	Fy=56.257	56 ksi	80 ksi
Fy=56.735	57 ksi	80 ksi	Fy=56.209	56 ksi	80 ksi
Fy=56.761	57 ksi	80 ksi			

**TOWER DESIGN NOTES**

1. Tower is located in Middlesex County, Massachusetts.
2. Tower designed for Exposure B to the TIA-222-H Standard.
3. Tower designed for a 127 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 50 mph basic wind with 1.50 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Risk Category II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. TOWER RATING: 50.9%



**telamon**  **Telamon**  
 319 Chapanoke Rd, Suite 118  
 Raleigh, NC 27603  
 Phone: (405) 348-5460  
 FAX: (405) 341-6334

Job: <b>BU #822823 - BS538/Dept.ofPubWks</b>		
Project: <b>42285-822823-2323131-01-STR</b>		
Client: Crown Castle	Drawn by: RSR	App'd:
Code: TIA-222-H	Date: 08/23/24	Scale: NTS
Path:		Dwg No. E-1

## Tower Input Data

The tower is a monopole.  
 This tower is designed using the TIA-222-H standard.  
 The following design criteria apply:

- Tower is located in Middlesex County, Massachusetts.
- Tower base elevation above sea level: 200.00 ft.
- Basic wind speed of 127 mph.
- Risk Category II.
- Exposure Category B.
- Simplified Topographic Factor Procedure for wind speed-up calculations is used.
- Topographic Category: 1.
- Crest Height: 0.00 ft.
- Nominal ice thickness of 1.5000 in.
- Ice thickness is considered to increase with height.
- Ice density of 56 pcf.
- A wind speed of 50 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 60 mph.
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in pole design is 1.
- Tower analysis based on target reliabilities in accordance with Annex S.
- Load Modification Factors used:  $K_{es}(F_w) = 0.95$ ,  $K_{es}(t_i) = 0.85$ .
- Maximum demand-capacity ratio is: 1.05.
- Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

## Options

Consider Moments - Legs Consider Moments - Horizontals Consider Moments - Diagonals Use Moment Magnification ✓ Use Code Stress Ratios ✓ Use Code Safety Factors - Guys Escalate Ice Always Use Max Kz Use Special Wind Profile Include Bolts In Member Capacity Leg Bolts Are At Top Of Section Secondary Horizontal Braces Leg Use Diamond Inner Bracing (4 Sided) SR Members Have Cut Ends SR Members Are Concentric Distribute Leg Loads As Uniform	Assume Legs Pinned ✓ Assume Rigid Index Plate ✓ Use Clear Spans For Wind Area Use Clear Spans For KL/r Retension Guys To Initial Tension ✓ Bypass Mast Stability Checks ✓ Use Azimuth Dish Coefficients ✓ Project Wind Area of Appurtenances ✓ Alternative Appurt. EPA Calculation Autocalc Torque Arm Areas Add IBC .6D+W Combination Sort Capacity Reports By Component Triangulate Diamond Inner Bracing Treat Feed Line Bundles As Cylinder Ignore KL/ry For 60 Deg. Angle Legs Use ASCE 10 X-Brace Ly Rules	Calculate Redundant Bracing Forces Ignore Redundant Members in FEA SR Leg Bolts Resist Compression All Leg Panels Have Same Allowable Offset Girt At Foundation ✓ Consider Feed Line Torque Include Angle Block Shear Check Use TIA-222-H Bracing Resist. Exemption Use TIA-222-H Tension Splice Exemption <div style="text-align: center; background-color: #e0e0e0; padding: 2px;"><b>Poles</b></div> ✓ Include Shear-Torsion Interaction Always Use Sub-Critical Flow Use Top Mounted Sockets ✓ Pole Without Linear Attachments Pole With Shroud Or No Appurtenances Outside and Inside Corner Radii Are Known
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## Tapered Pole Section Geometry

Section	Elevation	Section Length	Splice Length	Number of Sides	Top Diameter	Bottom Diameter	Wall Thickness	Bend Radius	Pole Grade
	ft	ft	ft		in	in	in	in	
L1	149.08-136.50	12.58	0.00	18	22.2500	25.1985	0.2500	1.0000	A572-65 (65 ksi)
L2	136.50-133.08	3.42	2.17	18	25.1985	26.0000	0.2500	1.0000	Fy=56.735 (57 ksi)
L3	133.08-102.08	33.17	0.00	18	24.9922	32.9948	0.3125	1.2500	A572-65 (65 ksi)

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L4	102.08-97.75	4.33	2.84	18	32.9948	34.0625	0.3125	1.2500	Fy=56.761 (57 ksi)
L5	97.75-68.26	32.33	0.00	18	32.7376	40.4738	0.3750	1.5000	A572-65 (65 ksi)
L6	68.26-63.09	5.17	3.48	18	40.4738	41.7500	0.3750	1.5000	Fy=56.257 (56 ksi)
L7	63.09-35.06	31.50	0.00	18	40.1412	47.5881	0.3750	1.5000	A572-65 (65 ksi)
L8	35.06-29.06	6.00	4.09	18	47.5881	49.0625	0.3750	1.5000	Fy=56.209 (56 ksi)
L9	29.06-0.00	33.15		18	47.3078	56.1250	0.3750	1.5000	A572-65 (65 ksi)

### Tapered Pole Properties

Section	Tip Dia. in	Area in <sup>2</sup>	I in <sup>4</sup>	r in	C in	I/C in <sup>3</sup>	J in <sup>4</sup>	It/Q in <sup>2</sup>	w in	w/t
L1	22.5547	17.4570	1067.4620	7.8100	11.3030	94.4406	2136.3286	8.7302	3.4760	13.904
	25.5487	19.7966	1556.7458	8.8567	12.8008	121.6128	3115.5400	9.9002	3.9949	15.98
L2	25.5487	19.7966	1556.7458	8.8567	12.8008	121.6128	3115.5400	9.9002	3.9949	15.98
	26.3625	20.4326	1711.6544	9.1412	13.2080	129.5922	3425.5610	10.2183	4.1360	16.544
L3	25.8604	24.4792	1883.7161	8.7613	12.6961	148.3702	3769.9109	12.2419	3.8486	12.316
	33.4556	32.4168	4374.5384	11.6022	16.7614	260.9895	8754.8329	16.2115	5.2571	16.823
L4	33.4556	32.4168	4374.5384	11.6022	16.7614	260.9895	8754.8329	16.2115	5.2571	16.823
	34.5398	33.4758	4817.4335	11.9812	17.3038	278.4040	9641.2058	16.7411	5.4450	17.424
L5	33.8745	38.5195	5096.8813	11.4887	16.6307	306.4745	10200.469	19.2634	5.1018	13.605
	41.0403	47.7276	9695.4901	14.2351	20.5607	471.5547	19403.737	23.8683	6.4634	17.236
L6	41.0403	47.7276	9695.4901	14.2351	20.5607	471.5547	19403.737	23.8683	6.4634	17.236
	42.3362	49.2466	10650.982	14.6881	21.2090	502.1916	21315.979	24.6280	6.6880	17.835
L7	41.5378	47.3317	9456.2115	14.1170	20.3917	463.7280	18924.865	23.6703	6.4048	17.08
	48.2644	56.1954	15825.709	16.7607	24.1748	654.6379	31672.243	28.1030	7.7155	20.575
L8	48.2644	56.1954	15825.709	16.7607	24.1748	654.6379	31672.243	28.1030	7.7155	20.575
	49.7615	57.9503	17355.137	17.2841	24.9238	696.3293	34733.111	28.9807	7.9750	21.267
L9	49.0839	55.8618	15545.521	16.6611	24.0324	646.8577	31111.497	27.9362	7.6662	20.443
	56.9330	66.3564	26056.150	19.7913	28.5115	913.8821	52146.586	33.1845	9.2180	24.581

Tower Elevation ft	Gusset Area (per face) ft <sup>2</sup>	Gusset Thickness in	Gusset Grade	Adjust. Factor A <sub>r</sub>	Adjust. Factor A <sub>r</sub>	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
L1 149.08-136.50				1	1	1			
L2 136.50-133.08				1	1	1			
L3 133.08-102.08				1	1	1			
L4 102.08-97.75				1	1	1			
L5 97.75-68.26				1	1	1			
L6 68.26-63.09				1	1	1			
L7 63.09-				1	1	1			

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor $A_r$	Adjust. Factor $A_r$	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals	Double Angle Stitch Bolt Spacing Redundants
ft	ft <sup>2</sup>	in					in	in	in
35.06									
L8 35.06-29.06				1	1	1			
L9 29.06-0.00				1	1	1			

### Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		$C_{AA}$ ft <sup>2</sup> /ft	Weight plf
***									
Safety Line 3/8	C	No	No	CaAa (Out Of Face)	149.08 - 0.00	1	No Ice	0.04	0.22
							1/2" Ice	0.14	0.75
							1" Ice	0.24	1.28
							2" Ice	0.44	2.34
Climbing Ladder	C	No	No	CaAa (Out Of Face)	149.08 - 0.00	1	No Ice	0.29	7.90
							1/2" Ice	0.40	8.66
							1" Ice	0.51	9.76
							2" Ice	0.74	13.00
***147***									
LDF5-50A(7/8)	C	No	No	Inside Pole	147.00 - 0.00	6	No Ice	0.00	0.33
							1/2" Ice	0.00	0.33
							1" Ice	0.00	0.33
							2" Ice	0.00	0.33
HCS 6X12 4AWG(1-5/8)	C	No	No	Inside Pole	147.00 - 0.00	3	No Ice	0.00	2.40
							1/2" Ice	0.00	2.40
							1" Ice	0.00	2.40
							2" Ice	0.00	2.40
MLE HYBRID 9POWER/18FIBER RL 2(1-5/8)	C	No	No	Inside Pole	147.00 - 0.00	1	No Ice	0.00	1.07
							1/2" Ice	0.00	1.07
							1" Ice	0.00	1.07
							2" Ice	0.00	1.07
***134***									
HB114-1-08U4-M5F(1-1/4)	C	No	No	Inside Pole	134.00 - 0.00	3	No Ice	0.00	1.30
							1/2" Ice	0.00	1.30
							1" Ice	0.00	1.30
							2" Ice	0.00	1.30
HB114-08U3M12-XXXF(7/8)	C	No	No	Inside Pole	134.00 - 0.00	1	No Ice	0.00	0.68
							1/2" Ice	0.00	0.68
							1" Ice	0.00	0.68
							2" Ice	0.00	0.68
***123***									
HB158-U12S24-XXX-LI(1-5/8)	A	No	No	Inside Pole	123.00 - 0.00	2	No Ice	0.00	3.20
							1/2" Ice	0.00	3.20
							1" Ice	0.00	3.20
							2" Ice	0.00	3.20
**									
**									

### Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation	Face	$A_R$	$A_F$	$C_{AA}$ In Face	$C_{AA}$ Out Face	Weight
n	ft		ft <sup>2</sup>	ft <sup>2</sup>	ft <sup>2</sup>	ft <sup>2</sup>	K
L1	149.08-136.50	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	4.141	0.21

Tower Section n	Tower Elevation ft	Face	$A_R$ ft <sup>2</sup>	$A_F$ ft <sup>2</sup>	$C_A A_A$ In Face ft <sup>2</sup>	$C_A A_A$ Out Face ft <sup>2</sup>	Weight K
L2	136.50-133.08	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	1.126	0.07
L3	133.08-102.08	A	0.000	0.000	0.000	0.000	0.13
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	10.205	0.71
L4	102.08-97.75	A	0.000	0.000	0.000	0.000	0.03
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	1.425	0.10
L5	97.75-68.26	A	0.000	0.000	0.000	0.000	0.19
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	9.708	0.68
L6	68.26-63.09	A	0.000	0.000	0.000	0.000	0.03
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	1.702	0.12
L7	63.09-35.06	A	0.000	0.000	0.000	0.000	0.18
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	9.224	0.64
L8	35.06-29.06	A	0.000	0.000	0.000	0.000	0.04
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	1.975	0.14
L9	29.06-0.00	A	0.000	0.000	0.000	0.000	0.19
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	9.567	0.67

**Feed Line/Linear Appurtenances Section Areas - With Ice**

Tower Section n	Tower Elevation ft	Face or Leg	Ice Thickness in	$A_R$ ft <sup>2</sup>	$A_F$ ft <sup>2</sup>	$C_A A_A$ In Face ft <sup>2</sup>	$C_A A_A$ Out Face ft <sup>2</sup>	Weight K
L1	149.08-136.50	A	1.476	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	11.981	0.27
L2	136.50-133.08	A	1.468	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	3.245	0.08
L3	133.08-102.08	A	1.447	0.000	0.000	0.000	0.000	0.13
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	29.417	0.86
L4	102.08-97.75	A	1.424	0.000	0.000	0.000	0.000	0.03
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	4.029	0.12
L5	97.75-68.26	A	1.397	0.000	0.000	0.000	0.000	0.19
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	27.444	0.82
L6	68.26-63.09	A	1.366	0.000	0.000	0.000	0.000	0.03
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	4.683	0.14
L7	63.09-35.06	A	1.326	0.000	0.000	0.000	0.000	0.18
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	25.382	0.77
L8	35.06-29.06	A	1.271	0.000	0.000	0.000	0.000	0.04
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	5.196	0.16
L9	29.06-0.00	A	1.172	0.000	0.000	0.000	0.000	0.19
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	25.168	0.79

**Feed Line Center of Pressure**

Section	Elevation	CP <sub>x</sub>	CP <sub>z</sub>	CP <sub>x</sub> Ice	CP <sub>z</sub> Ice
	ft	in	in	in	in
L1	149.08-136.50	-2.1242	1.2264	-2.8543	1.6479
L2	136.50-133.08	-2.1567	1.2452	-2.9239	1.6881
L3	133.08-102.08	-2.2107	1.2764	-3.0563	1.7645
L4	102.08-97.75	-2.2606	1.3052	-3.1360	1.8105
L5	97.75-68.26	-2.2939	1.3244	-3.2220	1.8602
L6	68.26-63.09	-2.3274	1.3437	-3.2396	1.8704
L7	63.09-35.06	-2.3491	1.3563	-3.2987	1.9045
L8	35.06-29.06	-2.3733	1.3702	-3.2404	1.8709
L9	29.06-0.00	-2.3935	1.3819	-3.2990	1.9047

Note: For pole sections, center of pressure calculations do not consider feed line shielding.

### Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustmen t °	Placement ft	C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K	
***147***									
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	A	From Leg	4.00	0.0000	147.00	No Ice	3.14	2.59	0.11
			0.00			1/2"	3.45	2.88	0.16
			-1.00			Ice	3.77	3.19	0.23
						1" Ice	4.43	3.84	0.38
						2" Ice			
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	B	From Leg	4.00	0.0000	147.00	No Ice	3.14	2.59	0.11
			0.00			1/2"	3.45	2.88	0.16
			-1.00			Ice	3.77	3.19	0.23
						1" Ice	4.43	3.84	0.38
						2" Ice			
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	C	From Leg	4.00	0.0000	147.00	No Ice	3.14	2.59	0.11
			0.00			1/2"	3.45	2.88	0.16
			-1.00			Ice	3.77	3.19	0.23
						1" Ice	4.43	3.84	0.38
						2" Ice			
AIR6449 B41 w/ Mount Pipe	A	From Leg	4.00	0.0000	147.00	No Ice	5.18	2.72	0.12
			0.00			1/2"	5.59	3.05	0.16
			0.00			Ice	6.01	3.39	0.22
						1" Ice	6.90	4.13	0.34
						2" Ice			
AIR6449 B41 w/ Mount Pipe	B	From Leg	4.00	0.0000	147.00	No Ice	5.18	2.72	0.12
			0.00			1/2"	5.59	3.05	0.16
			0.00			Ice	6.01	3.39	0.22
						1" Ice	6.90	4.13	0.34
						2" Ice			
AIR6449 B41 w/ Mount Pipe	C	From Leg	4.00	0.0000	147.00	No Ice	5.18	2.72	0.12
			0.00			1/2"	5.59	3.05	0.16
			0.00			Ice	6.01	3.39	0.22
						1" Ice	6.90	4.13	0.34
						2" Ice			
APXVAALL24_43-U-NA20 w/ Mount Pipe	A	From Leg	4.00	0.0000	147.00	No Ice	14.69	6.87	0.18
			0.00			1/2"	15.46	7.55	0.31
			0.00			Ice	16.23	8.25	0.45
						1" Ice	17.82	9.67	0.78
						2" Ice			
APXVAALL24_43-U-NA20 w/ Mount Pipe	B	From Leg	4.00	0.0000	147.00	No Ice	14.69	6.87	0.18
			0.00			1/2"	15.46	7.55	0.31
			0.00			Ice	16.23	8.25	0.45
						1" Ice	17.82	9.67	0.78
						2" Ice			
APXVAALL24_43-U-NA20	C	From Leg	4.00	0.0000	147.00	No Ice	14.69	6.87	0.18

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment t °	Placement ft	C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K	
w/ Mount Pipe			0.00 0.00			1/2" Ice 1" Ice 2" Ice	15.46 16.23 17.82	7.55 8.25 9.67	0.31 0.45 0.78
AIR 32 B2A B66AA w/ Mount Pipe	A	From Leg	4.00 0.00 -1.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	3.76 4.12 4.48 5.24	3.15 3.49 3.84 4.58	0.19 0.25 0.32 0.48
AIR 32 B2A B66AA w/ Mount Pipe	B	From Leg	4.00 0.00 -1.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	3.76 4.12 4.48 5.24	3.15 3.49 3.84 4.58	0.19 0.25 0.32 0.48
AIR 32 B2A B66AA w/ Mount Pipe	C	From Leg	4.00 0.00 -1.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	3.76 4.12 4.48 5.24	3.15 3.49 3.84 4.58	0.19 0.25 0.32 0.48
ATMAA1412D-1A20	A	From Leg	4.00 0.00 0.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.41 0.50 0.59 0.81	1.00 1.13 1.26 1.55	0.01 0.02 0.03 0.06
ATMAA1412D-1A20	B	From Leg	4.00 0.00 0.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.41 0.50 0.59 0.81	1.00 1.13 1.26 1.55	0.01 0.02 0.03 0.06
ATMAA1412D-1A20	C	From Leg	4.00 0.00 0.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.41 0.50 0.59 0.81	1.00 1.13 1.26 1.55	0.01 0.02 0.03 0.06
RADIO 4449 B71/B85A	A	From Leg	4.00 0.00 1.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.64 1.80 1.97 2.33	1.31 1.46 1.61 1.94	0.07 0.09 0.11 0.16
RADIO 4449 B71/B85A	B	From Leg	4.00 0.00 1.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.64 1.80 1.97 2.33	1.31 1.46 1.61 1.94	0.07 0.09 0.11 0.16
RADIO 4449 B71/B85A	C	From Leg	4.00 0.00 1.00	0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.64 1.80 1.97 2.33	1.31 1.46 1.61 1.94	0.07 0.09 0.11 0.16
Platform Mount [LP 303-1_HR-1]	C	None		0.0000	147.00	No Ice 1/2" Ice 1" Ice 2" Ice	17.09 21.47 25.72 33.96	17.09 21.47 25.72 33.96	1.50 1.88 2.35 3.52
***134*** ETCR-654L12H6 w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	134.00	No Ice 1/2" Ice 1" Ice 2" Ice	10.90 11.57 12.24 13.64	4.61 5.18 5.77 7.00	0.10 0.19 0.28 0.51
ETCR-654L12H6 w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	134.00	No Ice 1/2" Ice 1" Ice 2" Ice	10.90 11.57 12.24 13.64	4.61 5.18 5.77 7.00	0.10 0.19 0.28 0.51

Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C <sub>A</sub> A <sub>A</sub> Front	C <sub>A</sub> A <sub>A</sub> Side	Weight
			Horz Lateral	Vert					
ETCR-654L12H6 w/ Mount Pipe	C	From Leg	4.00	0.0000	134.00	No Ice	10.90	4.61	0.10
			0.00			1/2"	11.57	5.18	0.19
			0.00			Ice	12.24	5.77	0.28
						1" Ice	13.64	7.00	0.51
1900MHZ 4X40W RRH	A	From Leg	4.00	0.0000	134.00	No Ice	2.32	2.24	0.06
			0.00			1/2"	2.53	2.44	0.08
			-2.00			Ice	2.74	2.65	0.11
						1" Ice	3.19	3.09	0.17
1900MHZ 4X40W RRH	B	From Leg	4.00	0.0000	134.00	No Ice	2.32	2.24	0.06
			0.00			1/2"	2.53	2.44	0.08
			1.00			Ice	2.74	2.65	0.11
						1" Ice	3.19	3.09	0.17
1900MHZ 4X40W RRH	C	From Leg	4.00	0.0000	134.00	No Ice	2.32	2.24	0.06
			0.00			1/2"	2.53	2.44	0.08
			-2.00			Ice	2.74	2.65	0.11
						1" Ice	3.19	3.09	0.17
TD-RRH8X20-25	A	From Leg	4.00	0.0000	134.00	No Ice	4.05	1.53	0.07
			0.00			1/2"	4.30	1.71	0.10
			2.00			Ice	4.56	1.90	0.13
						1" Ice	5.10	2.30	0.20
TD-RRH8X20-25	B	From Leg	4.00	0.0000	134.00	No Ice	4.05	1.53	0.07
			0.00			1/2"	4.30	1.71	0.10
			-2.00			Ice	4.56	1.90	0.13
						1" Ice	5.10	2.30	0.20
TD-RRH8X20-25	C	From Leg	4.00	0.0000	134.00	No Ice	4.05	1.53	0.07
			0.00			1/2"	4.30	1.71	0.10
			1.00			Ice	4.56	1.90	0.13
						1" Ice	5.10	2.30	0.20
800MHZ 2X50W RRH	A	From Leg	4.00	0.0000	134.00	No Ice	2.13	1.77	0.05
			0.00			1/2"	2.32	1.95	0.07
			2.00			Ice	2.51	2.13	0.10
						1" Ice	2.92	2.51	0.16
800MHZ 2X50W RRH	B	From Leg	4.00	0.0000	134.00	No Ice	2.13	1.77	0.05
			0.00			1/2"	2.32	1.95	0.07
			-2.00			Ice	2.51	2.13	0.10
						1" Ice	2.92	2.51	0.16
800MHZ 2X50W RRH	C	From Leg	4.00	0.0000	134.00	No Ice	2.13	1.77	0.05
			0.00			1/2"	2.32	1.95	0.07
			1.00			Ice	2.51	2.13	0.10
						1" Ice	2.92	2.51	0.16
800MHz 2X50W RRH W/FILTER	A	From Leg	4.00	0.0000	134.00	No Ice	2.06	1.93	0.06
			0.00			1/2"	2.24	2.11	0.09
			2.00			Ice	2.43	2.29	0.11
						1" Ice	2.83	2.68	0.17
800MHz 2X50W RRH W/FILTER	B	From Leg	4.00	0.0000	134.00	No Ice	2.06	1.93	0.06
			0.00			1/2"	2.24	2.11	0.09
			-2.00			Ice	2.43	2.29	0.11
						1" Ice	2.83	2.68	0.17
800MHz 2X50W RRH W/FILTER	C	From Leg	4.00	0.0000	134.00	No Ice	2.06	1.93	0.06
			0.00			1/2"	2.24	2.11	0.09
			1.00			Ice	2.43	2.29	0.11
						1" Ice	2.83	2.68	0.17

Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C <sub>A</sub> A <sub>A</sub> Front	C <sub>A</sub> A <sub>A</sub> Side	Weight
			Horz Lateral	Vert					
(3) 6' x 2" Mount Pipe	A	From Leg	4.00	0.0000	134.00	No Ice	1.43	1.43	0.02
						1/2" Ice	1.92	1.92	0.03
						Ice	2.29	2.29	0.05
						1" Ice	3.06	3.06	0.09
(3) 6' x 2" Mount Pipe	B	From Leg	4.00	0.0000	134.00	No Ice	1.43	1.43	0.02
						1/2" Ice	1.92	1.92	0.03
						Ice	2.29	2.29	0.05
						1" Ice	3.06	3.06	0.09
(3) 6' x 2" Mount Pipe	C	From Leg	4.00	0.0000	134.00	No Ice	1.43	1.43	0.02
						1/2" Ice	1.92	1.92	0.03
						Ice	2.29	2.29	0.05
						1" Ice	3.06	3.06	0.09
Platform Mount [LP 303-1]	C	None	0.0000	134.00	No Ice	14.69	14.69	1.25	
					1/2" Ice	18.01	18.01	1.57	
					Ice	21.34	21.34	1.94	
					1" Ice	28.08	28.08	2.85	
***123*** (2) NHH-45B-R2B w/ Mount Pipe	A	From Leg	4.00	0.0000	123.00	No Ice	8.26	4.39	0.10
						1/2" Ice	8.83	4.91	0.18
						Ice	9.41	5.43	0.27
						1" Ice	10.61	6.53	0.48
(2) NHH-45B-R2B w/ Mount Pipe	B	From Leg	4.00	0.0000	123.00	No Ice	8.26	4.39	0.10
						1/2" Ice	8.83	4.91	0.18
						Ice	9.41	5.43	0.27
						1" Ice	10.61	6.53	0.48
(2) NHH-65B-R2B w/ Mount Pipe	A	From Face	4.00	0.0000	123.00	No Ice	4.09	3.29	0.07
						1/2" Ice	4.48	3.67	0.13
						Ice	4.88	4.06	0.21
						1" Ice	5.70	4.86	0.39
(2) NHH-65B-R2B w/ Mount Pipe	C	From Leg	4.00	0.0000	123.00	No Ice	4.09	3.29	0.07
						1/2" Ice	4.48	3.67	0.13
						Ice	4.88	4.06	0.21
						1" Ice	5.70	4.86	0.39
MT6413-77A w/ Mount Pipe	A	From Face	4.00	0.0000	123.00	No Ice	4.00	2.15	0.07
						1/2" Ice	4.31	2.55	0.10
						Ice	4.63	2.97	0.14
						1" Ice	5.31	3.85	0.23
MT6413-77A w/ Mount Pipe	B	From Leg	4.00	0.0000	123.00	No Ice	4.00	2.15	0.07
						1/2" Ice	4.31	2.55	0.10
						Ice	4.63	2.97	0.14
						1" Ice	5.31	3.85	0.23
MT6413-77A w/ Mount Pipe	C	From Leg	4.00	0.0000	123.00	No Ice	4.00	2.15	0.07
						1/2" Ice	4.31	2.55	0.10
						Ice	4.63	2.97	0.14
						1" Ice	5.31	3.85	0.23
RF4439D-25A	A	From Leg	4.00	0.0000	123.00	No Ice	1.87	1.25	0.07
						1/2" Ice	2.03	1.39	0.09
						Ice	2.21	1.54	0.11
						1" Ice	2.59	1.87	0.17
(2) RF4439D-25A	B	From Leg	4.00	0.0000	123.00	No Ice	1.87	1.25	0.07
						1/2" Ice	2.03	1.39	0.09
						Ice	2.21	1.54	0.11
						1" Ice	2.59	1.87	0.17

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment t °	Placement ft	C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K	
RF4439D-25A	C	From Leg	4.00 0.00 0.00	0.0000	123.00	2" Ice			
						No Ice	1.87	1.25	0.07
						1/2"	2.03	1.39	0.09
						Ice	2.21	1.54	0.11
						1" Ice	2.59	1.87	0.17
RF4461D-13A	A	From Leg	4.00 0.00 0.00	0.0000	123.00	2" Ice			
						No Ice	1.87	1.28	0.08
						1/2"	2.03	1.42	0.10
						Ice	2.21	1.57	0.12
						1" Ice	2.59	1.89	0.17
RF4461D-13A	B	From Leg	4.00 0.00 0.00	0.0000	123.00	2" Ice			
						No Ice	1.87	1.28	0.08
						1/2"	2.03	1.42	0.10
						Ice	2.21	1.57	0.12
						1" Ice	2.59	1.89	0.17
(2) RF4461D-13A	C	From Leg	4.00 0.00 0.00	0.0000	123.00	2" Ice			
						No Ice	1.87	1.28	0.08
						1/2"	2.03	1.42	0.10
						Ice	2.21	1.57	0.12
						1" Ice	2.59	1.89	0.17
RVZDC-6627-PF-48_CCIV2	A	From Leg	4.00 0.00 0.00	0.0000	123.00	2" Ice			
						No Ice	4.06	3.10	0.03
						1/2"	4.32	3.34	0.07
						Ice	4.58	3.58	0.11
						1" Ice	5.14	4.09	0.20
8' x 2" Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	123.00	2" Ice			
						No Ice	1.90	1.90	0.03
						1/2"	2.73	2.73	0.04
						Ice	3.40	3.40	0.06
						1" Ice	4.40	4.40	0.12
3' x 2" Pipe Mount	A	From Leg	2.00 0.00 0.00	0.0000	123.00	2" Ice			
						No Ice	0.58	0.58	0.01
						1/2"	0.77	0.77	0.02
						Ice	0.97	0.97	0.02
						1" Ice	1.39	1.39	0.05
PV-SLPP12U-HR-16-9	C	None		0.0000	123.00	2" Ice			
						No Ice	55.58	55.58	3.08
						1/2"	62.44	62.44	4.29
						Ice	69.14	69.14	5.68
						1" Ice	82.18	82.18	8.98
2" Ice									
***117***									

## Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice
3	0.9 Dead+1.0 Wind 0 deg - No Ice
4	1.2 Dead+1.0 Wind 30 deg - No Ice
5	0.9 Dead+1.0 Wind 30 deg - No Ice
6	1.2 Dead+1.0 Wind 60 deg - No Ice
7	0.9 Dead+1.0 Wind 60 deg - No Ice
8	1.2 Dead+1.0 Wind 90 deg - No Ice
9	0.9 Dead+1.0 Wind 90 deg - No Ice
10	1.2 Dead+1.0 Wind 120 deg - No Ice
11	0.9 Dead+1.0 Wind 120 deg - No Ice

Comb. No.	Description
12	1.2 Dead+1.0 Wind 150 deg - No Ice
13	0.9 Dead+1.0 Wind 150 deg - No Ice
14	1.2 Dead+1.0 Wind 180 deg - No Ice
15	0.9 Dead+1.0 Wind 180 deg - No Ice
16	1.2 Dead+1.0 Wind 210 deg - No Ice
17	0.9 Dead+1.0 Wind 210 deg - No Ice
18	1.2 Dead+1.0 Wind 240 deg - No Ice
19	0.9 Dead+1.0 Wind 240 deg - No Ice
20	1.2 Dead+1.0 Wind 270 deg - No Ice
21	0.9 Dead+1.0 Wind 270 deg - No Ice
22	1.2 Dead+1.0 Wind 300 deg - No Ice
23	0.9 Dead+1.0 Wind 300 deg - No Ice
24	1.2 Dead+1.0 Wind 330 deg - No Ice
25	0.9 Dead+1.0 Wind 330 deg - No Ice
26	1.2 Dead+1.0 Ice+1.0 Temp
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
39	Dead+Wind 0 deg - Service
40	Dead+Wind 30 deg - Service
41	Dead+Wind 60 deg - Service
42	Dead+Wind 90 deg - Service
43	Dead+Wind 120 deg - Service
44	Dead+Wind 150 deg - Service
45	Dead+Wind 180 deg - Service
46	Dead+Wind 210 deg - Service
47	Dead+Wind 240 deg - Service
48	Dead+Wind 270 deg - Service
49	Dead+Wind 300 deg - Service
50	Dead+Wind 330 deg - Service

### Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	149.08 - 136.5	Pole	Max Tension	8	0.00	0.00	0.00
			Max. Compression	26	-10.75	0.19	-0.09
			Max. Mx	20	-5.18	45.84	-0.03
			Max. My	14	-5.18	0.09	-45.79
			Max. Vy	20	-4.81	45.84	-0.03
			Max. Vx	14	4.81	0.09	-45.79
			Max. Torque	24			0.18
L2	136.5 - 133.08	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-10.95	0.21	-0.09
			Max. Mx	20	-5.31	51.94	-0.04
			Max. My	14	-5.31	0.10	-51.89
			Max. Vy	20	-4.91	51.94	-0.04
			Max. Vx	14	4.91	0.10	-51.89
			Max. Torque	24			0.20
L3	133.08 - 102.077	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-37.12	3.40	1.01
			Max. Mx	20	-18.44	462.27	2.82
			Max. My	14	-18.44	-1.87	-461.48
			Max. Vy	20	-15.70	462.27	2.82

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L4	102.077 - 97.7467	Pole	Max. Vx	14	15.69	-1.87	-461.48
			Max. Torque	16			-1.41
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-37.47	3.44	1.00
			Max. Mx	20	-18.70	485.78	3.03
			Max. My	14	-18.70	-2.08	-484.97
			Max. Vy	20	-15.82	485.78	3.03
L5	97.7467 - 68.2552	Pole	Max. Vx	14	15.81	-2.08	-484.97
			Max. Torque	16			-1.42
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-47.15	4.26	0.66
			Max. Mx	20	-26.06	1041.83	7.60
			Max. My	14	-26.06	-6.42	-1040.69
			Max. Vy	20	-18.59	1041.83	7.60
L6	68.2552 - 63.0852	Pole	Max. Vx	14	18.58	-6.42	-1040.69
			Max. Torque	2			1.94
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-47.67	4.30	0.64
			Max. Mx	20	-26.46	1073.38	7.84
			Max. My	14	-26.46	-6.65	-1072.22
			Max. Vy	20	-18.73	1073.38	7.84
L7	63.0852 - 35.0644	Pole	Max. Vx	14	18.72	-6.65	-1072.22
			Max. Torque	2			1.97
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-58.87	5.01	0.23
			Max. Mx	20	-35.18	1703.05	12.21
			Max. My	14	-35.18	-10.78	-1701.55
			Max. Vy	20	-21.22	1703.05	12.21
L8	35.0644 - 29.0644	Pole	Max. Vx	14	21.21	-10.78	-1701.55
			Max. Torque	2			2.51
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-59.54	5.06	0.20
			Max. Mx	20	-35.70	1743.74	12.47
			Max. My	14	-35.70	-11.02	-1742.21
			Max. Vy	20	-21.35	1743.74	12.47
L9	29.0644 - 0	Pole	Max. Vx	14	21.35	-11.02	-1742.21
			Max. Torque	2			2.54
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-72.95	5.91	-0.30
			Max. Mx	20	-46.44	2490.81	16.89
			Max. My	14	-46.44	-15.19	-2488.88
			Max. Vy	20	-23.70	2490.81	16.89
			Max. Vx	14	23.70	-15.19	-2488.88
			Max. Torque	2			3.12

### Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	26	72.95	0.00	0.00
	Max. H <sub>x</sub>	20	46.45	23.68	0.14
	Max. H <sub>z</sub>	2	46.45	0.14	23.68
	Max. M <sub>x</sub>	2	2486.57	0.14	23.68
	Max. M <sub>z</sub>	8	2485.07	-23.68	-0.14
	Max. Torsion	2	3.12	0.14	23.68
	Min. Vert	7	34.84	-20.44	11.72
	Min. H <sub>x</sub>	8	46.45	-23.68	-0.14
	Min. H <sub>z</sub>	14	46.45	-0.14	-23.68
	Min. M <sub>x</sub>	14	-2488.88	-0.14	-23.68

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
	Min. M <sub>z</sub>	20	-2490.81	23.68	0.14
	Min. Torsion	14	-3.11	-0.14	-23.68

### Tower Mast Reaction Summary

Load Combination	Vertical K	Shear <sub>x</sub> K	Shear <sub>z</sub> K	Overturning Moment, M <sub>x</sub> kip-ft	Overturning Moment, M <sub>z</sub> kip-ft	Torque kip-ft
Dead Only	38.71	0.00	0.00	0.93	2.27	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	46.45	-0.14	-23.68	-2486.57	20.91	-3.12
0.9 Dead+1.0 Wind 0 deg - No Ice	34.84	-0.14	-23.68	-2460.18	19.97	-3.12
1.2 Dead+1.0 Wind 30 deg - No Ice	46.45	11.72	-20.44	-2144.26	-1225.49	-2.41
0.9 Dead+1.0 Wind 30 deg - No Ice	34.84	11.72	-20.44	-2121.55	-1213.06	-2.41
1.2 Dead+1.0 Wind 60 deg - No Ice	46.45	20.44	-11.72	-1227.08	-2142.75	-1.05
0.9 Dead+1.0 Wind 60 deg - No Ice	34.84	20.44	-11.72	-1214.20	-2120.49	-1.05
1.2 Dead+1.0 Wind 90 deg - No Ice	46.45	23.68	0.14	19.21	-2485.07	0.58
0.9 Dead+1.0 Wind 90 deg - No Ice	34.84	23.68	0.14	18.71	-2459.14	0.58
1.2 Dead+1.0 Wind 120 deg - No Ice	46.45	20.58	11.96	1260.64	-2160.77	2.06
0.9 Dead+1.0 Wind 120 deg - No Ice	34.84	20.58	11.96	1246.83	-2138.31	2.06
1.2 Dead+1.0 Wind 150 deg - No Ice	46.45	11.97	20.58	2164.60	-1256.74	2.99
0.9 Dead+1.0 Wind 150 deg - No Ice	34.84	11.97	20.58	2141.09	-1243.97	2.98
1.2 Dead+1.0 Wind 180 deg - No Ice	46.45	0.14	23.68	2488.88	-15.19	3.11
0.9 Dead+1.0 Wind 180 deg - No Ice	34.84	0.14	23.68	2461.90	-15.74	3.11
1.2 Dead+1.0 Wind 210 deg - No Ice	46.45	-11.72	20.44	2146.59	1231.21	2.41
0.9 Dead+1.0 Wind 210 deg - No Ice	34.84	-11.72	20.44	2123.27	1217.30	2.41
1.2 Dead+1.0 Wind 240 deg - No Ice	46.45	-20.44	11.72	1229.40	2148.49	1.06
0.9 Dead+1.0 Wind 240 deg - No Ice	34.84	-20.44	11.72	1215.93	2124.73	1.06
1.2 Dead+1.0 Wind 270 deg - No Ice	46.45	-23.68	-0.14	-16.89	2490.81	-0.58
0.9 Dead+1.0 Wind 270 deg - No Ice	34.84	-23.68	-0.14	-17.00	2463.38	-0.58
1.2 Dead+1.0 Wind 300 deg - No Ice	46.45	-20.58	-11.96	-1258.33	2166.51	-2.06
0.9 Dead+1.0 Wind 300 deg - No Ice	34.84	-20.58	-11.96	-1245.12	2142.55	-2.06
1.2 Dead+1.0 Wind 330 deg - No Ice	46.45	-11.97	-20.58	-2162.29	1262.46	-2.99
0.9 Dead+1.0 Wind 330 deg - No Ice	34.84	-11.97	-20.58	-2139.38	1248.20	-2.99
1.2 Dead+1.0 Ice+1.0 Temp	72.95	-0.00	-0.00	0.30	5.91	-0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	72.95	-0.02	-6.27	-650.39	9.01	-1.17
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	72.95	3.11	-5.41	-561.75	-316.56	-0.78
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	72.95	5.41	-3.11	-322.52	-555.68	-0.19
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	72.95	6.26	0.02	3.21	-644.28	0.45

Load Combination	Vertical K	Shear <sub>x</sub> K	Shear <sub>z</sub> K	Overturning Moment, M <sub>x</sub> kip-ft	Overturning Moment, M <sub>z</sub> kip-ft	Torque kip-ft
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 120	72.95	5.44	3.15	328.16	-558.60	0.98
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 150	72.95	3.15	5.44	565.26	-321.62	1.24
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 180	72.95	0.02	6.27	650.97	3.17	1.17
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 210	72.95	-3.11	5.41	562.34	328.75	0.78
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 240	72.95	-5.41	3.11	323.10	567.87	0.19
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 270	72.95	-6.26	-0.02	-2.63	656.46	-0.45
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 300	72.95	-5.44	-3.15	-327.58	570.78	-0.98
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 330	72.95	-3.15	-5.44	-564.67	333.80	-1.24
deg+1.0 Ice+1.0 Temp						
Dead+Wind 0 deg - Service	38.71	-0.03	-4.98	-518.55	6.14	-0.66
Dead+Wind 30 deg - Service	38.71	2.46	-4.30	-447.07	-254.14	-0.51
Dead+Wind 60 deg - Service	38.71	4.30	-2.46	-255.53	-445.69	-0.22
Dead+Wind 90 deg - Service	38.71	4.98	0.03	4.73	-517.18	0.12
Dead+Wind 120 deg - Service	38.71	4.33	2.51	263.98	-449.46	0.43
Dead+Wind 150 deg - Service	38.71	2.52	4.33	452.75	-260.67	0.63
Dead+Wind 180 deg - Service	38.71	0.03	4.98	520.47	-1.39	0.66
Dead+Wind 210 deg - Service	38.71	-2.46	4.30	448.98	258.89	0.51
Dead+Wind 240 deg - Service	38.71	-4.30	2.46	257.45	450.44	0.22
Dead+Wind 270 deg - Service	38.71	-4.98	-0.03	-2.81	521.93	-0.12
Dead+Wind 300 deg - Service	38.71	-4.33	-2.51	-262.06	454.21	-0.43
Dead+Wind 330 deg - Service	38.71	-2.52	-4.33	-450.84	265.42	-0.63

## Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.00	-38.71	0.00	0.00	38.71	0.00	0.000%
2	-0.14	-46.45	-23.68	0.14	46.45	23.68	0.000%
3	-0.14	-34.84	-23.68	0.14	34.84	23.68	0.000%
4	11.72	-46.45	-20.44	-11.72	46.45	20.44	0.000%
5	11.72	-34.84	-20.44	-11.72	34.84	20.44	0.000%
6	20.44	-46.45	-11.72	-20.44	46.45	11.72	0.000%
7	20.44	-34.84	-11.72	-20.44	34.84	11.72	0.000%
8	23.68	-46.45	0.14	-23.68	46.45	-0.14	0.000%
9	23.68	-34.84	0.14	-23.68	34.84	-0.14	0.000%
10	20.58	-46.45	11.96	-20.58	46.45	-11.96	0.000%
11	20.58	-34.84	11.96	-20.58	34.84	-11.96	0.000%
12	11.97	-46.45	20.58	-11.97	46.45	-20.58	0.000%
13	11.97	-34.84	20.58	-11.97	34.84	-20.58	0.000%
14	0.14	-46.45	23.68	-0.14	46.45	-23.68	0.000%
15	0.14	-34.84	23.68	-0.14	34.84	-23.68	0.000%
16	-11.72	-46.45	20.44	11.72	46.45	-20.44	0.000%
17	-11.72	-34.84	20.44	11.72	34.84	-20.44	0.000%
18	-20.44	-46.45	11.72	20.44	46.45	-11.72	0.000%
19	-20.44	-34.84	11.72	20.44	34.84	-11.72	0.000%
20	-23.68	-46.45	-0.14	23.68	46.45	0.14	0.000%
21	-23.68	-34.84	-0.14	23.68	34.84	0.14	0.000%
22	-20.58	-46.45	-11.96	20.58	46.45	11.96	0.000%
23	-20.58	-34.84	-11.96	20.58	34.84	11.96	0.000%

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
24	-11.97	-46.45	-20.58	11.97	46.45	20.58	0.000%
25	-11.97	-34.84	-20.58	11.97	34.84	20.58	0.000%
26	0.00	-72.95	0.00	0.00	72.95	0.00	0.000%
27	-0.02	-72.95	-6.27	0.02	72.95	6.27	0.000%
28	3.11	-72.95	-5.41	-3.11	72.95	5.41	0.000%
29	5.41	-72.95	-3.11	-5.41	72.95	3.11	0.000%
30	6.26	-72.95	0.02	-6.26	72.95	-0.02	0.000%
31	5.44	-72.95	3.15	-5.44	72.95	-3.15	0.000%
32	3.15	-72.95	5.44	-3.15	72.95	-5.44	0.000%
33	0.02	-72.95	6.27	-0.02	72.95	-6.27	0.000%
34	-3.11	-72.95	5.41	3.11	72.95	-5.41	0.000%
35	-5.41	-72.95	3.11	5.41	72.95	-3.11	0.000%
36	-6.26	-72.95	-0.02	6.26	72.95	0.02	0.000%
37	-5.44	-72.95	-3.15	5.44	72.95	3.15	0.000%
38	-3.15	-72.95	-5.44	3.15	72.95	5.44	0.000%
39	-0.03	-38.71	-4.98	0.03	38.71	4.98	0.000%
40	2.46	-38.71	-4.30	-2.46	38.71	4.30	0.000%
41	4.30	-38.71	-2.46	-4.30	38.71	2.46	0.000%
42	4.98	-38.71	0.03	-4.98	38.71	-0.03	0.000%
43	4.33	-38.71	2.51	-4.33	38.71	-2.51	0.000%
44	2.52	-38.71	4.33	-2.52	38.71	-4.33	0.000%
45	0.03	-38.71	4.98	-0.03	38.71	-4.98	0.000%
46	-2.46	-38.71	4.30	2.46	38.71	-4.30	0.000%
47	-4.30	-38.71	2.46	4.30	38.71	-2.46	0.000%
48	-4.98	-38.71	-0.03	4.98	38.71	0.03	0.000%
49	-4.33	-38.71	-2.51	4.33	38.71	2.51	0.000%
50	-2.52	-38.71	-4.33	2.52	38.71	4.33	0.000%

### Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	5	0.00000001	0.00011358
3	Yes	5	0.00000001	0.00005664
4	Yes	5	0.00000001	0.00079304
5	Yes	5	0.00000001	0.00038351
6	Yes	5	0.00000001	0.00086038
7	Yes	5	0.00000001	0.00041809
8	Yes	4	0.00000001	0.00044204
9	Yes	4	0.00000001	0.00023455
10	Yes	5	0.00000001	0.00089057
11	Yes	5	0.00000001	0.00043116
12	Yes	5	0.00000001	0.00083053
13	Yes	5	0.00000001	0.00040042
14	Yes	5	0.00000001	0.00008352
15	Yes	5	0.00000001	0.00004177
16	Yes	5	0.00000001	0.00088682
17	Yes	5	0.00000001	0.00043060
18	Yes	5	0.00000001	0.00081457
19	Yes	5	0.00000001	0.00039336
20	Yes	4	0.00000001	0.00052875
21	Yes	4	0.00000001	0.00030847
22	Yes	5	0.00000001	0.00085047
23	Yes	5	0.00000001	0.00040995
24	Yes	5	0.00000001	0.00091531
25	Yes	5	0.00000001	0.00044329
26	Yes	4	0.00000001	0.00006117
27	Yes	5	0.00000001	0.00040419
28	Yes	5	0.00000001	0.00044268
29	Yes	5	0.00000001	0.00044364
30	Yes	5	0.00000001	0.00039507
31	Yes	5	0.00000001	0.00044896
32	Yes	5	0.00000001	0.00044587
33	Yes	5	0.00000001	0.00040230

34	Yes	5	0.00000001	0.00045610
35	Yes	5	0.00000001	0.00045337
36	Yes	5	0.00000001	0.00040701
37	Yes	5	0.00000001	0.00045930
38	Yes	5	0.00000001	0.00046433
39	Yes	4	0.00000001	0.00009930
40	Yes	4	0.00000001	0.00016375
41	Yes	4	0.00000001	0.00020076
42	Yes	4	0.00000001	0.00005386
43	Yes	4	0.00000001	0.00020579
44	Yes	4	0.00000001	0.00017241
45	Yes	4	0.00000001	0.00009524
46	Yes	4	0.00000001	0.00022343
47	Yes	4	0.00000001	0.00017242
48	Yes	4	0.00000001	0.00005484
49	Yes	4	0.00000001	0.00018007
50	Yes	4	0.00000001	0.00022690

### Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	149.08 - 136.5	13.670	49	0.7646	0.0021
L2	136.5 - 133.08	11.663	49	0.7548	0.0021
L3	135.247 - 102.077	11.466	49	0.7525	0.0020
L4	102.077 - 97.7467	6.613	49	0.6152	0.0014
L5	100.585 - 68.2552	6.423	49	0.6057	0.0013
L6	68.2552 - 63.0852	2.940	49	0.4123	0.0008
L7	66.5644 - 35.0644	2.796	49	0.4014	0.0008
L8	35.0644 - 29.0644	0.769	49	0.2041	0.0004
L9	33.1529 - 0	0.690	49	0.1918	0.0003

### Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
147.00	ERICSSON AIR 21 B2A B4P w/ Mount Pipe	49	13.337	0.7639	0.0021	84988
134.00	ETCR-654L12H6 w/ Mount Pipe	49	11.269	0.7500	0.0020	31747
123.00	(2) NHH-45B-R2B w/ Mount Pipe	49	9.569	0.7188	0.0019	16564

### Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	149.08 - 136.5	65.334	22	3.6559	0.0098
L2	136.5 - 133.08	55.748	22	3.6091	0.0096
L3	135.247 - 102.077	54.803	22	3.5981	0.0095
L4	102.077 - 97.7467	31.621	22	2.9431	0.0065

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L5	100.585 - 68.2552	30.710	22	2.8976	0.0064
L6	68.2552 - 63.0852	14.057	22	1.9723	0.0038
L7	66.5644 - 35.0644	13.368	22	1.9203	0.0036
L8	35.0644 - 29.0644	3.675	22	0.9760	0.0017
L9	33.1529 - 0	3.296	22	0.9173	0.0016

### Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
147.00	ERICSSON AIR 21 B2A B4P w/ Mount Pipe	22	63.742	3.6527	0.0102	17968
134.00	ETCR-654L12H6 w/ Mount Pipe	22	53.866	3.5861	0.0098	6721
123.00	(2) NHH-45B-R2B w/ Mount Pipe	22	45.744	3.4373	0.0090	3502

### Compression Checks

### Pole Design Data

Section No.	Elevation ft	Size	L ft	$L_u$ ft	$KI/r$	A $in^2$	$P_u$ K	$\phi P_n$ K	Ratio $\frac{P_u}{\phi P_n}$
L1	149.08 - 136.5 (1)	TP25.1985x22.25x0.25	12.58	0.00	0.0	19.796	-5.18	1158.10	0.004
L2	136.5 - 133.08 (2)	TP26x25.1985x0.25	3.42	0.00	0.0	20.029	-5.31	1022.75	0.005
L3	133.08 - 102.077 (3)	TP32.9948x24.9922x0.31	33.17	0.00	0.0	32.416	-18.43	1896.38	0.010
L4	102.077 - 97.7467 (4)	TP34.0625x32.9948x0.31	4.33	0.00	0.0	32.781	-18.69	1674.64	0.011
L5	97.7467 - 68.2552 (5)	TP40.4738x32.7376x0.37	32.33	0.00	0.0	47.727	-26.05	2792.06	0.009
L6	68.2552 - 63.0852 (6)	TP41.75x40.4738x0.375	5.17	0.00	0.0	48.224	-26.46	2441.66	0.011
L7	63.0852 - 35.0644 (7)	TP47.5881x40.1412x0.37	31.50	0.00	0.0	56.195	-35.17	3287.43	0.011
L8	35.0644 - 29.0644 (8)	TP49.0625x47.5881x0.37	6.00	0.00	0.0	56.754	-35.70	2871.10	0.012
L9	29.0644 - 0 (9)	TP56.125x47.3078x0.375	33.15	0.00	0.0	66.356	-46.44	3881.85	0.012

### Pole Bending Design Data

Section No.	Elevation ft	Size	$M_{ux}$ kip-ft	$\phi M_{nx}$ kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	$M_{uy}$ kip-ft	$\phi M_{ny}$ kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L1	149.08 - 136.5 (1)	TP25.1985x22.25x0.25	45.84	744.00	0.062	0.00	744.00	0.000
L2	136.5 -	TP26x25.1985x0.25	51.94	672.84	0.077	0.00	672.84	0.000

Section No.	Elevation ft	Size	$M_{ux}$ kip-ft	$\phi M_{nx}$ kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	$M_{uy}$ kip-ft	$\phi M_{ny}$ kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L3	133.08 (2) 133.08 - 102.077 (3)	TP32.9948x24.9922x0.31 25	464.69	1577.28	0.295	0.00	1577.28	0.000
L4	102.077 - 97.7467 (4)	TP34.0625x32.9948x0.31 25	488.38	1428.53	0.342	0.00	1428.53	0.000
L5	97.7467 - 68.2552 (5)	TP40.4738x32.7376x0.37 5	1048.38	2832.62	0.370	0.00	2832.62	0.000
L6	68.2552 - 63.0852 (6)	TP41.75x40.4738x0.375	1080.13	2542.86	0.425	0.00	2542.86	0.000
L7	63.0852 - 35.0644 (7)	TP47.5881x40.1412x0.37 5	1713.60	3739.59	0.458	0.00	3739.59	0.000
L8	35.0644 - 29.0644 (8)	TP49.0625x47.5881x0.37 5	1754.51	3364.89	0.521	0.00	3364.89	0.000
L9	29.0644 - 0 (9)	TP56.125x47.3078x0.375	2505.43	4897.52	0.512	0.00	4897.52	0.000

### Pole Shear Design Data

Section No.	Elevation ft	Size	Actual $V_u$ K	$\phi V_n$ K	Ratio $\frac{V_u}{\phi V_n}$	Actual $T_u$ kip-ft	$\phi T_n$ kip-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	149.08 - 136.5 (1)	TP25.1985x22.25x0.25	4.81	347.43	0.014	0.09	759.09	0.000
L2	136.5 - 133.08 (2)	TP26x25.1985x0.25	4.91	306.82	0.016	0.10	678.26	0.000
L3	133.08 - 102.077 (3)	TP32.9948x24.9922x0.31 25	15.83	568.91	0.028	0.32	1628.32	0.000
L4	102.077 - 97.7467 (4)	TP34.0625x32.9948x0.31 25	15.95	502.39	0.032	0.34	1454.10	0.000
L5	97.7467 - 68.2552 (5)	TP40.4738x32.7376x0.37 5	18.71	837.62	0.022	0.88	2941.43	0.000
L6	68.2552 - 63.0852 (6)	TP41.75x40.4738x0.375	18.86	732.50	0.026	0.91	2599.06	0.000
L7	63.0852 - 35.0644 (7)	TP47.5881x40.1412x0.37 5	21.34	986.23	0.022	1.45	4077.75	0.000
L8	35.0644 - 29.0644 (8)	TP49.0625x47.5881x0.37 5	21.48	861.33	0.025	1.48	3596.76	0.000
L9	29.0644 - 0 (9)	TP56.125x47.3078x0.375	23.82	1164.56	0.020	2.06	5685.72	0.000

### Pole Interaction Design Data

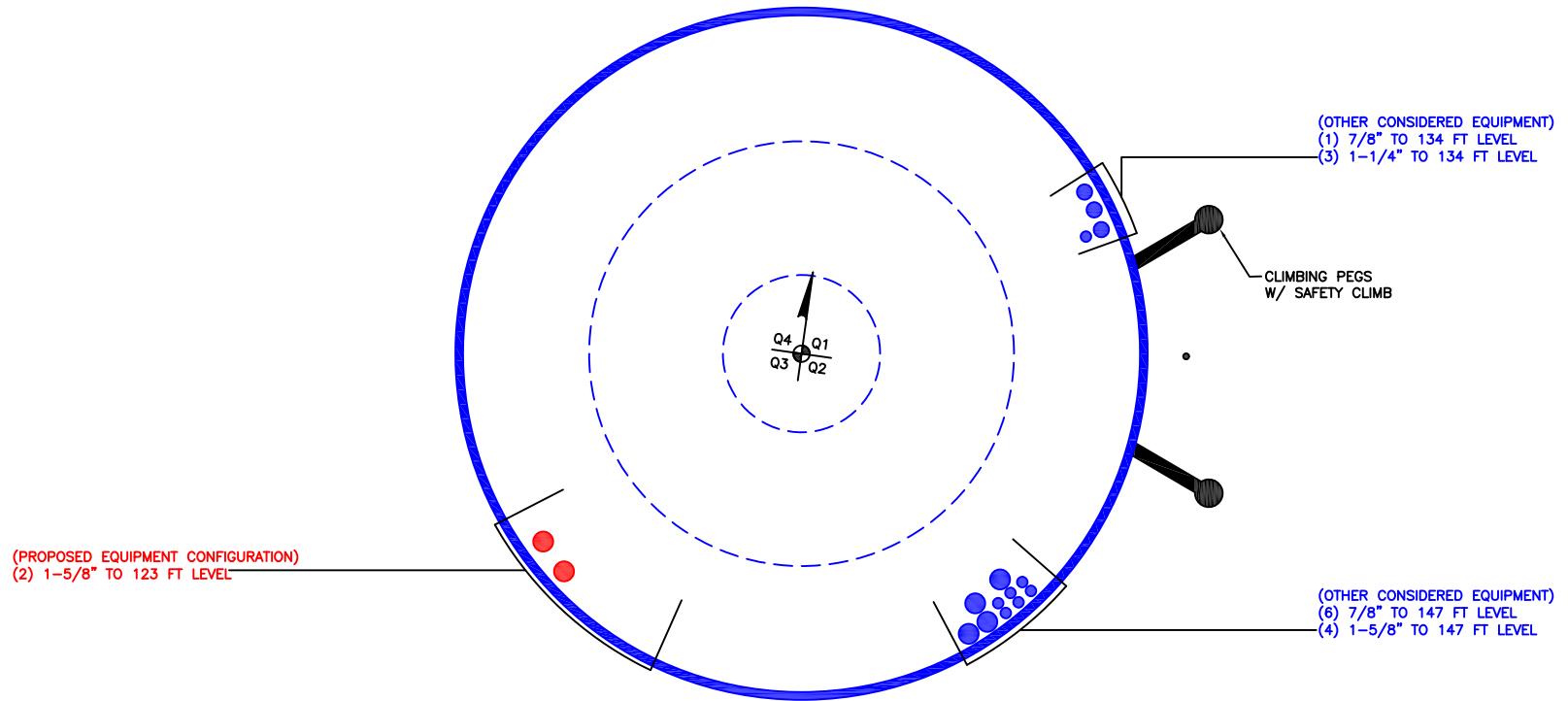
Section No.	Elevation ft	Ratio $P_u$	Ratio $M_{ux}$	Ratio $M_{uy}$	Ratio $V_u$	Ratio $T_u$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
		$\phi P_n$	$\phi M_{nx}$	$\phi M_{ny}$	$\phi V_n$	$\phi T_n$			
L1	149.08 - 136.5 (1)	0.004	0.062	0.000	0.014	0.000	0.066	1.050	
L2	136.5 - 133.08 (2)	0.005	0.077	0.000	0.016	0.000	0.083	1.050	
L3	133.08 - 102.077 (3)	0.010	0.295	0.000	0.028	0.000	0.305	1.050	
L4	102.077 - 97.7467 (4)	0.011	0.342	0.000	0.032	0.000	0.354	1.050	
L5	97.7467 - 68.2552 (5)	0.009	0.370	0.000	0.022	0.000	0.380	1.050	
L6	68.2552 - 63.0852 (6)	0.011	0.425	0.000	0.026	0.000	0.436	1.050	
L7	63.0852 - 35.0644 (7)	0.011	0.458	0.000	0.022	0.000	0.469	1.050	

Section No.	Elevation ft	Ratio	Ratio	Ratio	Ratio	Ratio	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
		$P_u$	$M_{ux}$	$M_{uy}$	$V_u$	$T_u$			
L8	35.0644 - 29.0644 (8)	0.012	0.521	0.000	0.025	0.000	0.534	1.050	
L9	29.0644 - 0 (9)	0.012	0.512	0.000	0.020	0.000	0.524	1.050	

### Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$\phi P_{allow}$ K	% Capacity	Pass Fail	
L1	149.08 - 136.5	Pole	TP25.1985x22.25x0.25	1	-5.18	1216.01	6.3	Pass	
L2	136.5 - 133.08	Pole	TP26x25.1985x0.25	2	-5.31	1073.89	7.9	Pass	
L3	133.08 - 102.077	Pole	TP32.9948x24.9922x0.3125	3	-18.43	1991.20	29.1	Pass	
L4	102.077 - 97.7467	Pole	TP34.0625x32.9948x0.3125	4	-18.69	1758.37	33.7	Pass	
L5	97.7467 - 68.2552	Pole	TP40.4738x32.7376x0.375	5	-26.05	2931.66	36.2	Pass	
L6	68.2552 - 63.0852	Pole	TP41.75x40.4738x0.375	6	-26.46	2563.74	41.6	Pass	
L7	63.0852 - 35.0644	Pole	TP47.5881x40.1412x0.375	7	-35.17	3451.80	44.7	Pass	
L8	35.0644 - 29.0644	Pole	TP49.0625x47.5881x0.375	8	-35.70	3014.65	50.9	Pass	
L9	29.0644 - 0	Pole	TP56.125x47.3078x0.375	9	-46.44	4075.94	49.9	Pass	
							Summary		
							Pole (L8)	50.9	Pass
							<b>RATING =</b>	<b>50.9</b>	<b>Pass</b>

**APPENDIX B**  
**BASE LEVEL DRAWING**



**APPENDIX C**  
**ADDITIONAL CALCULATIONS**

# Monopole Base Plate Connection

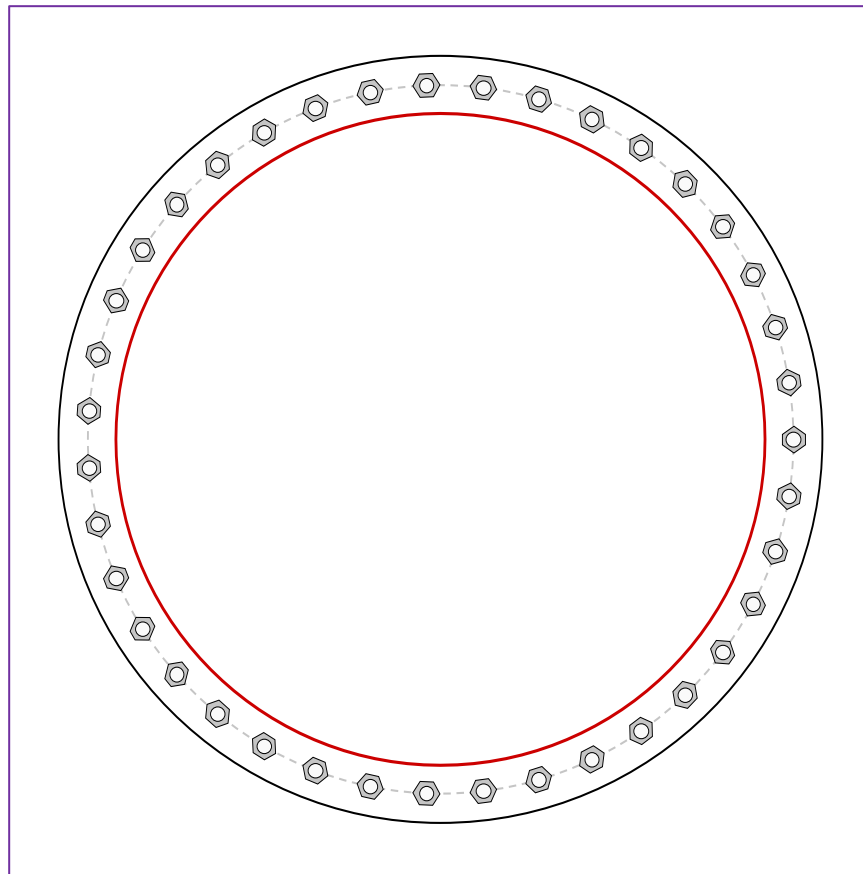


Site Info	
BU #	822823
Site Name	BS538/Dept.ofPubWks
Order #	658034 Rev. 2

Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	No
$l_{ar}$ (in)	1

Applied Loads	
Moment (kip-ft)	2505.42
Axial Force (kips)	46.44
Shear Force (kips)	23.82

\*TIA-222-H Section 15.5 Applied



Connection Properties	Analysis Results
-----------------------	------------------

Anchor Rod Data
(39) 1-1/4" $\phi$ bolts (A687 N; Fy=105 ksi, Fu=125 ksi) on 61" BC
Base Plate Data
66" OD x 1.5" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)
Stiffener Data
N/A
Pole Data
56.125" x 0.375" 18-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Anchor Rod Summary			<i>(units of kips, kip-in)</i>
$Pu_t = 49.35$	$\phi Pn_t = 90.84$		<b>Stress Rating</b>
$Vu = 0.61$	$\phi Vn = 57.52$		<b>51.7%</b>
$Mu = n/a$	$\phi Mn = n/a$		<b>Pass</b>
Base Plate Summary			
Max Stress (ksi):	-		
Allowable Stress (ksi):	-		
Stress Rating:			<b>Pi rod OK</b>

# Pier and Pad Foundation



**BU #:** 822823  
**Site Name:** BS538/Dept.ofPubV  
**App. Number:** 658034 Rev. 2

**TIA-222 Revision:** H  
**Tower Type:** Monopole

**Top & Bot. Pad Rein. Different?:**   
**Block Foundation?:**   
**Rectangular Pad?:**

Superstructure Analysis Reactions		
Compression, $P_{comp}$ :	46.44	kips
Base Shear, $Vu_{comp}$ :	23.82	kips
Moment, $M_u$ :	2505.42	ft-kips
Tower Height, $H$ :	149.08	ft
BP Dist. Above Fdn, $bp_{dist}$ :	3.75	in

Foundation Analysis Checks				
	Capacity	Demand	Rating*	Check
<i>Lateral (Sliding) (kips)</i>	274.14	23.82	8.3%	Pass
<i>Bearing Pressure (ksf)</i>	10.34	2.01	19.5%	Pass
<i>Overturning (kip*ft)</i>	5653.12	2679.60	47.4%	Pass
<i>Pier Flexure (Comp.) (kip*ft)</i>	5457.30	2618.57	45.7%	Pass
<i>Pier Compression (kip)</i>	21120.36	74.81	0.3%	Pass
<i>Pad Flexure (kip*ft)</i>	2884.86	925.73	30.6%	Pass
<i>Pad Shear - 1-way (kips)</i>	596.80	160.80	25.7%	Pass
<i>Pad Shear - 2-way (Comp) (ksi)</i>	0.190	0.050	25.3%	Pass
<i>Flexural 2-way (Comp) (kip*ft)</i>	3227.42	1571.14	46.4%	Pass

Pier Properties		
Pier Shape:	Circular	
Pier Diameter, $dpier$ :	6.5	ft
Ext. Above Grade, $E$ :	0.5	ft
Pier Rebar Size, $Sc$ :	9	
Pier Rebar Quantity, $mc$ :	37	
Pier Tie/Spiral Size, $St$ :	4	
Pier Tie/Spiral Quantity, $mt$ :	9	
Pier Reinforcement Type:	Tie	
Pier Clear Cover, $cc_{pier}$ :	3	in

\*Rating per TIA-222-H Section 15.5

Structural Rating*:	46.4%
Soil Rating*:	47.4%

Pad Properties		
Depth, $D$ :	6.5	ft
Pad Width, $W_1$ :	23.5	ft
Pad Thickness, $T$ :	2.25	ft
Pad Rebar Size (Bottom dir. 2), $Sp_2$ :	9	
Pad Rebar Quantity (Bottom dir. 2), $mp_2$ :	30	
Pad Clear Cover, $cc_{pad}$ :	3	in

Material Properties		
Rebar Grade, $F_y$ :	60	ksi
Concrete Compressive Strength, $F'_c$ :	4	ksi
Dry Concrete Density, $\delta_c$ :	150	pcf

Soil Properties		
Total Soil Unit Weight, $\gamma$ :	120	pcf
Ultimate Net Bearing, $Q_{net}$ :	13.000	ksf
Cohesion, $C_u$ :	0.000	ksf
Friction Angle, $\phi$ :	36	degrees
SPT Blow Count, $N_{blows}$ :		
Base Friction, $\mu$ :	0.5	
Neglected Depth, $N$ :	4.00	ft
Foundation Bearing on Rock?	No	
Groundwater Depth, $gw$ :	6.5	ft

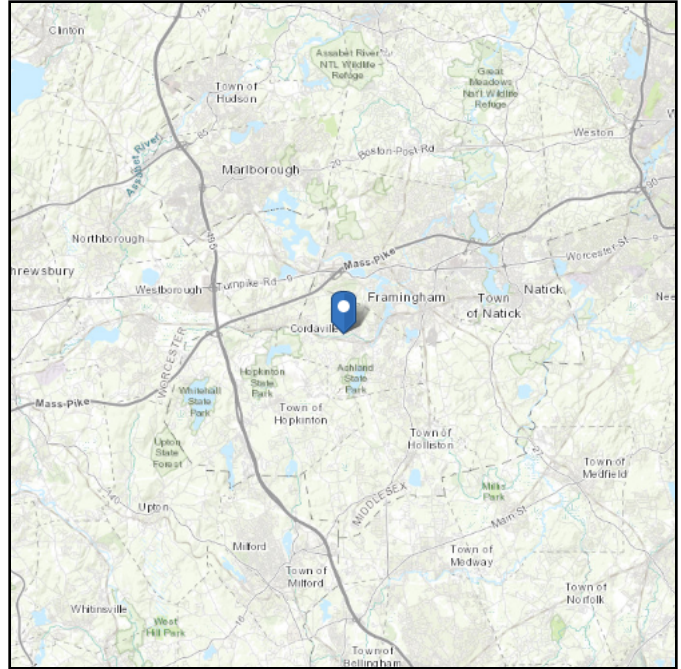
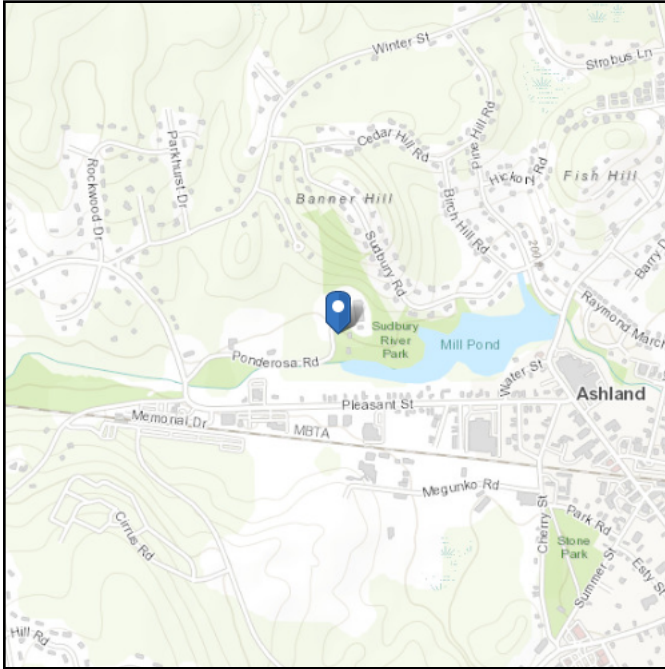
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# ASCE Hazards Report

**Address:**  
No Address at This Location

**Standard:** ASCE/SEI 7-10  
**Risk Category:** II  
**Soil Class:** D - Stiff Soil

**Latitude:** 42.26375  
**Longitude:** -71.474944  
**Elevation:** 200.28835847287556 ft (NAVD 88)



## Wind

**Results:**

Wind Speed	126 Vmph
10-year MRI	78 Vmph
25-year MRI	88 Vmph
50-year MRI	96 Vmph
100-year MRI	103 Vmph

**127mph JDX Wind Requirements**

Data Source: ASCE/SEI 7-10, Fig. 26.5-1A and Figs. CC-1–CC-4, and Section 26.5.2, incorporating errata of March 12, 2014  
Date Accessed: Thu Aug 22 2024

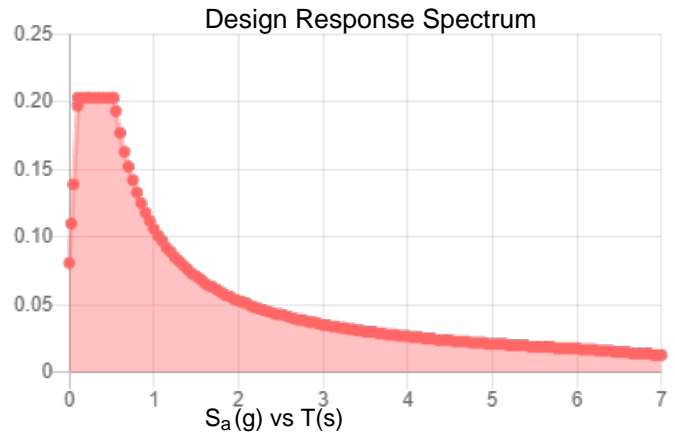
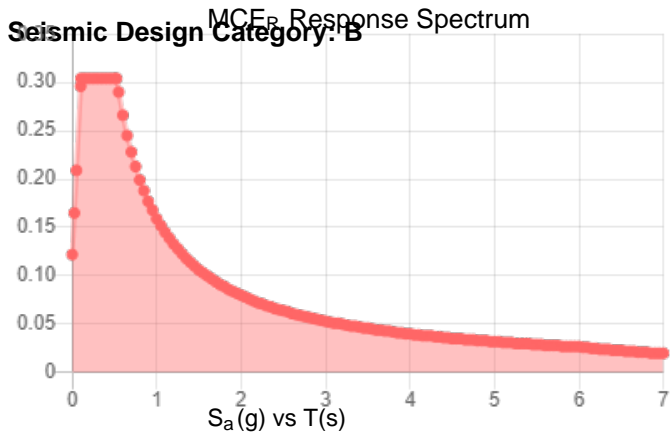
Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-10 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is in a hurricane-prone region as defined in ASCE/SEI 7-10 Section 26.2. Glazed openings need not be protected against wind-borne debris.

**Site Soil Class:** D - Stiff Soil

**Results:**

$S_s$ :	0.19	$S_{D1}$ :	0.106
$S_1$ :	0.066	$T_L$ :	6
$F_a$ :	1.6	PGA :	0.097
$F_v$ :	2.4	PGA <sub>M</sub> :	0.155
$S_{MS}$ :	0.304	$F_{PGA}$ :	1.6
$S_{M1}$ :	0.159	$I_e$ :	1
$S_{DS}$ :	0.203		



**Data Accessed:** Thu Aug 22 2024

**Date Source:**

USGS Seismic Design Maps based on ASCE/SEI 7-10, incorporating Supplement 1 and errata of March 31, 2013, and ASCE/SEI 7-10 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-10 Ch. 21 are available from USGS.

## Ice

---

**Results:**

Ice Thickness: 0.75 in.  
Concurrent Temperature: 15 F  
Gust Speed 50 mph

**Data Source:** Standard ASCE/SEI 7-10, Figs. 10-2 through 10-8

**Date Accessed:** Thu Aug 22 2024

Ice thicknesses on structures in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

Values provided are equivalent radial ice thicknesses due to freezing rain with concurrent 3-second gust speeds, for a 50-year mean recurrence interval, and temperatures concurrent with ice thicknesses due to freezing rain. Thicknesses for ice accretions caused by other sources shall be obtained from local meteorological studies. Ice thicknesses in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

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