

Date: **January 04, 2023**



Crown Castle
2000 Corporate Drive
Canonsburg, PA 15317
(724) 416-2000

Subject: **Structural Analysis Report**

Carrier Designation: **Verizon Wireless Co-Locate**
Site Number: 716127
Site Name: KCYC Lees Summit DT

Crown Castle Designation: **BU Number:** 877803
Site Name: LEE'S SUMMIT FIRE STATION
JDE Job Number: 736749
Work Order Number: 2192350
Order Number: 640178 Rev. 3

Engineering Firm Designation: **Crown Castle Project Number:** 2192350

Site Data: **207 SE DOUGLAS, LEE'S SUMMIT, JACKSON County, MO**
Latitude 38° 54' 49.83", Longitude -94° 22' 34.78"
180 Foot - Monopole Tower

Crown Castle 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 has been performed in accordance with the 2018 International Building Code based upon an ultimate 3-second gust wind speed of 122 mph. Applicable Standard references and design criteria are listed in Section 2 - "Analysis Criteria".

Structural analysis prepared by: Matthew Hussak

Respectfully submitted by:

Matthew E. Hussak, P.E.
Project Engineer



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1) INTRODUCTION

This tower is a 180 ft Monopole tower designed by ENGINEERED ENDEAVORS, INC.

2) ANALYSIS CRITERIA

TIA-222 Revision:	TIA-222-H
Risk Category:	IV
Wind Speed:	122 mph
Exposure Category:	B
Topographic Factor:	1
Ice Thickness:	1.5 in
Wind Speed with Ice:	40 mph
Service Wind Speed:	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)
85.0	85.0	1	-	MCG22HD-12M-12-126 (3)	2	1-5/8
		3	commscope	NHH-65C-R2B w/ Mount Pipe		
		3	commscope	NHHSS-65B-R2B w/ Mount Pipe		
		3	ericsson	4449		
		3	ericsson	8843		
		3	ericsson	AIR 6449 B77 w/ Mount Pipe		
		3	ericsson	RADIO 4408		
		1	raycap	RCMDC-6627-PF-48		

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)
180.0	188.0	3	telewave	ANT150D6-9	3 1	1-1/2 1-1/4
	183.0	1	andrew	VHLP800-11-2GR		
	180.0	3	ericsson	AIR 6468 B41 w/ Mount Pipe		
		3	ericsson	RRUS 11 B26A		
		6	ericsson	RRUS 31 B25		
		3	ericsson	RRUS-11		
		18	rfs celwave	ACU-A20-N		
		3	rfs celwave	APXVERR18-C w/ Mount Pipe		
		3	rfs celwave	APXVSP18-C w/ Mount Pipe		
		1	tower mounts	Platform Mount [LP 602-1]		
158.0	170.0	1	nokia	FRIG	6 1 14 2	1-5/8 1-1/4 7/8 1/2
		3	sinclair	SD214		
	165.0	2	alvarion	AN1252 w/ Mount Pipe		
		2	alvarion	BREEZEACCESS AU-D-BS-900		
	162.0	2	alvarion	AN1252 w/ Mount Pipe		
		2	alvarion	BREEZEACCESS AU-D-BS-900		

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
	161.0	6	andrew	E15S08P78		
		3	andrew	TMBX-6517-R2M w/ Mount Pipe		
		6	andrew	TMBXX-6517-A2M w/ Mount Pipe		
		2	nokia	FRIG		
	158.0	1	tower mounts	Platform Mount (LP 101-1)		
134.0	142.0	2	sinclair	SD214	3 3 3 3 1	3/8 1/2 5/16 elliptical conduit
	138.0	1	andrew	VHLP2-18		
	136.0	1	andrew	VHLP1-23		
		2	andrew	VHLP800-11		
		3	argus technologies	LLPX310R-V1 w/ Mount Pipe		
	134.0	4	dragonwave	HORIZON DUO		
		3	motorola	VX DAP I/V RF MODULE		
		1	terrawave	JUNCTION BOX		
		1	tower mounts	Platform Mount [LP 713-1]		
	126.0	1	sinclair	SD214		
118.0	121.0	1	andrew	PG1N0F-0093-608	1	7/8
	118.0	1	tower mounts	Side Arm Mount [SO 702-1]		
98.0	108.0	1	rfs celwave	PD220	2 2	7/8 3/8
	105.0	1	decibel	DB498		
	101.0	1	decibel	DB498		
	98.0	2	tower mounts	Side Arm Mount [SO 701-1]		
	88.0	1	sinclair	SD214		
92.0	94.0	1	andrew	PG1N0F-0093-608	1	1/2
	92.0	1	tower mounts	Side Arm Mount [SO 701-1]		
69.0	70.0	1	decibel	ASP-816	1	1/2
	69.0	1	tower mounts	Side Arm Mount [SO 701-1]		
45.0	47.0	1	andrew	DB201-P	2	1/2
	45.0	1	tower mounts	Side Arm Mount [SO 701-1]		
	44.0	1	decibel	ASP-816		
42.0	44.0	1	astron wireless	VG-1060	1	1/2
	42.0	1	tower mounts	Side Arm Mount [SO 701-1]		
29.0	42.0	1	wilson electronics inc	311129	10	3/8
	38.0	1	wilson electronics inc	311129		
	36.0	1	astron wireless	918-3		
	34.0	1	wilson electronics inc	311129		
	32.0	1	astron wireless	918-3		
	30.0	1	wilson electronics inc	311129		
	29.0	1	tower mounts	Side Arm Mount [SO 701-1]		

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
	26.0	1	wilson electronics inc	311129		
	24.0	1	astron wireless	918-3		
	22.0	1	wilson electronics inc	311129		
	18.0	1	wilson electronics inc	311129		

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Reference	Source
4-GEOTECHNICAL REPORTS	1473847	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	1473914	CCISITES
4-TOWER MANUFACTURER DRAWINGS	1549695	CCISITES

3.1) Analysis Method

tnxTower (version 8.1.1.0), 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.

This analysis may be affected if any assumptions are not valid or have been made in error. Crown Castle 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	180 - 150	Pole	TP35.2396x29x0.25	1	-10.41	1729.47	22.8	Pass
L2	150 - 106.98	Pole	TP44.235x35.2396x0.2813	2	-19.51	2247.57	49.3	Pass
L3	106.98 - 76.63	Pole	TP49.8505x42.4116x0.3438	3	-31.37	3270.27	53.1	Pass
L4	76.63 - 36.15	Pole	TP57.4645x47.7869x0.4063	4	-45.42	4458.22	58.3	Pass
L5	36.15 - 0	Pole	TP64x55.0777x0.4688	5	-66.18	5890.20	59.8	Pass
							Summary	
						Pole (L5)	59.8	Pass
						Rating =	59.8	Pass

Table 5 - Tower Component Stresses vs. Capacity - LC5

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Flange Bolts	150	23.6	Pass
1	Flange Plate	150	11.4	Pass
1	Anchor Rods	0	57.2	Pass
1	Base Plate	0	57.5	Pass
1	Base Foundation (Structure)	0	65.2	Pass
1	Base Foundation (Soil Interaction)	0	25.5	Pass

Structure Rating (max from all components) =	65.2%
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Notes:

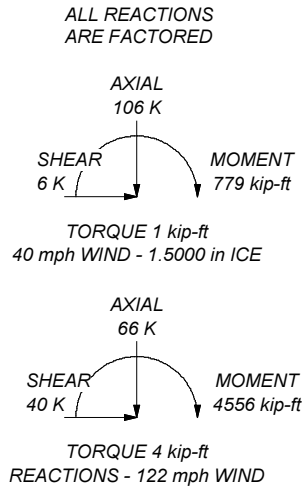
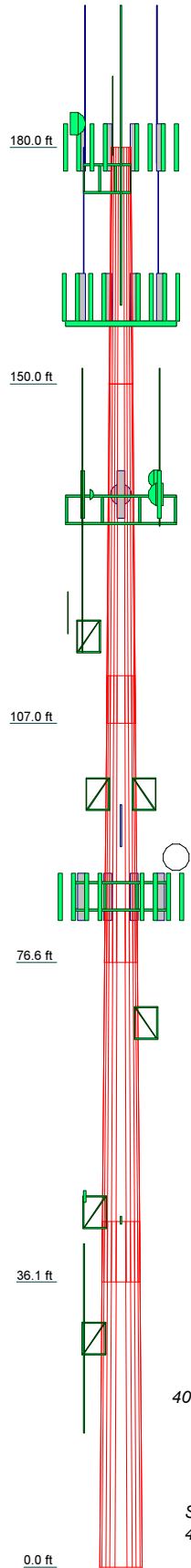
- 1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

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
Length (ft)	30.00	43.02	36.38	47.21	43.83
Number of Sides	12	12	12	12	12
Thickness (in)	0.2500	0.2813	0.3438	0.4063	0.4688
Socket Length (ft)		6.03	6.73	7.68	
Top Dia (in)	29.0000	35.2396	42.4116	47.7869	55.0777
Bot Dia (in)	35.2396	44.2350	49.8505	57.4645	64.0000
Grade			A572-65		
Weight (K)	2.6	5.2	6.3	11.0	13.3
					38.4



MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower is located in Jackson County, Missouri.
2. Tower designed for Exposure B to the TIA-222-H Standard.
3. Tower designed for a 122 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 40 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: 59.8%

 Crown Castle The Pathway to Possible		2000 Corporate Drive Canonsburg, PA 15317 Phone: (724) 416-2000 FAX:	
Job: BU# 877803		Project:	
Client: Crown Castle		Drawn by: MHussak	
Code: TIA-222-H		Date: 01/04/23	
Path: C:\WP\877803\WO 2192350 - SAIProd877803.dwg		Scale: NTS	
		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 Jackson County, Missouri.
- Tower base elevation above sea level: 1021.00 ft.
- Basic wind speed of 122 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 40 mph is used in combination with ice.
- 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	Distribute Leg Loads As Uniform	Use ASCE 10 X-Brace Ly Rules
Consider Moments - Horizontals	Assume Legs Pinned	Calculate Redundant Bracing Forces
Consider Moments - Diagonals	√ Assume Rigid Index Plate	Ignore Redundant Members in FEA
Use Moment Magnification	Use Clear Spans For Wind Area	SR Leg Bolts Resist Compression
√ Use Code Stress Ratios	Use Clear Spans For KL/r	All Leg Panels Have Same Allowable
√ Use Code Safety Factors - Guys	Retention Guys To Initial Tension	Offset Girt At Foundation
Escalate Ice	√ Bypass Mast Stability Checks	√ Consider Feed Line Torque
Always Use Max Kz	√ Use Azimuth Dish Coefficients	Include Angle Block Shear Check
Use Special Wind Profile	√ Project Wind Area of Appurt.	Use TIA-222-H Bracing Resist.
Include Bolts In Member Capacity	Autocalc Torque Arm Areas	Exemption
Leg Bolts Are At Top Of Section	Add IBC .6D+W Combination	Use TIA-222-H Tension Splice
Secondary Horizontal Braces Leg	√ Sort Capacity Reports By Component	Exemption
Use Diamond Inner Bracing (4 Sided)	Triangulate Diamond Inner Bracing	
SR Members Have Cut Ends	Treat Feed Line Bundles As Cylinder	
SR Members Are Concentric	Ignore KL/ry For 60 Deg. Angle Legs	

Poles

- √ 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

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	

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
L1	180.00-150.00	30.00	0.00	12	29.0000	35.2396	0.2500	1.0000	A572-65 (65 ksi)
L2	150.00-106.98	43.02	6.03	12	35.2396	44.2350	0.2813	1.1250	A572-65 (65 ksi)
L3	106.98-76.63	36.38	6.73	12	42.4116	49.8505	0.3438	1.3750	A572-65 (65 ksi)
L4	76.63-36.15	47.21	7.68	12	47.7869	57.4645	0.4063	1.6250	A572-65 (65 ksi)
L5	36.15-0.00	43.83		12	55.0777	64.0000	0.4688	1.8750	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in ²	I in ⁴	r in	C in	I/C in ³	J in ⁴	It/Q in ²	w in	w/t
L1	29.9348	23.1438	2441.7173	10.2925	15.0220	162.5428	4947.5812	11.3906	7.1020	28.408
	36.3945	28.1666	4401.4803	12.5263	18.2541	241.1227	8918.5924	13.8628	8.7742	35.097
L2	36.3835	31.6592	4938.4099	12.5151	18.2541	270.5368	10006.557	15.5817	8.6905	30.899
	45.6962	39.8056	9815.7198	15.7354	22.9137	428.3772	19889.309	19.5911	11.1012	39.471
L3	45.0630	46.5639	10518.084	15.0603	21.9692	478.7644	21312.490	22.9173	10.4451	30.386
	51.4878	54.7978	17142.642	17.7234	25.8226	663.8631	34735.642	26.9698	12.4387	36.185
L4	50.7576	61.9798	17759.775	16.9623	24.7536	717.4623	35986.119	30.5046	11.7181	28.845
	59.3483	74.6393	31016.339	20.4269	29.7666	1041.9842	62847.512	36.7352	14.3117	35.229
L5	58.4738	82.4253	31374.285	19.5500	28.5302	1099.6856	63572.808	40.5672	13.5046	28.81
	66.0923	95.8925	49402.087	22.7442	33.1520	1490.1692	100102.02	47.1954	15.8958	33.911

Tower Elevation ft	Gusset Area (per face) ft ²	Gusset Thickness in	Gusset Grade	Adjust. Factor A _r	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
L1 180.00- 150.00				1	1	1			
L2 150.00- 106.98				1	1	1			
L3 106.98- 76.63				1	1	1			
L4 76.63- 36.15				1	1	1			
L5 36.15-0.00				1	1	1			

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Exclude From Torque Calculation	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight plf
LMR-400(3/8)	A	No	Surface Ar (CaAa)	29.00 - 8.00	10	5	0.190 0.210	0.4050		0.07

EC4-50(1/2)	C	No	Surface Ar (CaAa)	134.00 - 8.00	3	3	-0.360 -0.330	0.6300		0.16

Description	Sector	Exclude From Torque Calculation	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight plf
2" Rigid Conduit	C	No	Surface Ar (CaAa)	134.00 - 8.00	1	1	-0.375 -0.375	2.0000		2.80
MLE HYBRID 3POWER/6FIBER RL 2(1-1/4) ***	C	No	Surface Ar (CaAa)	85.00 - 0.00	2	2	-0.025 0.025	1.2500		0.68

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		CaAa ft ² /ft	Weight plf
LMR-400(3/8)	A	No	No	Inside Pole	134.00 - 8.00	3	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.07 0.07 0.07 0.07
LDF5-50A(7/8)	A	No	No	Inside Pole	118.00 - 8.00	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.33 0.33 0.33 0.33
LDF5-50A(7/8)	A	No	No	Inside Pole	98.00 - 8.00	2	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.33 0.33 0.33 0.33
LMR-400(3/8)	A	No	No	Inside Pole	98.00 - 8.00	2	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.07 0.07 0.07 0.07
LDF4-50A(1/2)	A	No	No	Inside Pole	92.00 - 8.00	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.15 0.15 0.15 0.15
LDF4-50A(1/2)	A	No	No	Inside Pole	69.00 - 8.00	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.15 0.15 0.15 0.15
LDF4-50A(1/2)	A	No	No	Inside Pole	45.00 - 8.00	2	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.15 0.15 0.15 0.15
LDF4-50A(1/2)	A	No	No	Inside Pole	42.00 - 8.00	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.15 0.15 0.15 0.15

LDF5-50A(7/8)	A	No	No	Inside Pole	158.00 - 8.00	14	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.33 0.33 0.33 0.33
LDF7-50A(1-5/8)	A	No	No	Inside Pole	158.00 - 8.00	6	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.82 0.82 0.82 0.82
LDF6-50A(1-1/4)	A	No	No	Inside Pole	158.00 - 8.00	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.60 0.60 0.60 0.60
LDF4-50A(1/2)	A	No	No	Inside Pole	158.00 - 0.00	2	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.15 0.15 0.15 0.15
9207(5/16)	C	No	No	Inside Pole	134.00 - 8.00	3	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.60 0.60 0.60

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C _{AA} ft ² /ft	Weight plf
9077(ELLIPTICAL)	C	No	No	Inside Pole	134.00 - 8.00	3	2" Ice	0.00	0.60
							No Ice	0.00	0.05
							1/2" Ice	0.00	0.05
							1" Ice	0.00	0.05
							2" Ice	0.00	0.05
TSZ 999 067(1-1/2)	C	No	No	Inside Pole	180.00 - 8.00	3	No Ice	0.00	1.12
							1/2" Ice	0.00	1.12
							1" Ice	0.00	1.12
							2" Ice	0.00	1.12
LDF4-50A(1/2)	C	No	No	Inside Pole	180.00 - 8.00	3	No Ice	0.00	0.15
							1/2" Ice	0.00	0.15
							1" Ice	0.00	0.15
							2" Ice	0.00	0.15
942-98887-1FXXX(1-1/4)	C	No	No	Inside Pole	180.00 - 8.00	1	No Ice	0.00	1.26
							1/2" Ice	0.00	1.26
							1" Ice	0.00	1.26
							2" Ice	0.00	1.26

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _{AA} In Face ft ²	C _{AA} Out Face ft ²	Weight K
L1	180.00-150.00	A	0.000	0.000	0.000	0.000	0.08
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.15
L2	150.00-106.98	A	0.000	0.000	0.000	0.000	0.46
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	10.511	0.000	0.36
L3	106.98-76.63	A	0.000	0.000	0.000	0.000	0.35
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	13.899	0.000	0.32
L4	76.63-36.15	A	0.000	0.000	0.000	0.000	0.49
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	25.867	0.000	0.47
L5	36.15-0.00	A	0.000	0.000	4.253	0.000	0.37
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	19.988	0.000	0.34

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A _R ft ²	A _F ft ²	C _{AA} In Face ft ²	C _{AA} Out Face ft ²	Weight K
L1	180.00-150.00	A	1.497	0.000	0.000	0.000	0.000	0.08
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.15
L2	150.00-106.98	A	1.460	0.000	0.000	0.000	0.000	0.46
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	29.540	0.000	0.67
L3	106.98-76.63	A	1.412	0.000	0.000	0.000	0.000	0.35
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	38.851	0.000	0.72
L4	76.63-36.15	A	1.345	0.000	0.000	0.000	0.000	0.49
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	70.323	0.000	1.16
L5	36.15-0.00	A	1.198	0.000	0.000	12.378	0.000	0.48
		B		0.000	0.000	0.000	0.000	0.00

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft ²	A_F ft ²	C_{AA} In Face ft ²	C_{AA} Out Face ft ²	Weight K
		C		0.000	0.000	52.774	0.000	0.83

Feed Line Center of Pressure

Section	Elevation ft	CP_x in	CP_z in	CP_x Ice in	CP_z Ice in
L1	180.00-150.00	0.0000	0.0000	0.0000	0.0000
L2	150.00-106.98	1.0243	1.0877	1.8637	1.9952
L3	106.98-76.63	1.4972	1.9948	2.5652	3.4192
L4	76.63-36.15	1.4573	2.9127	2.3597	4.6749
L5	36.15-0.00	0.7503	2.0527	1.1454	3.1702

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

Shielding Factor K_a

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L2	16	EC4-50(1/2)	106.98 - 134.00	1.0000	1.0000
L2	17	2" Rigid Conduit	106.98 - 134.00	1.0000	1.0000
L3	16	EC4-50(1/2)	76.63 - 106.98	1.0000	1.0000
L3	17	2" Rigid Conduit	76.63 - 106.98	1.0000	1.0000
L3	23	MLE HYBRID 3POWER/6FIBER RL 2(1- 1/4)	76.63 - 85.00	1.0000	1.0000
L4	16	EC4-50(1/2)	36.15 - 76.63	1.0000	1.0000
L4	17	2" Rigid Conduit	36.15 - 76.63	1.0000	1.0000
L4	23	MLE HYBRID 3POWER/6FIBER RL 2(1- 1/4)	36.15 - 76.63	1.0000	1.0000
L5	8	LMR-400(3/8)	8.00 - 29.00	1.0000	1.0000
L5	16	EC4-50(1/2)	8.00 - 36.15	1.0000	1.0000
L5	17	2" Rigid Conduit	8.00 - 36.15	1.0000	1.0000
L5	23	MLE HYBRID 3POWER/6FIBER RL 2(1- 1/4)	0.00 - 36.15	1.0000	1.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft
Lighting Rod 3/4" x 8'	C	From Leg	0.00 0.00 4.00	0.0000	180.00

APXVERR18-C w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	180.00
APXVERR18-C w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	180.00
APXVERR18-C w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	180.00
APXSPP18-C w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	180.00
APXSPP18-C w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	180.00
APXSPP18-C w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	180.00
AIR 6468 B41 w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	180.00
AIR 6468 B41 w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	180.00
AIR 6468 B41 w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	180.00
RRUS 11 B26A	A	From Leg	4.00 0.00 0.00	0.0000	180.00
RRUS 11 B26A	B	From Leg	4.00 0.00 0.00	0.0000	180.00
RRUS 11 B26A	C	From Leg	4.00 0.00 0.00	0.0000	180.00
(2) RRUS 31 B25	A	From Leg	4.00 0.00 0.00	0.0000	180.00
(2) RRUS 31 B25	B	From Leg	4.00 0.00 0.00	0.0000	180.00
(2) RRUS 31 B25	C	From Leg	4.00 0.00 0.00	0.0000	180.00
RRUS-11	A	From Leg	4.00 0.00 0.00	0.0000	180.00
RRUS-11	B	From Leg	4.00 0.00 0.00	0.0000	180.00
RRUS-11	C	From Leg	4.00 0.00 0.00	0.0000	180.00
(6) ACU-A20-N	A	From Leg	4.00 0.00 0.00	0.0000	180.00
(6) ACU-A20-N	B	From Leg	4.00 0.00 0.00	0.0000	180.00
(6) ACU-A20-N	C	From Leg	4.00	0.0000	180.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft
			0.00		
ANT150D6-9	A	From Face	0.00		
			4.00	0.0000	180.00
			0.00		
			8.00		
ANT150D6-9	B	From Face	4.00	0.0000	180.00
			0.00		
			8.00		
ANT150D6-9	C	From Face	4.00	0.0000	180.00
			0.00		
			8.00		
Platform Mount [LP 602-1]	C	None		0.0000	180.00
climbing ladder	C	From Centroid-Leg	2.00	0.0000	180.00
			0.00		
			-4.00		
Side Arm Mount [SO 301-1]	B	From Face	4.00	0.0000	180.00
			0.00		
			0.00		
Miscellaneous [NA 507-1]	B	None		0.0000	180.00
6' x 2" Mount Pipe	A	From Leg	4.00	0.0000	180.00
			0.00		
			0.00		
6' x 2" Mount Pipe	B	From Leg	4.00	0.0000	180.00
			0.00		
			0.00		
6' x 2" Mount Pipe	C	From Leg	4.00	0.0000	180.00
			0.00		
			0.00		
10' x 2" Mount Pipe	A	From Leg	4.00	0.0000	180.00
			0.00		
			0.00		
10' x 2" Mount Pipe	B	From Leg	4.00	0.0000	180.00
			0.00		
			0.00		
10' x 2" Mount Pipe	C	From Leg	4.00	0.0000	180.00
			0.00		
			0.00		

(2) TMBXX-6517-A2M w/ Mount Pipe	A	From Leg	4.00	0.0000	158.00
			0.00		
			3.00		
(2) TMBXX-6517-A2M w/ Mount Pipe	B	From Leg	4.00	0.0000	158.00
			0.00		
			3.00		
(2) TMBXX-6517-A2M w/ Mount Pipe	C	From Leg	4.00	0.0000	158.00
			0.00		
			3.00		
AN1252 w/ Mount Pipe	A	From Leg	4.00	0.0000	158.00
			0.00		
			4.00		
(2) AN1252 w/ Mount Pipe	B	From Leg	4.00	0.0000	158.00
			0.00		
			7.00		
AN1252 w/ Mount Pipe	C	From Leg	4.00	0.0000	158.00
			0.00		
			4.00		
TMBX-6517-R2M w/ Mount Pipe	A	From Leg	4.00	0.0000	158.00
			0.00		
			3.00		
TMBX-6517-R2M w/ Mount Pipe	B	From Leg	4.00	0.0000	158.00
			0.00		
			3.00		
TMBX-6517-R2M w/ Mount Pipe	C	From Leg	4.00	0.0000	158.00
			0.00		
			3.00		

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft
SD214	A	From Face	4.00 0.00 12.00	0.0000	158.00
SD214	B	From Face	4.00 0.00 12.00	0.0000	158.00
SD214	C	From Face	4.00 0.00 12.00	0.0000	158.00
FRIG	A	From Leg	4.00 0.00 12.00	0.0000	158.00
FRIG	B	From Leg	4.00 0.00 3.00	0.0000	158.00
FRIG	C	From Leg	4.00 0.00 3.00	0.0000	158.00
BREEZEACCESS AU-D-BS-900	A	From Leg	4.00 0.00 4.00	0.0000	158.00
(2) BREEZEACCESS AU-D-BS-900	B	From Leg	4.00 0.00 7.00	0.0000	158.00
BREEZEACCESS AU-D-BS-900	C	From Leg	4.00 0.00 4.00	0.0000	158.00
(2) E15S08P78	A	From Leg	4.00 0.00 3.00	0.0000	158.00
(2) E15S08P78	B	From Leg	4.00 0.00 3.00	0.0000	158.00
(2) E15S08P78	C	From Leg	4.00 0.00 3.00	0.0000	158.00
Platform Mount (LP 101-1)	C	None		0.0000	158.00
Side Arm Mount [SO 202-3]	C	None		0.0000	158.00
climbing ladder	C	From Leg	2.00 0.00 -4.00	0.0000	158.00
10' x 2" Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	158.00
10' x 2" Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	158.00
10' x 2" Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	158.00

LLPX310R-V1 w/ Mount Pipe	A	From Leg	4.00 0.00 2.00	0.0000	134.00
LLPX310R-V1 w/ Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	134.00
LLPX310R-V1 w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	134.00
SD214	B	From Leg	4.00 0.00 8.00	0.0000	134.00
SD214	C	From Leg	4.00 0.00	0.0000	134.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft
SD214	C	From Leg	8.00 4.00 0.00 -8.00	0.0000	134.00
HORIZON DUO	A	From Leg	4.00 0.00 0.00	0.0000	134.00
(2) HORIZON DUO	B	From Leg	4.00 0.00 0.00	0.0000	134.00
HORIZON DUO	C	From Leg	4.00 0.00 0.00	0.0000	134.00
VX DAP I/V RF MODULE	A	From Leg	4.00 0.00 0.00	0.0000	134.00
VX DAP I/V RF MODULE	B	From Leg	4.00 0.00 0.00	0.0000	134.00
VX DAP I/V RF MODULE	C	From Leg	4.00 0.00 0.00	0.0000	134.00
JUNCTION BOX	A	From Leg	4.00 0.00 0.00	0.0000	134.00
Platform Mount [LP 713-1]	C	None		0.0000	134.00
Side Arm Mount [SO 202-3]	C	None		0.0000	134.00
(2) 6' x 2" Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	134.00
(2) 6' x 2" Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	134.00
(2) 6' x 2" Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	134.00

PG1N0F-0093-608	C	From Leg	6.00 0.00 3.00	0.0000	118.00
Side Arm Mount [SO 702-1]	C	From Leg	3.00 0.00 0.00	0.0000	118.00

PD220	B	From Leg	3.00 0.00 10.00	0.0000	98.00
DB498	C	From Leg	3.00 0.00 7.00	0.0000	98.00
DB498	C	From Leg	3.00 0.00 3.00	0.0000	98.00
SD214	C	From Leg	3.00 0.00 -10.00	0.0000	98.00
Side Arm Mount [SO 701-1]	B	From Leg	1.50 0.00 0.00	0.0000	98.00
Side Arm Mount [SO 701-1]	C	From Leg	1.50 0.00 0.00	0.0000	98.00

PG1N0F-0093-608	A	From Leg	3.00 0.00	0.0000	92.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft
Side Arm Mount [SO 701-1]	A	From Leg	2.00 1.50 0.00 0.00	0.0000	92.00

NHHSS-65B-R2B w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	85.00
NHHSS-65B-R2B w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	85.00
NHHSS-65B-R2B w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	85.00
AIR 6449 B77 w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	85.00
AIR 6449 B77 w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	85.00
AIR 6449 B77 w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	85.00
NHH-65C-R2B w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	85.00
NHH-65C-R2B w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	85.00
NHH-65C-R2B w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	85.00
RADIO 4408	A	From Leg	4.00 0.00 0.00	0.0000	85.00
RADIO 4408	B	From Leg	4.00 0.00 0.00	0.0000	85.00
RADIO 4408	C	From Leg	4.00 0.00 0.00	0.0000	85.00
8843	A	From Leg	4.00 0.00 0.00	0.0000	85.00
8843	B	From Leg	4.00 0.00 0.00	0.0000	85.00
8843	C	From Leg	4.00 0.00 0.00	0.0000	85.00
4449	A	From Leg	4.00 0.00 0.00	0.0000	85.00
4449	B	From Leg	4.00 0.00 0.00	0.0000	85.00
4449	C	From Leg	4.00 0.00 0.00	0.0000	85.00
RCMDC-6627-PF-48	A	From Leg	4.00 0.00 0.00	0.0000	85.00
MCG22HD-12M-12-126 (3) 8' x 2" Mount Pipe	C A	None From Leg	0.00 0.00	0.0000 0.0000	85.00 85.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft
8' x 2" Mount Pipe	B	From Leg	0.00 0.00 0.00 0.00	0.0000	85.00
8' x 2" Mount Pipe	C	From Leg	0.00 0.00 0.00	0.0000	85.00
*** ASP-816	B	From Leg	3.00 0.00 1.00	0.0000	69.00
Side Arm Mount [SO 701-1]	B	From Leg	1.50 0.00 0.00	0.0000	69.00
**** DB201-P	C	From Leg	3.00 0.00 2.00	0.0000	45.00
ASP-816	C	From Leg	3.00 0.00 -1.00	0.0000	45.00
Side Arm Mount [SO 701-1]	C	From Leg	1.50 0.00 0.00	0.0000	45.00
**** VG-1060	C	From Face	3.00 0.00 2.00	0.0000	42.00
Side Arm Mount [SO 701-1]	C	From Face	1.50 0.00 0.00	0.0000	42.00
**** 311129	C	From Leg	3.00 0.00 13.00	0.0000	29.00
311129	C	From Leg	3.00 0.00 9.00	0.0000	29.00
311129	C	From Leg	3.00 0.00 5.00	0.0000	29.00
311129	C	From Leg	3.00 0.00 1.00	0.0000	29.00
311129	C	From Leg	3.00 0.00 -3.00	0.0000	29.00
311129	C	From Leg	3.00 0.00 -7.00	0.0000	29.00
918-3	C	From Leg	3.00 0.00 7.00	0.0000	29.00
918-3	C	From Leg	3.00 0.00 3.00	0.0000	29.00
918-3	C	From Leg	3.00 0.00 -5.00	0.0000	29.00
Side Arm Mount [SO 701-1]	C	From Leg	1.50 0.00 0.00	0.0000	29.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft
24"x4.5" mount pipe	C	From Leg	3.00 0.00 0.00	0.0000	29.00

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft

VHLP800-11-2GR	C	Paraboloid w/Shroud (HP)	From Leg	4.00 0.00 3.00	0.0000		180.00	2.80

VHLP800-11	A	Paraboloid w/Shroud (HP)	From Leg	4.00 0.00 2.00	0.0000		134.00	2.80
VHLP2-18	B	Paraboloid w/Shroud (HP)	From Centroi d-Leg	4.00 0.00 4.00	0.0000		134.00	2.17
VHLP800-11	B	Paraboloid w/Shroud (HP)	From Centroi d-Leg	4.00 0.00 2.00	0.0000		134.00	2.80
VHLP1-23	C	Paraboloid w/o Radome	From Centroi d-Leg	4.00 0.00 2.00	0.0000		134.00	1.27

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
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

Comb. No.	Description
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
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice
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	180 - 150	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-24.97	0.15	-0.62
			Max. Mx	8	-10.41	-272.29	2.75
			Max. My	2	-10.42	-4.88	269.14
			Max. Vy	8	13.77	-272.29	2.75
			Max. Vx	2	-13.65	-4.88	269.14
			Max. Torque	12			-0.80
L2	150 - 106.98	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-41.54	0.55	-2.49
			Max. Mx	8	-19.51	-945.47	3.51
			Max. My	14	-19.52	2.40	-939.35
			Max. Vy	20	-22.10	943.06	-0.81
			Max. Vx	14	22.03	2.40	-939.35
			Max. Torque	24			1.91
L3	106.98 - 76.63	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-61.81	0.56	-3.10
			Max. Mx	8	-31.37	-1670.43	3.39
			Max. My	14	-31.37	0.06	-1663.10
			Max. Vy	20	-29.21	1668.64	3.13
			Max. Vx	14	29.17	0.06	-1663.10
			Max. Torque	22			2.77
L4	76.63 - 36.15	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-80.44	0.77	-5.66
			Max. Mx	8	-45.43	-2927.91	2.95
			Max. My	14	-45.43	-2.99	-2920.45
			Max. Vy	20	-34.32	2926.54	7.57
			Max. Vx	14	34.30	-2.99	-2920.45
			Max. Torque	24			2.40
L5	36.15 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-106.46	5.94	-10.89

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Mx	20	-66.18	4556.01	9.30
			Max. My	14	-66.18	-1.77	-4545.73
			Max. Vy	20	-39.55	4556.01	9.30
			Max. Vx	14	39.45	-1.77	-4545.73
			Max. Torque	24			4.41

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	26	106.46	0.00	-0.00
	Max. H _x	20	66.19	39.52	0.08
	Max. H _z	2	66.19	0.00	39.42
	Max. M _x	2	4536.78	0.00	39.42
	Max. M _z	8	4550.52	-39.51	0.06
	Max. Torsion	24	4.40	19.83	34.11
	Min. Vert	5	49.64	-19.84	34.11
	Min. H _x	8	66.19	-39.51	0.06
	Min. H _z	14	66.19	-0.03	-39.42
	Min. M _x	14	-4545.73	-0.03	-39.42
	Min. M _z	20	-4556.01	39.52	0.08
	Min. Torsion	12	-4.38	-19.71	-34.13

Tower Mast Reaction Summary

Load Combination	Vertical K	Shear _x K	Shear _z K	Overturning Moment, M _x kip-ft	Overturning Moment, M _z kip-ft	Torque kip-ft
Dead Only	55.16	0.00	0.00	3.81	3.11	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	66.19	-0.00	-39.42	-4536.78	2.44	-2.80
0.9 Dead+1.0 Wind 0 deg - No Ice	49.64	-0.00	-39.42	-4500.06	1.53	-2.80
1.2 Dead+1.0 Wind 30 deg - No Ice	66.19	19.84	-34.11	-3922.83	-2284.13	-0.42
0.9 Dead+1.0 Wind 30 deg - No Ice	49.64	19.84	-34.11	-3891.23	-2265.95	-0.42
1.2 Dead+1.0 Wind 60 deg - No Ice	66.19	34.25	-19.70	-2261.94	-3942.14	1.31
0.9 Dead+1.0 Wind 60 deg - No Ice	49.64	34.25	-19.70	-2244.21	-3910.12	1.31
1.2 Dead+1.0 Wind 90 deg - No Ice	66.19	39.51	-0.06	-2.13	-4550.52	2.69
0.9 Dead+1.0 Wind 90 deg - No Ice	49.64	39.51	-0.06	-3.25	-4513.42	2.69
1.2 Dead+1.0 Wind 120 deg - No Ice	66.19	34.22	19.64	2265.08	-3944.03	4.06
0.9 Dead+1.0 Wind 120 deg - No Ice	49.64	34.22	19.64	2245.05	-3911.98	4.06
1.2 Dead+1.0 Wind 150 deg - No Ice	66.19	19.71	34.13	3939.84	-2268.57	4.38
0.9 Dead+1.0 Wind 150 deg - No Ice	49.64	19.71	34.13	3905.77	-2250.56	4.38
1.2 Dead+1.0 Wind 180 deg - No Ice	66.19	0.03	39.42	4545.73	-1.77	2.88
0.9 Dead+1.0 Wind 180 deg - No Ice	49.64	0.03	39.42	4506.62	-2.71	2.88
1.2 Dead+1.0 Wind 210 deg - No Ice	66.19	-19.69	34.16	3937.79	2267.46	0.57
0.9 Dead+1.0 Wind 210 deg - No Ice	49.64	-19.69	34.16	3903.75	2247.57	0.57

Load Combination	Vertical K	Shear _x K	Shear _z K	Overturning Moment, M _x kip-ft	Overturning Moment, M _z kip-ft	Torque kip-ft
- No Ice						
1.2 Dead+1.0 Wind 240 deg	66.19	-34.22	19.64	2261.59	3942.85	-1.26
- No Ice						
0.9 Dead+1.0 Wind 240 deg	49.64	-34.22	19.64	2241.55	3908.98	-1.26
- No Ice						
1.2 Dead+1.0 Wind 270 deg	66.19	-39.52	-0.08	-9.30	4556.01	-2.82
- No Ice						
0.9 Dead+1.0 Wind 270 deg	49.64	-39.52	-0.08	-10.40	4517.03	-2.82
- No Ice						
1.2 Dead+1.0 Wind 300 deg	66.19	-34.23	-19.72	-2268.97	3950.76	-4.19
- No Ice						
0.9 Dead+1.0 Wind 300 deg	49.64	-34.23	-19.72	-2251.20	3916.81	-4.19
- No Ice						
1.2 Dead+1.0 Wind 330 deg	66.19	-19.83	-34.11	-3925.99	2294.31	-4.40
- No Ice						
0.9 Dead+1.0 Wind 330 deg	49.64	-19.83	-34.11	-3894.38	2274.20	-4.40
- No Ice						
1.2 Dead+1.0 Ice	106.46	-0.00	0.00	10.89	5.94	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice	106.46	0.00	-6.27	-755.28	5.70	-0.65
1.2 Dead+1.0 Wind 30 deg+1.0 Ice	106.46	3.15	-5.42	-651.83	-379.42	-0.05
1.2 Dead+1.0 Wind 60 deg+1.0 Ice	106.46	5.44	-3.13	-371.50	-659.22	0.47
1.2 Dead+1.0 Wind 90 deg+1.0 Ice	106.46	6.28	-0.01	10.22	-761.82	0.86
1.2 Dead+1.0 Wind 120 deg+1.0 Ice	106.46	5.44	3.13	392.93	-659.50	1.11
1.2 Dead+1.0 Wind 150 deg+1.0 Ice	106.46	3.13	5.43	675.24	-377.16	1.07
1.2 Dead+1.0 Wind 180 deg+1.0 Ice	106.46	0.00	6.27	777.64	5.37	0.66
1.2 Dead+1.0 Wind 210 deg+1.0 Ice	106.46	-3.13	5.43	675.04	388.22	0.07
1.2 Dead+1.0 Wind 240 deg+1.0 Ice	106.46	-5.44	3.12	392.65	670.41	-0.46
1.2 Dead+1.0 Wind 270 deg+1.0 Ice	106.46	-6.28	-0.01	9.41	773.64	-0.87
1.2 Dead+1.0 Wind 300 deg+1.0 Ice	106.46	-5.44	-3.14	-372.33	671.40	-1.12
1.2 Dead+1.0 Wind 330 deg+1.0 Ice	106.46	-3.15	-5.43	-652.17	391.74	-1.07
Dead+Wind 0 deg - Service	55.16	-0.00	-8.98	-1025.58	2.86	-0.65
Dead+Wind 30 deg - Service	55.16	4.52	-7.77	-886.41	-515.47	-0.10
Dead+Wind 60 deg - Service	55.16	7.80	-4.49	-509.91	-891.32	0.30
Dead+Wind 90 deg - Service	55.16	9.00	-0.01	2.36	-1029.23	0.62
Dead+Wind 120 deg - Service	55.16	7.80	4.48	516.30	-891.74	0.94
Dead+Wind 150 deg - Service	55.16	4.49	7.78	895.93	-511.95	1.01
Dead+Wind 180 deg - Service	55.16	0.01	8.98	1033.28	1.89	0.66
Dead+Wind 210 deg - Service	55.16	-4.49	7.78	895.47	516.29	0.13
Dead+Wind 240 deg - Service	55.16	-7.80	4.47	515.50	896.07	-0.29
Dead+Wind 270 deg - Service	55.16	-9.00	-0.02	0.73	1035.07	-0.64
Dead+Wind 300 deg - Service	55.16	-7.80	-4.49	-511.50	897.87	-0.96
Dead+Wind 330 deg - Service	55.16	-4.52	-7.77	-887.12	522.38	-1.01

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	-55.16	0.00	0.00	55.16	0.00	0.000%
2	-0.00	-66.19	-39.42	0.00	66.19	39.42	0.000%
3	-0.00	-49.64	-39.42	0.00	49.64	39.42	0.000%
4	19.84	-66.19	-34.11	-19.84	66.19	34.11	0.000%
5	19.84	-49.64	-34.11	-19.84	49.64	34.11	0.000%
6	34.25	-66.19	-19.70	-34.25	66.19	19.70	0.000%
7	34.25	-49.64	-19.70	-34.25	49.64	19.70	0.000%
8	39.51	-66.19	-0.06	-39.51	66.19	0.06	0.000%
9	39.51	-49.64	-0.06	-39.51	49.64	0.06	0.000%
10	34.22	-66.19	19.64	-34.22	66.19	-19.64	0.000%
11	34.22	-49.64	19.64	-34.22	49.64	-19.64	0.000%
12	19.71	-66.19	34.13	-19.71	66.19	-34.13	0.000%
13	19.71	-49.64	34.13	-19.71	49.64	-34.13	0.000%
14	0.03	-66.19	39.42	-0.03	66.19	-39.42	0.000%
15	0.03	-49.64	39.42	-0.03	49.64	-39.42	0.000%
16	-19.69	-66.19	34.16	19.69	66.19	-34.16	0.000%
17	-19.69	-49.64	34.16	19.69	49.64	-34.16	0.000%
18	-34.22	-66.19	19.64	34.22	66.19	-19.64	0.000%
19	-34.22	-49.64	19.64	34.22	49.64	-19.64	0.000%
20	-39.52	-66.19	-0.08	39.52	66.19	0.08	0.000%
21	-39.52	-49.64	-0.08	39.52	49.64	0.08	0.000%
22	-34.23	-66.19	-19.72	34.23	66.19	19.72	0.000%
23	-34.23	-49.64	-19.72	34.23	49.64	19.72	0.000%
24	-19.83	-66.19	-34.11	19.83	66.19	34.11	0.000%
25	-19.83	-49.64	-34.11	19.83	49.64	34.11	0.000%
26	0.00	-106.46	0.00	0.00	106.46	-0.00	0.000%
27	0.00	-106.46	-6.27	-0.00	106.46	6.27	0.000%
28	3.15	-106.46	-5.42	-3.15	106.46	5.42	0.000%
29	5.44	-106.46	-3.13	-5.44	106.46	3.13	0.000%
30	6.28	-106.46	-0.01	-6.28	106.46	0.01	0.000%
31	5.44	-106.46	3.13	-5.44	106.46	-3.13	0.000%
32	3.13	-106.46	5.43	-3.13	106.46	-5.43	0.000%
33	0.00	-106.46	6.27	-0.00	106.46	-6.27	0.000%
34	-3.13	-106.46	5.43	3.13	106.46	-5.43	0.000%
35	-5.44	-106.46	3.12	5.44	106.46	-3.12	0.000%
36	-6.28	-106.46	-0.01	6.28	106.46	0.01	0.000%
37	-5.44	-106.46	-3.14	5.44	106.46	3.14	0.000%
38	-3.15	-106.46	-5.43	3.15	106.46	5.43	0.000%
39	-0.00	-55.16	-8.98	0.00	55.16	8.98	0.000%
40	4.52	-55.16	-7.77	-4.52	55.16	7.77	0.000%
41	7.80	-55.16	-4.49	-7.80	55.16	4.49	0.000%
42	9.00	-55.16	-0.01	-9.00	55.16	0.01	0.000%
43	7.80	-55.16	4.48	-7.80	55.16	-4.48	0.000%
44	4.49	-55.16	7.78	-4.49	55.16	-7.78	0.000%
45	0.01	-55.16	8.98	-0.01	55.16	-8.98	0.000%
46	-4.49	-55.16	7.78	4.49	55.16	-7.78	0.000%
47	-7.80	-55.16	4.47	7.80	55.16	-4.47	0.000%
48	-9.00	-55.16	-0.02	9.00	55.16	0.02	0.000%
49	-7.80	-55.16	-4.49	7.80	55.16	4.49	0.000%
50	-4.52	-55.16	-7.77	4.52	55.16	7.77	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	4	0.00000001	0.00053831
3	Yes	4	0.00000001	0.00033332
4	Yes	5	0.00000001	0.00058979
5	Yes	5	0.00000001	0.00027415
6	Yes	5	0.00000001	0.00057488
7	Yes	5	0.00000001	0.00026684
8	Yes	4	0.00000001	0.00065504
9	Yes	4	0.00000001	0.00041134
10	Yes	5	0.00000001	0.00060481

11	Yes	5	0.00000001	0.00028162
12	Yes	5	0.00000001	0.00056275
13	Yes	5	0.00000001	0.00026080
14	Yes	4	0.00000001	0.00059437
15	Yes	4	0.00000001	0.00037116
16	Yes	5	0.00000001	0.00058034
17	Yes	5	0.00000001	0.00026942
18	Yes	5	0.00000001	0.00059172
19	Yes	5	0.00000001	0.00027511
20	Yes	4	0.00000001	0.00067307
21	Yes	4	0.00000001	0.00042366
22	Yes	5	0.00000001	0.00056498
23	Yes	5	0.00000001	0.00026186
24	Yes	5	0.00000001	0.00060995
25	Yes	5	0.00000001	0.00028406
26	Yes	4	0.00000001	0.00000801
27	Yes	4	0.00000001	0.00023377
28	Yes	4	0.00000001	0.00040432
29	Yes	4	0.00000001	0.00038399
30	Yes	4	0.00000001	0.00025674
31	Yes	4	0.00000001	0.00047055
32	Yes	4	0.00000001	0.00039627
33	Yes	4	0.00000001	0.00024085
34	Yes	4	0.00000001	0.00041254
35	Yes	4	0.00000001	0.00044242
36	Yes	4	0.00000001	0.00025941
37	Yes	4	0.00000001	0.00038669
38	Yes	4	0.00000001	0.00045466
39	Yes	4	0.00000001	0.00005925
40	Yes	4	0.00000001	0.00022891
41	Yes	4	0.00000001	0.00021486
42	Yes	4	0.00000001	0.00006384
43	Yes	4	0.00000001	0.00025331
44	Yes	4	0.00000001	0.00020833
45	Yes	4	0.00000001	0.00006051
46	Yes	4	0.00000001	0.00022424
47	Yes	4	0.00000001	0.00023782
48	Yes	4	0.00000001	0.00006489
49	Yes	4	0.00000001	0.00020810
50	Yes	4	0.00000001	0.00025604

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 150	19.177	48	0.9019	0.0020
L2	150 - 106.98	13.639	48	0.8425	0.0014
L3	113.01 - 76.63	7.789	48	0.6477	0.0010
L4	83.36 - 36.15	4.244	48	0.4757	0.0006
L5	43.83 - 0	1.192	48	0.2419	0.0003

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
183.00	VHLP800-11-2GR	48	19.177	0.9019	0.0021	85652
180.00	Lighting Rod 3/4" x 8'	48	19.177	0.9019	0.0021	85652
158.00	(2) TMBXX-6517-A2M w/ Mount Pipe	48	15.074	0.8661	0.0016	19466
138.00	VHLP2-18	48	11.588	0.7907	0.0013	12302
136.00	VHLP800-11	48	11.260	0.7805	0.0013	12023
134.00	LLPX310R-V1 w/ Mount Pipe	48	10.935	0.7700	0.0012	11758

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
118.00	PG1N0F-0093-608	48	8.491	0.6776	0.0010	9990
98.00	PD220	48	5.864	0.5602	0.0008	10061
92.00	PG1N0F-0093-608	48	5.170	0.5257	0.0007	10284
85.00	NHHSS-65B-R2B w/ Mount Pipe	48	4.413	0.4852	0.0006	10523
69.00	ASP-816	48	2.898	0.3907	0.0005	9408
45.00	DB201-P	48	1.251	0.2486	0.0003	7985
42.00	VG-1060	48	1.104	0.2313	0.0003	8230
29.00	311129	48	0.606	0.1579	0.0002	11841

Maximum Tower Deflections - Design Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	180 - 150	84.644	8	3.9880	0.0088
L2	150 - 106.98	60.176	8	3.7248	0.0063
L3	113.01 - 76.63	34.347	22	2.8600	0.0042
L4	83.36 - 36.15	18.711	22	2.0991	0.0026
L5	43.83 - 0	5.251	22	1.0659	0.0014

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
183.00	VHLP800-11-2GR	8	84.644	3.9880	0.0090	19533
180.00	Lighting Rod 3/4" x 8'	8	84.644	3.9880	0.0090	19533
158.00	(2) TMBXX-6517-A2M w/ Mount Pipe	8	66.512	3.8297	0.0070	4437
138.00	VHLP2-18	8	51.115	3.4948	0.0056	2799
136.00	VHLP800-11	8	49.663	3.4494	0.0055	2736
134.00	LLPX310R-V1 w/ Mount Pipe	8	48.229	3.4026	0.0054	2675
118.00	PG1N0F-0093-608	22	37.442	2.9923	0.0045	2271
98.00	PD220	22	25.854	2.4728	0.0033	2283
92.00	PG1N0F-0093-608	22	22.794	2.3203	0.0030	2333
85.00	NHHSS-65B-R2B w/ Mount Pipe	22	19.457	2.1414	0.0026	2386
69.00	ASP-816	22	12.775	1.7236	0.0020	2133
45.00	DB201-P	22	5.511	1.0958	0.0014	1810
42.00	VG-1060	22	4.862	1.0194	0.0013	1865
29.00	311129	20	2.669	0.6956	0.0010	2683

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L _u	Kl/r	A	P _u	φP _n	Ratio P _u / φP _n
	ft		ft	ft		in ²	K	K	
L1	180 - 150 (1)	TP35.2396x29x0.25	30.00	0.00	0.0	28.166 6	-10.41	1647.11	0.006
L2	150 - 106.98 (2)	TP44.235x35.2396x0.281 3	43.02	0.00	0.0	38.663 7	-19.51	2140.54	0.009
L3	106.98 - 76.63 (3)	TP49.8505x42.4116x0.34 38	36.38	0.00	0.0	53.274 6	-31.37	3114.54	0.010

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
L4	76.63 - 36.15 (4)	TP57.4645x47.7869x0.40 63	47.21	0.00	0.0	72.579 9	-45.42	4245.92	0.011
L5	36.15 - 0 (5)	TP64x55.0777x0.4688	43.83	0.00	0.0	95.892 5	-66.18	5609.71	0.012

Pole Bending Design Data

Section No.	Elevation ft	Size	M _{ux} kip-ft	φM _{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M _{uy} kip-ft	φM _{ny} kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L1	180 - 150 (1)	TP35.2396x29x0.25	272.58	1175.02	0.232	0.00	1175.02	0.000
L2	150 - 106.98 (2)	TP44.235x35.2396x0.281 3	945.48	1864.24	0.507	0.00	1864.24	0.000
L3	106.98 - 76.63 (3)	TP49.8505x42.4116x0.34 38	1670.43	3056.32	0.547	0.00	3056.32	0.000
L4	76.63 - 36.15 (4)	TP57.4645x47.7869x0.40 63	2928.00	4873.45	0.601	0.00	4873.45	0.000
L5	36.15 - 0 (5)	TP64x55.0777x0.4688	4556.02	7406.32	0.615	0.00	7406.32	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V _u K	φV _n K	Ratio $\frac{V_u}{\phi V_n}$	Actual T _u kip-ft	φT _n kip-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	180 - 150 (1)	TP35.2396x29x0.25	13.77	494.32	0.028	0.11	1521.43	0.000
L2	150 - 106.98 (2)	TP44.235x35.2396x0.281 3	22.09	678.55	0.033	1.11	2548.22	0.000
L3	106.98 - 76.63 (3)	TP49.8505x42.4116x0.34 38	29.21	934.97	0.031	1.16	3958.39	0.000
L4	76.63 - 36.15 (4)	TP57.4645x47.7869x0.40 63	34.37	1273.78	0.027	2.37	6216.71	0.000
L5	36.15 - 0 (5)	TP64x55.0777x0.4688	39.55	1682.91	0.023	2.82	9404.75	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P _u φP _n	Ratio M _{ux} φM _{nx}	Ratio M _{uy} φM _{ny}	Ratio V _u φV _n	Ratio T _u φT _n	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	180 - 150 (1)	0.006	0.232	0.000	0.028	0.000	0.239	1.050	4.8.2
L2	150 - 106.98 (2)	0.009	0.507	0.000	0.033	0.000	0.517	1.050	4.8.2
L3	106.98 - 76.63 (3)	0.010	0.547	0.000	0.031	0.000	0.558	1.050	4.8.2
L4	76.63 - 36.15 (4)	0.011	0.601	0.000	0.027	0.000	0.612	1.050	4.8.2
L5	36.15 - 0 (5)	0.012	0.615	0.000	0.023	0.000	0.628	1.050	4.8.2

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
L1	180 - 150	Pole	TP35.2396x29x0.25	1	-10.41	1729.47	22.8	Pass
L2	150 - 106.98	Pole	TP44.235x35.2396x0.2813	2	-19.51	2247.57	49.3	Pass
L3	106.98 - 76.63	Pole	TP49.8505x42.4116x0.3438	3	-31.37	3270.27	53.1	Pass
L4	76.63 - 36.15	Pole	TP57.4645x47.7869x0.4063	4	-45.42	4458.22	58.3	Pass
L5	36.15 - 0	Pole	TP64x55.0777x0.4688	5	-66.18	5890.20	59.8	Pass
							Summary	
							Pole (L5)	59.8
							RATING =	59.8
								Pass

APPENDIX B
BASE LEVEL DRAWING



(OTHER CONSIDERED EQUIPMENT)
(2) 1/2" TO 158 FT LEVEL
(14) 7/8" TO 158 FT LEVEL
(1) 1-1/4" TO 158 FT LEVEL
(6) 1-5/8" TO 158 FT LEVEL

CLIMBING PEGS
W/ SAFETY CLIMB

(OTHER CONSIDERED EQUIPMENT)
(10) 3/8" TO 29 FT LEVEL
(1) 1/2" TO 42 FT LEVEL
(2) 1/2" TO 45 FT LEVEL
(1) 1/2" TO 69 FT LEVEL
(1) 1/2" TO 92 FT LEVEL
(2) 3/8" TO 98 FT LEVEL
(2) 7/8" TO 98 FT LEVEL
(1) 7/8" TO 118 FT LEVEL
(3) 3/8" TO 134 FT LEVEL

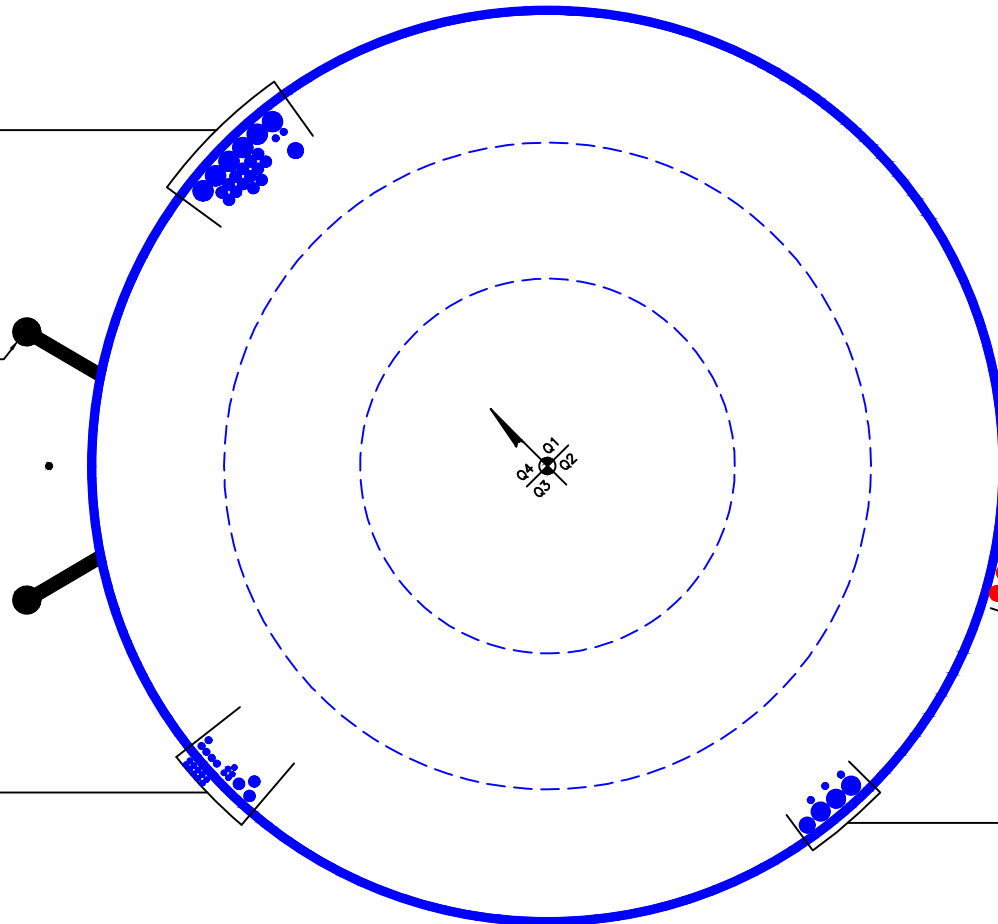
(OTHER CONSIDERED EQUIPMENT--IN CONDUIT)
(2) 5/16" TO 134 FT LEVEL

(OTHER CONSIDERED EQUIPMENT--IN CONDUIT)
(3) ELLIPTICAL TO 134 FT LEVEL
(1) 5/16" TO 134 FT LEVEL
(OTHER CONSIDERED EQUIPMENT)
(3) 1/2" TO 134 FT LEVEL

(PROPOSED EQUIPMENT CONFIGURATION)
(2) 1-1/4" TO 85 FT LEVEL

(OTHER CONSIDERED EQUIPMENT)
(3) 1/2" TO 180 FT LEVEL

(OTHER CONSIDERED EQUIPMENT)
(1) 1-1/4" TO 180 FT LEVEL
(3) 1-1/2" TO 180 FT LEVEL



APPENDIX C

ADDITIONAL CALCULATIONS

Monopole Flange Plate Connection

Elevation = 150 ft.

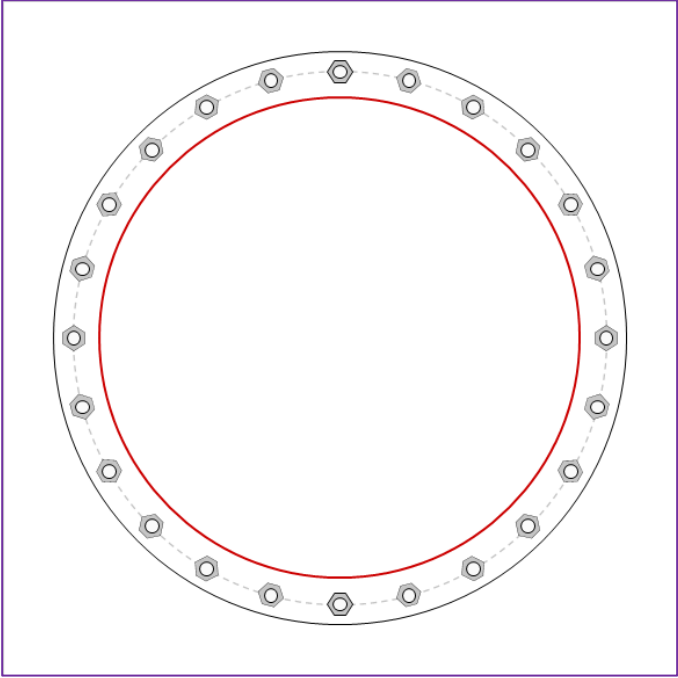


BU #	877803
Site Name	ee's Summit Fire Station
Order #	640178 Rev. 3
TIA-222 Revision	H

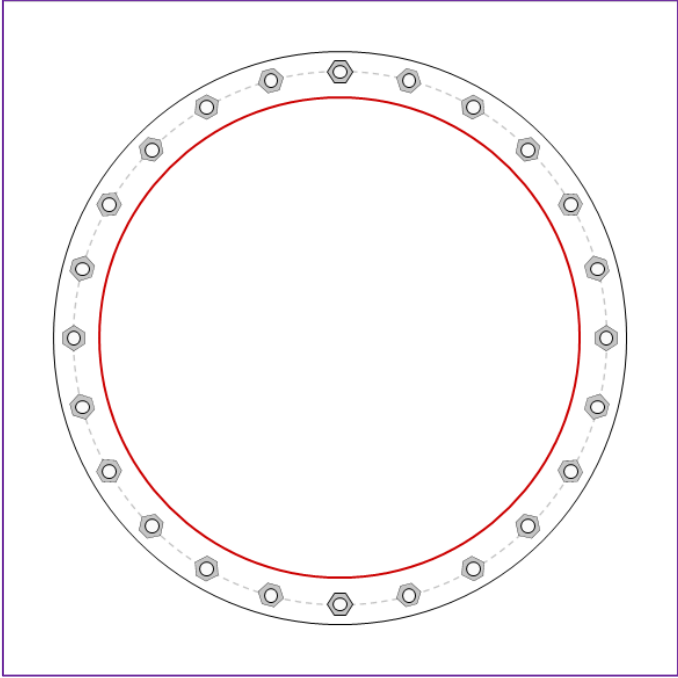
Applied Loads	
Moment (kip-ft)	272.58
Axial Force (kips)	10.41
Shear Force (kips)	13.77

*TIA-222-H Section 15.5 Applied

Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(24) 1" $\varnothing$ bolts (A325 X; Fy=92 ksi, Fu=120 ksi) on 39" BC

Top Plate Data

42" OD x 1.5" Plate (A572-60; Fy=60 ksi, Fu=75 ksi)

Top Stiffener Data

N/A

Top Pole Data

35.2396" x 0.25" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Bottom Plate Data

42" OD x 1.5" Plate (A572-60; Fy=60 ksi, Fu=75 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

35.2396" x 0.28125" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	13.54
Allowable (kips)	54.54
Stress Rating:	23.6% Pass

Top Plate Capacity

Max Stress (ksi):	6.49	(Flexural)
Allowable Stress (ksi):	54.00	
Stress Rating:	11.4%	Pass
Tension Side Stress Rating:	5.7%	Pass

Bottom Plate Capacity

Max Stress (ksi):	6.49	(Flexural)
Allowable Stress (ksi):	54.00	
Stress Rating:	11.4%	Pass
Tension Side Stress Rating:	5.7%	Pass

Monopole Base Plate Connection

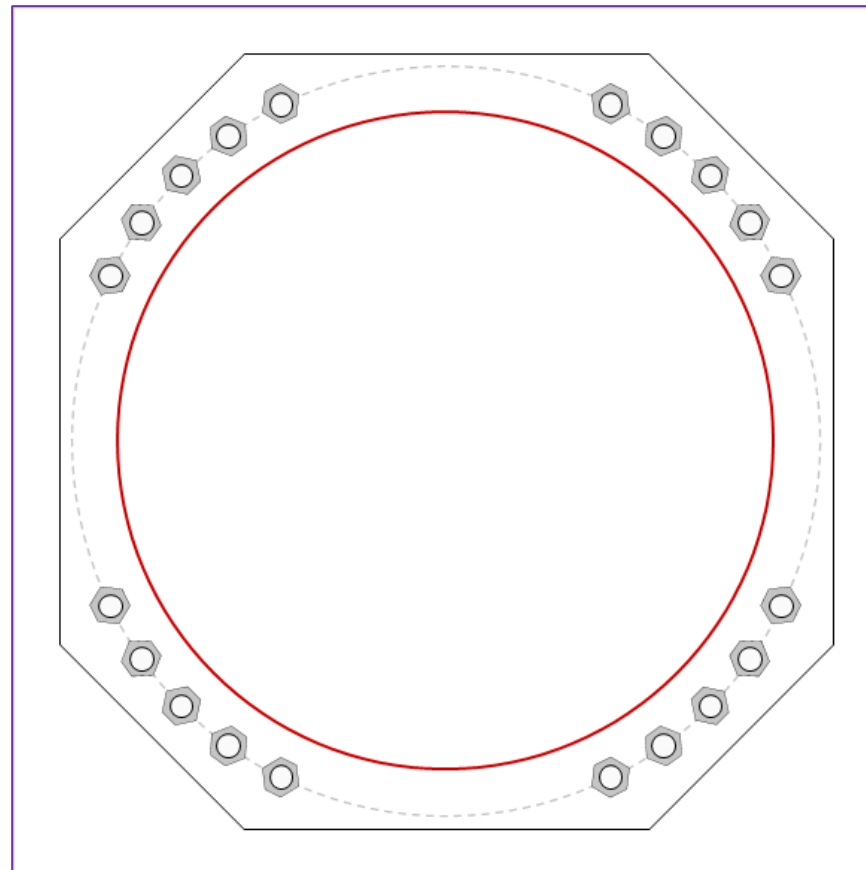


Site Info	
BU #	877803
Site Name	ee's Summit Fire Station
Order #	640178 Rev. 3

Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	No
l_{ar} (in)	0.5

Applied Loads	
Moment (kip-ft)	4556.02
Axial Force (kips)	66.18
Shear Force (kips)	39.55

*TIA-222-H Section 15.5 Applied



Connection Properties

Anchor Rod Data

(20) 2-1/4" ϕ bolts (A615-75 N; $F_y=75$ ksi, $F_u=100$ ksi) on 73" BC
Anchor Spacing: 6 in

Base Plate Data

75.5" W x 2.75" Plate (A572-60; $F_y=60$ ksi, $F_u=75$ ksi); Clip: 18 in

Stiffener Data

N/A

Pole Data

64" x 0.46875" 12-sided pole (A572-65; $F_y=65$ ksi, $F_u=80$ ksi)

Analysis Results

Anchor Rod Summary

(units of kips, kip-in)

$Pu_t = 146.42$	$\phi Pn_t = 243.75$	Stress Rating
$Vu = 1.98$	$\phi Vn = 149.1$	57.2%
$Mu = n/a$	$\phi Mn = n/a$	Pass

Base Plate Summary

Max Stress (ksi):	32.59	(Flexural)
Allowable Stress (ksi):	54	
Stress Rating:	57.5%	Pass

Drilled Pier Foundation

BU # :	877803
Site Name:	Lee's Summit Fire Station
Order Number:	640178 Rev. 0
TIA-222 Revision:	H
Tower Type:	Monopole

Applied Loads		
	Comp.	Uplift
Moment (kip-ft)	4556.02	
Axial Force (kips)	66.19	
Shear Force (kips)	39.52	

Material Properties		
Concrete Strength, f'c:	4	ksi
Rebar Strength, Fy:	60	ksi
Tie Yield Strength, Fyt:	40	ksi

Pier Design Data		
Depth	31	ft
Ext. Above Grade	1	ft
Pier Section 1		
From 1' above grade to 31' below grade		
Pier Diameter	8	ft
Rebar Quantity	24	
Rebar Size	11	
Clear Cover to Ties	3	in
Tie Size	5	
Tie Spacing		in

[Rebar & Pier Options](#)

[Embedded Pole Inputs](#)

[Belled Pier Inputs](#)

Analysis Results		
Soil Lateral Check		
	Compression	Uplift
D _{v=0} (ft from TOC)	8.72	-
Soil Safety Factor	9.20	-
Max Moment (kip-ft)	4846.76	-
Rating*	13.8%	-
Soil Vertical Check		
	Compression	Uplift
Skin Friction (kips)	1328.27	-
End Bearing (kips)	0.00	-
Weight of Concrete (kips)	289.53	-
Total Capacity (kips)	1328.27	-
Axial (kips)	355.72	-
Rating*	25.5%	-
Reinforced Concrete Flexure		
	Compression	Uplift
Critical Depth (ft from TOC)	8.78	-
Critical Moment (kip-ft)	4846.72	-
Critical Moment Capacity	7245.17	-
Rating*	63.7%	-
Reinforced Concrete Shear		
	Compression	Uplift
Critical Depth (ft from TOC)	23.33	-
Critical Shear (kip)	500.57	-
Critical Shear Capacity	731.20	-
Rating*	65.2%	-

Structural Foundation Rating*	65.2%
Soil Interaction Rating*	25.5%

*Rating per TIA-222-H Section 15.5



Check Limitation	
Apply TIA-222-H Section 15.5:	☒
N/A	☐
Additional Longitudinal Rebar	
Input Effective Depths (else Actual):	☐
Shear Design Options	
Check Shear along Depth of Pier:	☒
Utilize Shear-Friction Methodology:	☐
Override Critical Depth:	☐

[Go to Soil Calculations](#)

Soil Profile														
Groundwater Depth		N/A		# of Layers		4								
Layer	Top (ft)	Bottom (ft)	Thickness (ft)	Y _{soil} (pcf)	Y _{concrete} (pcf)	Cohesion (ksf)	Angle of Friction (degrees)	Calculated Ultimate Skin Friction Comp (ksf)	Calculated Ultimate Skin Friction Uplift (ksf)	Ultimate Skin Friction Comp Override (ksf)	Ultimate Skin Friction Uplift Override (ksf)	Ult. Gross Bearing Capacity (ksf)	SPT Blow Count	Soil Type
1	0	4	4	126	150	0	0	0.000	0.000					Cohesionless
2	4	6.5	2.5	126	150	0.955	0	0.525	0.525					Cohesive
3	6.5	16.5	10	122	150	2.691	0	1.480	1.480					Cohesive
4	16.5	31	14.5	142	150	8.33	0	3.749	3.749			0		Cohesive

Address:
No Address at This Location

ASCE 7 Hazards Report

Standard: ASCE/SEI 7-16

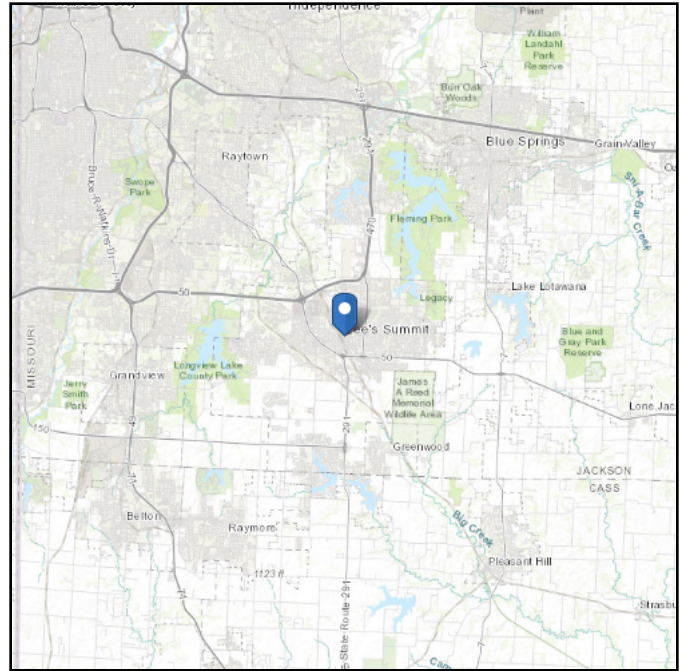
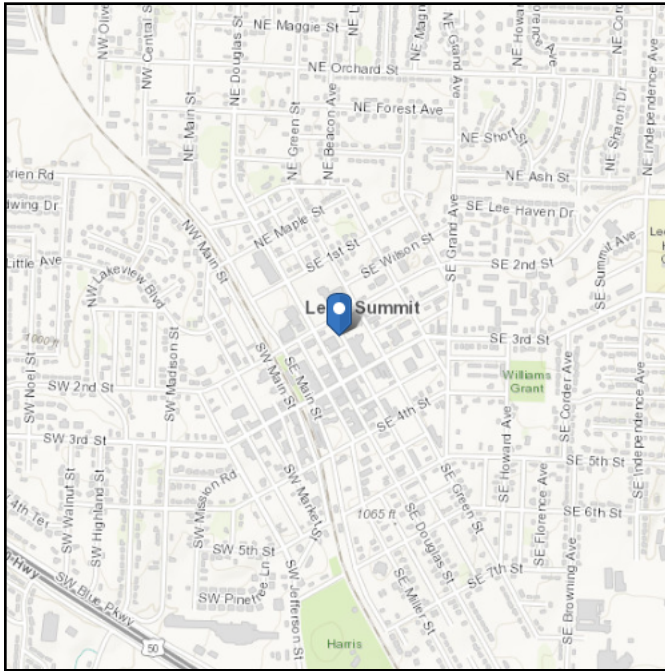
Risk Category: IV

Soil Class: D - Default (see Section 11.4.3)

Latitude: 38.913842

Longitude: -94.376328

Elevation: 1021.03 ft (NAVD 88)



Wind

Results:

Wind Speed	122 Vmph
10-year MRI	76 Vmph
25-year MRI	83 Vmph
50-year MRI	88 Vmph
100-year MRI	94 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1D and Figs. CC.2-1–CC.2-4, and Section 26.5.2

Date Accessed: Sat Dec 24 2022

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 7-16 Standard. Wind speeds correspond to approximately a 1.6% probability of exceedance in 50 years (annual exceedance probability = 0.00033, MRI = 3,000 years).

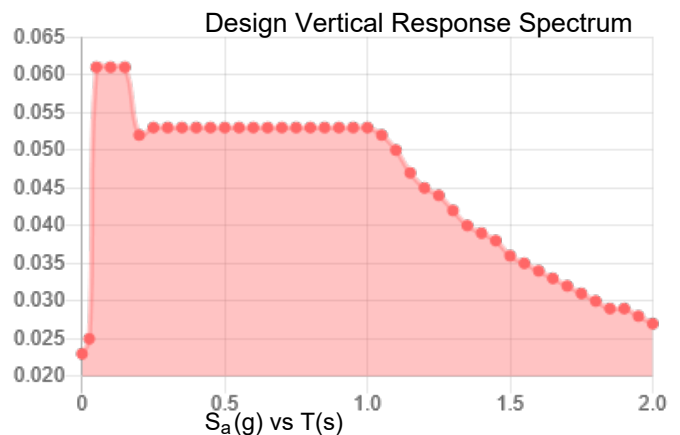
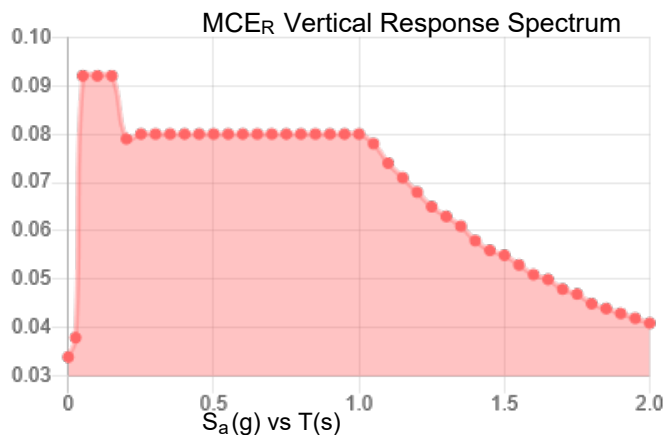
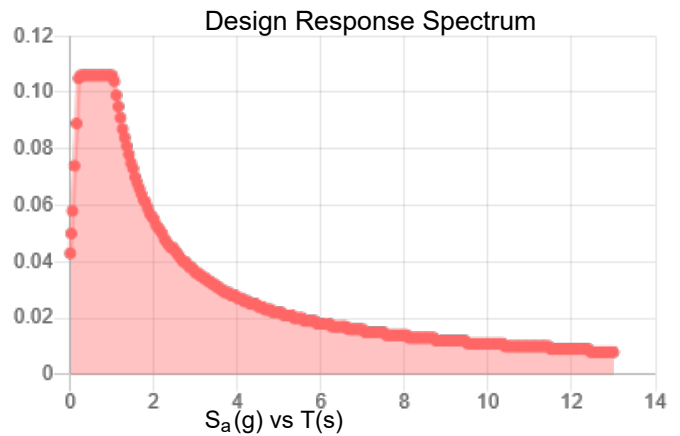
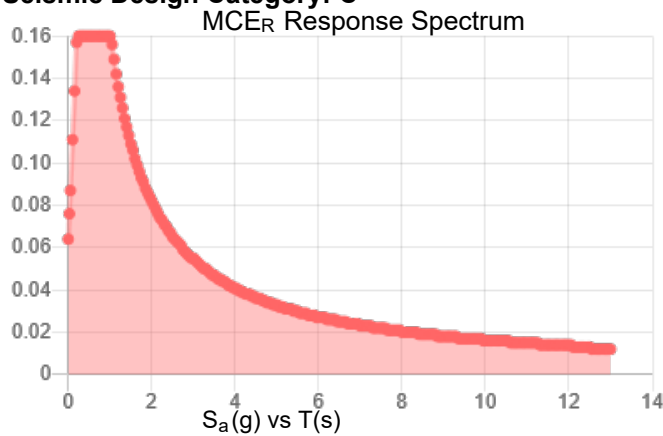
Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

Site Soil Class:

Results:

S_S :	0.1	S_{D1} :	0.109
S_1 :	0.068	T_L :	12
F_a :	1.6	PGA :	0.047
F_v :	2.4	PGA _M :	0.076
S_{MS} :	0.16	F_{PGA} :	1.6
S_{M1} :	0.164	I_e :	1.5
S_{DS} :	0.106	C_v :	0.7

Seismic Design Category: C



Data Accessed:

Sat Dec 24 2022

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

Results:

Ice Thickness: 1.50 in.
Concurrent Temperature: 5 F
Gust Speed 40 mph

Data Source: Standard ASCE/SEI 7-16, Figs. 10-2 through 10-8

Date Accessed: Sat Dec 24 2022

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 500-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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