STRUCTURAL ANALYSIS REPORT
MONOPOLE

Prepared For:

KGI Wireless, Inc.
Building Three, Suite 370
850 Las Climas Parkway
Austin, TX 78746

Structure Rating:	
Tower:	**Pass**
Anchor Rods:	**Pass**
Base Plate:	**Pass**
Foundation:	**Pass**

Sincerely,
Destek Engineering, LLC

08-23-2019

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Missouri Professional Engineer
License No: PE-2011011126

Site ID: A5C0028A
Site Name: Lee's Summit Fire Station
209 S.E. Douglas
Lee's Summit, MO 64063

Destek Job No: 1944007

August 23, 2019

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DESTEK ENGINEERING, LLC
1281 Kennestone Circle, Ste 100, Marietta, GA 30066 -Tel: (770) 693-0835

1.0 SUBJECT AND REFERENCES

The purpose of this analysis is to evaluate the structural capacity of the existing 180 ft. monopole located at 209 S.E Douglas, Lee's Summit, MO 64063 for the additions and alterations proposed by T-Mobile.

The structural analysis is based on the following information provided to Destek Engineering, LLC (Destek):

- RFDS provided by T-Mobile, dated 04/03/2019.
- Construction Drawings prepared by Centerline Solutions, dated 05/25/2017.
- Structural Analysis Report prepared by Selective Site Consultants, Inc., dated 05/31/2017.
- Mount Mapping Report prepared by High Tower Solutions, dated 07/30/2019.

1.1 STRUCTURE

The structure is a 180 ft. tall, 12-sided monopole, which is attached to the foundation with a base plate and anchor bolts. It is formed by the following sections:

Section Length (Feet)	Lap Splice (ft)	Shaft Thickness (in)	Top Diameter (in)	Bottom Diameter (in)	Yield Strength (ksi)
30.35	0.0	0.2500	29.0000	35.2490	65
42.89	6.03	0.2810	35.2490	44.0810	65
36.38	6.73	0.3440	42.2773	49.7680	65
47.21	7.68	0.4060	47.6943	57.4140	65
43.61	0.0	0.4690	55.0208	64.0000	65

2.0 EXISTING AND PROPOSED APPURTENANCES

T-Mobile is proposing the following antenna configuration on the tower:

Existing Configuration of T-Mobile Appurtenances:

RAD Center (Feet AGL)	Antenna & TMA	Feed lines*	Mount
160	(3) Andrew SBNHH-1D65C-SR (3) Andrew TMBX-6517-A1M (3) Andrew TMBXX-6517-A2M (3) FRIG (3) FHFB (6) ETT19V2S12UB (1) NSN COVP	(6) 1-5/8'' (12) 7/8''	(1) 12' Platform with Handrail & (3) Side Arms

***Inside shaft**

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Proposed and Final Configuration of T-Mobile Appurtenances:

RAD Center (Feet AGL)	Antenna & TMA	Feed lines**	Mount
160	(3) Nokia AAHF (3) Nokia AAFIA (3) Commscope FFHH-65C-R3 (3) AHLOA (3) AHFIB	(2) Nokia HCS 2.0 Trunk	(1) 12' Platform with Handrail & (3) Side Arms

****Inside shaft**

Appurtenances by Others:

RAD Center (Feet AGL)	Antenna & TMA	Feed lines	Mount
180	(6) Rfs/Celwave APXVSPP18-C (18) ACU-A20-N (3) RRUS11 (6) RRUS 31 B25	(3) 1-1/2''	(1) 12' Platform with Handrail
160	(3) Telewave ANT150D6-9 (2) Teletronics 15 – 216	(5) 1/2'' (3) 5/8''	(1) 12' Platform with Handrail & (3) Side Arms
134	(3) Argus LLPX310R-V1 (3) Telewave ANT150D6-9 (2) Andrew VHLP2-18 (2) Andrew VHLP1-23 (4) HORIZON DUO (3) nRRHv2 (1) Junction Box	(6) 1/2'' (3) 5/16''	(1) 12' Platform with Handrail & (3) Side Arms
100	(1) Rfs/Celwave PD220 (1) Sinclair SRL235-2	(2) 7/8''	(3) Side Arms
98	(1) Kathrein OGB4-900D	(1) 1/2''	(1) Side Arm
69	(1) Astron Wireless 918-2	(1) 1/2''	(1) Side Arm
45	(1) Decibel DB230-J (1) Kathrein OGB4-900D	(2) 1/2''	(1) Side Arm
42	(1) Astron Wireless VG-1060	(1) 1/2''	(1) Side Arm
29	(1) Sinclair SRL224NM*5	(1) 1/2''	(1) Side Arm

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3.0 CODES AND LOADING

This analysis has been performed in accordance with the TIA-222-H Standard. This analysis utilizes an ultimate 3-gust wind speed of 109 mph from the 2018 International Building Code. The following loading criteria were used in compliance with the standard for Jackson County, MO:

- Ultimate 3-second gust wind speed of 109 mph without ice (V)
- Wind speed of 40 mph concurrent with the ultimate ice thickness of 1.50'' (V_i and ti)
- Exposure Category C
- Topographic Category 1
- Risk Category II (I_w = 1.0)

The following load combinations were used with wind blowing at 0^o, 30^o, 60^o, and 90^o, measured from a line normal to the face of the tower:

- 1.2 D + 1.6 W_o
- 0.9 D + 1.6 W_o
- 1.2 D + 1.0 D_i + 1.0 W_i + 1.0 T_i

D: Dead load of structures and appurtenances
D_i: Weight of ice due to factored ice thickness (based upon t_i)
T_i: Load effects due to temperature
W_o: Wind load without ice (based upon V)
W_i: Weight of ice due to factored ice thickness (based upon V_i)

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4.0 STANDARD CONDITIONS FOR ENGINEERING SERVICES ON EXISTING STRUCTURES

The analysis is based on the information provided to Destek and is assumed to be current and correct. Unless noted otherwise, the structure and the foundation system are assumed to be in good condition, free of defects and can achieve theoretical strength.

It is assumed that the structure has been maintained and shall be maintained during its service. The superstructure and the foundation system are assumed to be designed with proper engineering practice and fabricated, constructed and erected in accordance with the design documents. Destek will accept no liability which may arise due to any existing deficiency in design, material, fabrication, erection, construction, etc. or lack of maintenance.

The analysis does not include a qualification of the mounts attached on the structure or their connections. The analysis is performed to verify the capacity of the main structural members, which is the current practice in the tower industry.

The analysis results presented in this report are only applicable for the previously mentioned existing and proposed additions and alterations. Any deviation of the proposed equipment and placement, etc., will require Destek to generate an additional structural analysis.

5.0 ANALYSIS AND ASSUMPTIONS

The structure was analyzed by utilizing tnxTower, a non-linear 3-Dimensional finite element software, a product of Tower Numerics, Inc. Software output for this analysis is provided in Appendix A of this report.

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6.0 RESULTS AND CONCLUSION

Based on a structural analysis per TIA-222-H, the existing monopole is found to have **adequate** structural capacity for the proposed changes by T-Mobile. For the code specified load combinations and as a maximum, the anchor bolts are stressed to **54.3%** of its structural capacity. The monopole, base plate, and flange connections are stressed to **54.1%**, **52.1%** and **18.8%** of their capacities, respectively.

Based on reaction comparison, the base foundation is found to have **adequate** structural capacity for the proposed changes by T-Mobile.

Maximums	Destek Analysis	Original Design *1.35
Base Shear (kips)	36	57
Base Axial (kips)	59	63
Base Moment(kip*ft)	4131	6677

*Reactions multiplied with 1.35 to compare ASD reactions with LRFD reactions

Note: Capacities per TIA-222-H, Section 15.5

Therefore, the proposed additions and alterations by T-Mobile **can** be implemented as intended with the conditions outlined in this report.

Should you need any clarifications or have any questions about this report, please contact Ahmet Colakoglu at (770) 693-0835 or acolakoglu@destekengineering.com

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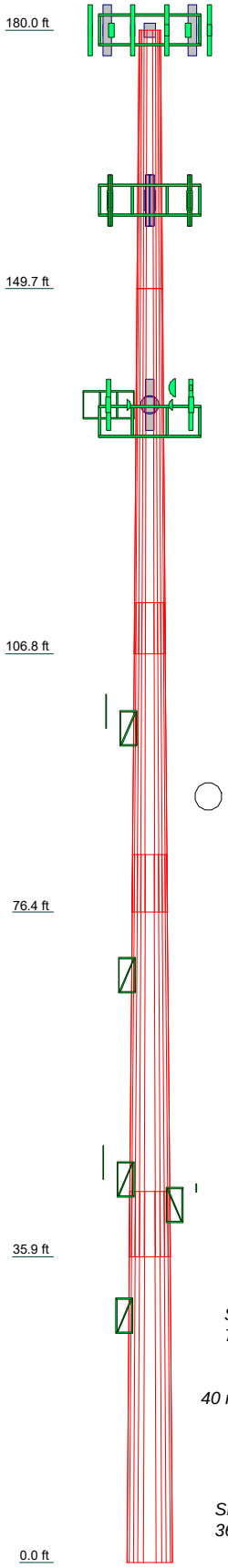
APPENDIX A
SOFTWARE OUTPUT

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	30.350	12	0.2500		29.0000	35.2490		2.6
2	42.890	12	0.2810	6.030	35.2490	44.0810		5.2
3	36.380	12	0.3440	6.730	42.2773	49.7680	A572-65	6.3
4	47.210	12	0.4060	7.680	47.6943	57.4140		11.0
5	43.610	12	0.4690		55.0208	64.0000		13.2
								38.3



ALL REACTIONS ARE FACTORED

AXIAL 96 K
SHEAR 7 K
MOMENT 776 kip-ft
TORQUE 1 kip-ft
40 mph WIND - 1.5000 in ICE

AXIAL 59 K
SHEAR 36 K
MOMENT 4131 kip-ft
TORQUE 4 kip-ft
REACTIONS - 109 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) APXVSPP18-C w/ Mount Pipe	180	6'-P2x0.154	160
(2) APXVSPP18-C w/ Mount Pipe	180	6'-P2x0.154	160
(2) APXVSPP18-C w/ Mount Pipe	180	LLPX310R-V1 w/ Mount Pipe	134
(6) ACU-A20-N	180	LLPX310R-V1 w/ Mount Pipe	134
(6) ACU-A20-N	180	LLPX310R-V1 w/ Mount Pipe	134
(6) ACU-A20-N	180	ANT150D6-9	134
RRUS 11	180	ANT150D6-9	134
RRUS 11	180	ANT150D6-9	134
RRUS 11	180	Horizon DUO	134
(2) RRUS 31 B25	180	Horizon DUO	134
(2) RRUS 31 B25	180	Horizon DUO	134
(2) RRUS 31 B25	180	Horizon DUO	134
Platform Mount [LP 602-1]	180	nRRHv2	134
Nokia AAHF	160	nRRHv2	134
Nokia AAHF	160	nRRHv2	134
Nokia AAHF	160	Junction Box	134
AAFIA w/ Mount Pipe	160	(3) Side Arms	134
AAFIA w/ Mount Pipe	160	Platform Mount [LP 713-1]	134
AAFIA w/ Mount Pipe	160	VHLP2-18	134
FFHH-65C-R3 w/ Mount Pipe	160	VHLP1-23	134
FFHH-65C-R3 w/ Mount Pipe	160	VHLP2-18	134
FFHH-65C-R3 w/ Mount Pipe	160	VHLP1-23	134
AHFIB	160	SRL235-2	100
AHFIB	160	PD220	100
AHFIB	160	(3) Side Arms	100
AHLOA	160	OGB4-900D	98
AHLOA	160	Side Arm	98
AHLOA	160	918-2	69
Platform Mount [LP 713-1]	160	Side Arm	69
Side Arm Mount [SO 601-3]	160	Side Arm	45
ANT150D6-9	160	OGB4-900D	45
ANT150D6-9	160	DB230-J	45
ANT150D6-9	160	VG-1060	42
15-216	160	Side Arm	42
15-216	160	SRL224NM*5	29
6'-P2x0.154	160	Side Arm	29

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 C to the TIA-222-H Standard.
3. Tower designed for a 109 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 0.000 ft
8. TIA-222-H Annex S
9. TOWER RATING: 54.1%

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Marietta, GA 30066
Phone: (770) 693-0835
FAX:

Job: *A5C0028A AAS*			
Project: *1944007*			
Client: KGI Wireless, Inc.	Drawn by:		App'd:
Code: TIA-222-H	Date: 08/08/19		Scale: NTS
Path: C:\Users\desan3\Desktop\CROWN 2019\Non-Crown SA\1944007 - A5C0028A AAS\TNX\1944007 - A5C0028A AAS.eri			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: 1022.000 ft.
Basic wind speed of 109 mph.
Risk Category II.
Exposure Category C.
Simplified Topographic Factor Procedure for wind speed-up calculations is used.
Topographic Category: 1.
Crest Height: 0.000 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.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
TIA-222-H Annex S.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.05.
Tower analysis based on target reliabilities in accordance with Annex S.
Load Modification Factors used: $K_{es}(F_w) = 0.95$, $K_{es}(t_i) = 0.85$.
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		Retension 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. Exemption
	Include Bolts In Member Capacity		Autocalc Torque Arm Areas		Use TIA-222-H Tension Splice Exemption
	Leg Bolts Are At Top Of Section		Add IBC .6D+W Combination		Poles
	Secondary Horizontal Braces Leg		Sort Capacity Reports By Component	√	Include Shear-Torsion Interaction
	Use Diamond Inner Bracing (4 Sided)		Triangulate Diamond Inner Bracing		Always Use Sub-Critical Flow
	SR Members Have Cut Ends		Treat Feed Line Bundles As Cylinder		Use Top Mounted Sockets
	SR Members Are Concentric		Ignore KL/ry For 60 Deg. Angle Legs		Pole Without Linear Attachments
					Pole With Shroud Or No Appurtenances
					Outside and Inside Corner Radii Are Known

Tapered Pole Section Geometry

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	180.000-149.650	30.350	0.00	12	29.0000	35.2490	0.2500	0.3750	A572-65 (65 ksi)
L2	149.650-106.760	42.890	6.03	12	35.2490	44.0810	0.2810	0.4215	A572-65 (65 ksi)
L3	106.760-76.410	36.380	6.73	12	42.2773	49.7680	0.3440	0.5160	A572-65 (65 ksi)
L4	76.410-35.930	47.210	7.68	12	47.6943	57.4140	0.4060	0.6090	A572-65 (65 ksi)
L5	35.930-0.000	43.610		12	55.0208	64.0000	0.4690	0.7035	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	29.9789	23.1438	2441.7173	10.2925	15.0220	162.5428	4947.5812	11.3906	7.4370	29.748
	36.4484	28.1742	4405.0287	12.5296	18.2590	241.2527	8925.7823	13.8665	9.1117	36.447
L2	36.4429	31.6397	4938.1073	12.5185	18.2590	270.4481	10005.9442	15.5721	9.0702	32.278
	45.5864	39.6311	9704.4399	15.6804	22.8340	425.0003	19663.8262	19.5052	11.4372	40.702
L3	44.9934	46.4487	10425.0243	15.0121	21.8996	476.0364	21123.9257	22.8606	10.8694	31.597
	51.4629	54.7460	17069.2303	17.6938	25.7798	662.1159	34586.8882	26.9443	12.8769	37.433
L4	50.7396	61.8209	17645.2741	16.9292	24.7056	714.2206	35754.1092	30.4264	12.2380	30.143
	59.3677	74.5277	30915.4285	20.4089	29.7405	1039.5077	62643.0397	36.6803	14.8429	36.559
L5	58.5161	82.3831	31292.6557	19.5296	28.5008	1097.9577	63407.4043	40.5464	14.1171	30.1
	66.1750	95.9432	49427.8521	22.7441	33.1520	1490.9463	100154.2289	47.2203	16.5235	35.231

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	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 180.000-149.650				1	1	1			
L2 149.650-106.760				1	1	1			
L3 106.760-76.410				1	1	1			
L4 76.410-35.930				1	1	1			
L5 35.930-0.000				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
***134' ***										
LDF4-50A(1/2)	C	No	Surface Ar (CaAa)	134.000 - 10.000	3	3	-0.270 -0.250	0.6250		0.15
LDF4-50A(1/2)	C	No	Surface Ar (CaAa)	134.000 - 10.000	3	3	-0.280 -0.280	0.0000		0.15
ATCB-B01-100(5/16)	C	No	Surface Ar (CaAa)	134.000 - 10.000	3	3	-0.280 -0.280	0.0000		0.06
2" Rigid Conduit	C	No	Surface Ar (CaAa)	134.000 - 10.000	1	1	-0.280 -0.280	2.0000		2.80
***180' ***										
HFT1206-24SV2-XXX(1-1/2)	C	No	Surface Ar (CaAa)	180.000 - 10.000	3	2	0.000 0.000	1.5500		1.89
***										
Safety Line 3/8	C	No	Surface Ar (CaAa)	180.000 - 10.000	1	1	0.000 0.000	0.3750		0.22
***										

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_A ft^2/ft	Weight plf
***									
LDF4-50A(1/2)	A	No	No	Inside Pole	29.000 - 10.000	6	No Ice	0.000	0.15
							1/2" Ice	0.000	0.15
							1" Ice	0.000	0.15
							2" Ice	0.000	0.15
LDF4-50A(1/2)	A	No	No	Inside Pole	42.000 - 29.000	5	No Ice	0.000	0.15
							1/2" Ice	0.000	0.15
							1" Ice	0.000	0.15
							2" Ice	0.000	0.15
LDF4-50A(1/2)	A	No	No	Inside Pole	45.000 - 42.000	3	No Ice	0.000	0.15
							1/2" Ice	0.000	0.15
							1" Ice	0.000	0.15
							2" Ice	0.000	0.15
LDF4-50A(1/2)	A	No	No	Inside Pole	69.000 - 45.000	2	No Ice	0.000	0.15
							1/2" Ice	0.000	0.15
							1" Ice	0.000	0.15
							2" Ice	0.000	0.15
LDF4-50A(1/2)	A	No	No	Inside Pole	98.000 - 69.000	1	No Ice	0.000	0.15
							1/2" Ice	0.000	0.15
							1" Ice	0.000	0.15
							2" Ice	0.000	0.15
***100' ***									
LDF5-50A(7/8)	A	No	No	Inside Pole	100.000 - 10.000	1	No Ice	0.000	0.33
							1/2" Ice	0.000	0.33
							1" Ice	0.000	0.33
							2" Ice	0.000	0.33
***160' ***									

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
LDF4-50A(1/2)	A	No	No	Inside Pole	160.000 - 10.000	5	No Ice	0.000	0.15
							1/2" Ice	0.000	0.15
							1" Ice	0.000	0.15
							2" Ice	0.000	0.15
LDF4.5-50(5/8)	A	No	No	Inside Pole	160.000 - 10.000	3	No Ice	0.000	0.15
							1/2" Ice	0.000	0.15
							1" Ice	0.000	0.15
							2" Ice	0.000	0.15
160' T-Mobile									
HCS 2.0 Part 2(5/8)	B	No	No	Inside Pole	160.000 - 10.000	2	No Ice	0.000	0.34
							1/2" Ice	0.000	0.34
							1" Ice	0.000	0.34
							2" Ice	0.000	0.34
***									

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	180.000-149.650	A	0.000	0.000	0.000	0.000	0.01
		B	0.000	0.000	0.000	0.000	0.01
		C	0.000	0.000	10.547	0.000	0.18
L2	149.650-106.760	A	0.000	0.000	0.000	0.000	0.05
		B	0.000	0.000	0.000	0.000	0.03
		C	0.000	0.000	25.460	0.000	0.36
L3	106.760-76.410	A	0.000	0.000	0.000	0.000	0.05
		B	0.000	0.000	0.000	0.000	0.02
		C	0.000	0.000	22.307	0.000	0.30
L4	76.410-35.930	A	0.000	0.000	0.000	0.000	0.08
		B	0.000	0.000	0.000	0.000	0.03
		C	0.000	0.000	29.753	0.000	0.40
L5	35.930-0.000	A	0.000	0.000	0.000	0.000	0.06
		B	0.000	0.000	0.000	0.000	0.02
		C	0.000	0.000	19.059	0.000	0.25

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_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	180.000-149.650	A	1.497	0.000	0.000	0.000	0.000	0.01
		B		0.000	0.000	0.000	0.000	0.01
		C		0.000	0.000	33.345	0.000	0.64
L2	149.650-106.760	A	1.460	0.000	0.000	0.000	0.000	0.05
		B		0.000	0.000	0.000	0.000	0.03

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
		C		0.000	0.000	96.005	0.000	1.45
L3	106.760-76.410	A	1.412	0.000	0.000	0.000	0.000	0.05
		B		0.000	0.000	0.000	0.000	0.02
		C		0.000	0.000	88.102	0.000	1.25
L4	76.410-35.930	A	1.344	0.000	0.000	0.000	0.000	0.08
		B		0.000	0.000	0.000	0.000	0.03
		C		0.000	0.000	114.791	0.000	1.61
L5	35.930-0.000	A	1.201	0.000	0.000	0.000	0.000	0.06
		B		0.000	0.000	0.000	0.000	0.02
		C		0.000	0.000	71.085	0.000	0.98

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	180.000-149.650	0.0000	2.1194	0.0000	3.6845
L2	149.650-106.760	0.7326	3.1357	1.6591	5.5053
L3	106.760-76.410	1.0954	3.6622	2.3979	6.4928
L4	76.410-35.930	1.1139	3.7109	2.5194	6.8197
L5	35.930-0.000	0.8317	2.7637	2.0811	5.6423

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

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L1	15	HFT1206-24SV2-XXX(1-1/2)	149.65 - 180.00	1.0000	1.0000
L1	23	Safety Line 3/8	149.65 - 180.00	1.0000	1.0000
L2	10	LDF4-50A(1/2)	106.76 - 134.00	1.0000	1.0000
L2	11	LDF4-50A(1/2)	106.76 - 134.00	1.0000	1.0000
L2	12	ATCB-B01-100(5/16)	106.76 - 134.00	1.0000	1.0000
L2	13	2" Rigid Conduit	106.76 - 134.00	1.0000	1.0000
L2	15	HFT1206-24SV2-XXX(1-1/2)	106.76 - 149.65	1.0000	1.0000
L2	23	Safety Line 3/8	106.76 - 149.65	1.0000	1.0000
L3	10	LDF4-50A(1/2)	76.41 - 106.76	1.0000	1.0000
L3	11	LDF4-50A(1/2)	76.41 - 106.76	1.0000	1.0000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L3	12	ATCB-B01-100(5/16)	76.41 - 106.76	1.0000	1.0000
L3	13	2" Rigid Conduit	76.41 - 106.76	1.0000	1.0000
L3	15	HFT1206-24SV2-XXX(1-1/2)	76.41 - 106.76	1.0000	1.0000
L3	23	Safety Line 3/8	76.41 - 106.76	1.0000	1.0000
L4	10	LDF4-50A(1/2)	35.93 - 76.41	1.0000	1.0000
L4	11	LDF4-50A(1/2)	35.93 - 76.41	1.0000	1.0000
L4	12	ATCB-B01-100(5/16)	35.93 - 76.41	1.0000	1.0000
L4	13	2" Rigid Conduit	35.93 - 76.41	1.0000	1.0000
L4	15	HFT1206-24SV2-XXX(1-1/2)	35.93 - 76.41	1.0000	1.0000
L4	23	Safety Line 3/8	35.93 - 76.41	1.0000	1.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
***180' ***									
(2) APXVSPP18-C w/ Mount Pipe	A	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.600 5.050 5.500 6.440	4.010 4.450 4.890 5.820	0.09 0.15 0.23 0.41
(2) APXVSPP18-C w/ Mount Pipe	B	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.600 5.050 5.500 6.440	4.010 4.450 4.890 5.820	0.09 0.15 0.23 0.41
(2) APXVSPP18-C w/ Mount Pipe	C	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.600 5.050 5.500 6.440	4.010 4.450 4.890 5.820	0.09 0.15 0.23 0.41
(6) ACU-A20-N	A	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.067 0.104 0.148 0.259	0.117 0.162 0.215 0.343	0.00 0.00 0.00 0.01
(6) ACU-A20-N	B	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.067 0.104 0.148 0.259	0.117 0.162 0.215 0.343	0.00 0.00 0.00 0.01
(6) ACU-A20-N	C	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.067 0.104 0.148 0.259	0.117 0.162 0.215 0.343	0.00 0.00 0.00 0.01
RRUS 11	A	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.784 2.992 3.207 3.658	1.187 1.334 1.490 1.833	0.05 0.07 0.10 0.15

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
RRUS 11	B	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.784 2.992 3.207 3.658	1.187 1.334 1.490 1.833	0.05 0.07 0.10 0.15
RRUS 11	C	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.784 2.992 3.207 3.658	1.187 1.334 1.490 1.833	0.05 0.07 0.10 0.15
(2) RRUS 31 B25	A	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.623 1.783 1.952 2.311	1.279 1.426 1.580 1.911	0.06 0.07 0.09 0.14
(2) RRUS 31 B25	B	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.623 1.783 1.952 2.311	1.279 1.426 1.580 1.911	0.06 0.07 0.09 0.14
(2) RRUS 31 B25	C	From Leg	4.000 0.00 0.00	0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.623 1.783 1.952 2.311	1.279 1.426 1.580 1.911	0.06 0.07 0.09 0.14
Platform Mount [LP 602-1]	C	None		0.0000	180.000	No Ice 1/2" Ice 1" Ice 2" Ice	31.070 34.820 38.480 45.600	31.070 34.820 38.480 45.600	1.34 1.97 2.67 4.31
***134' ***									
LLPX310R-V1 w/ Mount Pipe	A	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.538 4.891 5.254 6.006	2.983 3.526 4.086 5.236	0.05 0.08 0.13 0.23
LLPX310R-V1 w/ Mount Pipe	B	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.538 4.891 5.254 6.006	2.983 3.526 4.086 5.236	0.05 0.08 0.13 0.23
LLPX310R-V1 w/ Mount Pipe	C	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.538 4.891 5.254 6.006	2.983 3.526 4.086 5.236	0.05 0.08 0.13 0.23
ANT150D6-9	A	From Leg	4.000 0.00 8.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.960 5.610 7.260 10.560	3.960 5.610 7.260 10.560	0.03 0.06 0.09 0.15
ANT150D6-9	B	From Leg	4.000 0.00 8.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.960 5.610 7.260 10.560	3.960 5.610 7.260 10.560	0.03 0.06 0.09 0.15
ANT150D6-9	C	From Leg	4.000 0.00 -8.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.960 5.610 7.260 10.560	3.960 5.610 7.260 10.560	0.03 0.06 0.09 0.15
Horizon DUO	B	From Leg	4.000 0.00 4.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.469 0.556 0.650 0.861	0.294 0.365 0.444 0.624	0.01 0.01 0.02 0.04

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Horizon DUO	A	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.469 0.556 0.650 0.861	0.294 0.365 0.444 0.624	0.01 0.01 0.02 0.04
Horizon DUO	B	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.469 0.556 0.650 0.861	0.294 0.365 0.444 0.624	0.01 0.01 0.02 0.04
Horizon DUO	C	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.469 0.556 0.650 0.861	0.294 0.365 0.444 0.624	0.01 0.01 0.02 0.04
nRRHv2	A	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.486 2.687 2.895 3.333	1.482 1.645 1.820 2.196	0.06 0.08 0.10 0.16
nRRHv2	B	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.486 2.687 2.895 3.333	1.482 1.645 1.820 2.196	0.06 0.08 0.10 0.16
nRRHv2	C	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.486 2.687 2.895 3.333	1.482 1.645 1.820 2.196	0.06 0.08 0.10 0.16
Junction Box	C	From Leg	4.000 0.00 2.00	0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.530 0.630 0.730 0.930	0.270 0.340 0.410 0.550	0.01 0.01 0.01 0.02
(3) Side Arms	C	None		0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.140 3.160 4.180 6.220	2.140 3.160 4.180 6.220	0.07 0.10 0.13 0.19
Platform Mount [LP 713-1]	C	None		0.0000	134.000	No Ice 1/2" Ice 1" Ice 2" Ice	32.890 35.760 38.760 45.260	32.890 35.760 38.760 45.260	1.51 2.23 3.03 4.86
***100' ***									
SRL235-2	A	From Leg	4.000 0.00 9.00	0.0000	100.000	No Ice 1/2" Ice 1" Ice 2" Ice	13.630 15.630 17.630 21.630	13.630 15.630 17.630 21.630	0.05 0.14 0.22 0.40
PD220	B	From Leg	4.000 0.00 11.00	0.0000	100.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.080 5.300 7.537 12.060	3.080 5.300 7.537 12.060	0.02 0.05 0.09 0.21
(3) Side Arms	C	None		0.0000	100.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.220 4.150 5.080 6.940	3.220 4.150 5.080 6.940	0.08 0.11 0.14 0.20
***98' ***									
OGB4-900D	C	From Leg	4.000 0.00 2.00	0.0000	98.000	No Ice 1/2" Ice 1" Ice	0.785 1.028 1.281	0.785 1.028 1.281	0.01 0.02 0.03

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						2" Ice	1.814	1.814	0.05
Side Arm	C	From Leg	1.000 0.00 0.00	0.0000	98.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.850 1.140 1.430 2.010	1.670 2.340 3.010 4.350	0.07 0.08 0.09 0.11
***69' ***									
918-2	C	From Leg	4.000 0.00 1.00	0.0000	69.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.120 0.280 0.440 0.760	0.030 0.110 0.190 0.350	0.00 0.00 0.00 0.01
Side Arm	C	From Leg	1.000 0.00 0.00	0.0000	69.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.850 1.140 1.430 2.010	1.670 2.340 3.010 4.350	0.07 0.08 0.09 0.11
***45' ***									
OGB4-900D	C	From Leg	4.000 0.00 2.00	0.0000	45.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.785 1.028 1.281 1.814	0.785 1.028 1.281 1.814	0.01 0.02 0.03 0.05
DB230-J	C	From Leg	4.000 0.00 -1.00	0.0000	45.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.250 0.450 0.650 1.050	0.250 0.450 0.650 1.050	0.01 0.01 0.02 0.02
Side Arm	C	From Leg	1.000 0.00 0.00	0.0000	45.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.850 1.140 1.430 2.010	1.670 2.340 3.010 4.350	0.07 0.08 0.09 0.11
***42' **									
VG-1060	B	From Leg	4.000 0.00 2.00	0.0000	42.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.130 0.201 0.281 0.469	0.130 0.201 0.281 0.469	0.00 0.00 0.01 0.01
Side Arm	B	From Leg	1.000 0.00 0.00	0.0000	42.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.850 1.140 1.430 2.010	1.670 2.340 3.010 4.350	0.07 0.08 0.09 0.11
***29' ***									
SRL224NM*5	C	From Leg	4.000 0.00 6.00	0.0000	29.000	No Ice 1/2" Ice 1" Ice 2" Ice	5.220 7.020 8.820 12.420	5.220 7.020 8.820 12.420	0.04 0.07 0.11 0.18
Side Arm	C	From Leg	1.000 0.00 0.00	0.0000	29.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.850 1.140 1.430 2.010	1.670 2.340 3.010 4.350	0.07 0.08 0.09 0.11
***160' ***									
Nokia AAHF	A	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.212 4.468 4.731 5.279	2.073 2.265 2.468 2.904	0.10 0.14 0.17 0.26
Nokia AAHF	B	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice	4.212 4.468 4.731	2.073 2.265 2.468	0.10 0.14 0.17

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						2" Ice	5.279	2.904	0.26
Nokia AAHF	C	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.212 4.468 4.731 5.279	2.073 2.265 2.468 2.904	0.10 0.14 0.17 0.26
AAFIA w/ Mount Pipe	A	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	15.880 16.512 17.109 18.325	9.755 10.944 11.852 13.687	0.30 0.42 0.55 0.84
AAFIA w/ Mount Pipe	B	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	15.880 16.512 17.109 18.325	9.755 10.944 11.852 13.687	0.30 0.42 0.55 0.84
AAFIA w/ Mount Pipe	C	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	15.880 16.512 17.109 18.325	9.755 10.944 11.852 13.687	0.30 0.42 0.55 0.84
FFHH-65C-R3 w/ Mount Pipe	A	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	12.970 13.620 14.270 15.620	6.200 6.770 7.360 8.570	0.16 0.30 0.45 0.79
FFHH-65C-R3 w/ Mount Pipe	B	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	12.970 13.620 14.270 15.620	6.200 6.770 7.360 8.570	0.16 0.30 0.45 0.79
FFHH-65C-R3 w/ Mount Pipe	C	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	12.970 13.620 14.270 15.620	6.200 6.770 7.360 8.570	0.16 0.30 0.45 0.79
AHFIB	A	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.676 3.925 4.181 4.715	2.309 2.516 2.731 3.182	0.09 0.12 0.15 0.23
AHFIB	B	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.676 3.925 4.181 4.715	2.309 2.516 2.731 3.182	0.09 0.12 0.15 0.23
AHFIB	C	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.676 3.925 4.181 4.715	2.309 2.516 2.731 3.182	0.09 0.12 0.15 0.23
AHLOA	A	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.229 2.422 2.623 3.048	1.391 1.552 1.720 2.082	0.08 0.10 0.12 0.18
AHLOA	B	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.229 2.422 2.623 3.048	1.391 1.552 1.720 2.082	0.08 0.10 0.12 0.18
AHLOA	C	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.229 2.422 2.623 3.048	1.391 1.552 1.720 2.082	0.08 0.10 0.12 0.18

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Platform Mount [LP 713-1]	C	None		0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	32.890 35.760 38.760 45.260	32.890 35.760 38.760 45.260	1.51 2.23 3.03 4.86
Side Arm Mount [SO 601-3]	C	None		0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	7.630 9.410 11.340 15.830	7.630 9.410 11.340 15.830	0.48 0.59 0.72 1.08
ANT150D6-9	A	From Leg	4.000 0.00 10.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.960 5.610 7.260 10.560	3.960 5.610 7.260 10.560	0.03 0.06 0.09 0.15
ANT150D6-9	A	From Leg	4.000 0.00 10.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.960 5.610 7.260 10.560	3.960 5.610 7.260 10.560	0.03 0.06 0.09 0.15
ANT150D6-9	A	From Leg	4.000 0.00 10.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	3.960 5.610 7.260 10.560	3.960 5.610 7.260 10.560	0.03 0.06 0.09 0.15
15-216	C	From Leg	4.000 0.00 10.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.250 2.520 2.790 3.330	0.740 1.070 1.400 2.060	0.01 0.03 0.05 0.09
15-216	C	From Leg	4.000 0.00 4.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.250 2.520 2.790 3.330	0.740 1.070 1.400 2.060	0.01 0.03 0.05 0.09
6'-P2x0.154	A	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.425 1.925 2.294 3.060	1.425 1.925 2.294 3.060	0.02 0.03 0.05 0.09
6'-P2x0.154	B	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.425 1.925 2.294 3.060	1.425 1.925 2.294 3.060	0.02 0.03 0.05 0.09
6'-P2x0.154	C	From Leg	4.000 0.00 0.00	0.0000	160.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.425 1.925 2.294 3.060	1.425 1.925 2.294 3.060	0.02 0.03 0.05 0.09

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		Aperture Area ft^2	Weight K
VHLP2-18	A	Paraboloid w/o Radome	From Leg	1.000 0.00 2.00	0.0000		134.000	2.175	No Ice 1/2" Ice 1" Ice 2" Ice	3.715 4.006 4.296 4.876	0.03 0.05 0.07 0.11
VHLP1-23	B	Paraboloid w/o Radome	From Leg	1.000 0.00 2.00	0.0000		134.000	1.275	No Ice 1/2" Ice 1" Ice 2" Ice	1.280 1.450 1.620 1.970	0.01 0.02 0.03 0.04
VHLP2-18	B	Paraboloid w/o Radome	From Leg	1.000 0.00 4.00	0.0000		134.000	2.175	No Ice 1/2" Ice 1" Ice 2" Ice	3.715 4.006 4.296 4.876	0.03 0.05 0.07 0.11
VHLP1-23	C	Paraboloid w/o Radome	From Leg	1.000 0.00 2.00	0.0000		134.000	1.275	No Ice 1/2" Ice 1" Ice 2" Ice	1.280 1.450 1.620 1.970	0.01 0.02 0.03 0.04

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
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

Comb. No.	Description
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	180 - 149.65	Pole	Max Tension	2	0.00	-0.00	-0.00
			Max. Compression	26	-24.92	0.68	0.58
			Max. Mx	20	-10.80	218.69	-0.61
			Max. My	2	-10.86	-0.60	210.05
			Max. Vy	20	-12.73	218.69	-0.61
			Max. Vx	14	12.16	0.86	-209.68
			Max. Torque	8			1.98
L2	149.65 - 106.76	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-40.45	0.43	-1.98
			Max. Mx	20	-18.88	841.90	1.12
			Max. My	14	-18.95	1.82	-806.81
			Max. Vy	20	-20.56	841.90	1.12
			Max. Vx	2	-19.71	2.69	806.54
			Max. Torque	20			-2.12
L3	106.76 - 76.41	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-52.51	0.18	-3.40
			Max. Mx	20	-26.64	1533.83	4.11
			Max. My	14	-26.70	2.41	-1471.36
			Max. Vy	20	-25.53	1533.83	4.11
			Max. Vx	2	-24.60	7.55	1470.75
			Max. Torque	20			-4.73
L4	76.41 - 35.93	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-71.10	1.13	-7.67
			Max. Mx	20	-40.05	2653.25	8.11
			Max. My	14	-40.08	3.02	-2553.62
			Max. Vy	20	-31.01	2653.25	8.11
			Max. Vx	2	-30.10	14.97	2551.27
			Max. Torque	20			-4.56
L5	35.93 - 0	Pole	Max Tension	1	0.00	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	26	-95.85	1.83	-11.83
			Max. Mx	20	-59.47	4130.70	13.05
			Max. My	14	-59.47	2.75	-3992.62
			Max. Vy	20	-36.33	4130.70	13.05
			Max. Vx	2	-35.47	23.07	3988.65
			Max. Torque	20			-4.18

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	26	95.85	-0.00	0.00
	Max. H_x	20	59.49	36.30	0.15
	Max. H_z	3	44.61	0.18	35.44
	Max. M_x	2	3988.65	0.18	35.44
	Max. M_z	8	4118.92	-36.24	0.04
	Max. Torsion	6	3.54	-30.60	17.67
	Min. Vert	15	44.61	-0.01	-35.42
	Min. H_x	8	59.49	-36.24	0.04
	Min. H_z	15	44.61	-0.01	-35.42
	Min. M_x	14	-3992.62	-0.01	-35.41
	Min. M_z	20	-4130.70	36.30	0.15
	Min. Torsion	20	-3.60	36.30	0.15

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	49.57	-0.00	0.00	3.30	0.85	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	59.49	-0.18	-35.44	-3988.65	23.07	-1.16
0.9 Dead+1.0 Wind 0 deg - No Ice	44.61	-0.18	-35.44	-3959.41	22.65	-1.16
1.2 Dead+1.0 Wind 30 deg - No Ice	59.49	17.69	-30.56	-3436.23	-1996.85	-2.74
0.9 Dead+1.0 Wind 30 deg - No Ice	44.61	17.68	-30.56	-3410.97	-1981.82	-2.74
1.2 Dead+1.0 Wind 60 deg - No Ice	59.49	30.60	-17.67	-1987.77	-3451.18	-3.54
0.9 Dead+1.0 Wind 60 deg - No Ice	44.61	30.60	-17.67	-1973.58	-3425.04	-3.54
1.2 Dead+1.0 Wind 90 deg - No Ice	59.49	36.24	-0.04	-5.67	-4118.92	-3.40
0.9 Dead+1.0 Wind 90 deg - No Ice	44.61	36.23	-0.04	-6.62	-4087.50	-3.40
1.2 Dead+1.0 Wind 120 deg - No Ice	59.49	30.62	17.82	2011.55	-3451.08	-2.42

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
0.9 Dead+1.0 Wind 120 deg - No Ice	44.61	30.62	17.82	1995.18	-3424.95	-2.42
1.2 Dead+1.0 Wind 150 deg - No Ice	59.49	17.60	30.72	3464.09	-1978.91	-0.83
0.9 Dead+1.0 Wind 150 deg - No Ice	44.61	17.60	30.72	3436.63	-1964.06	-0.83
1.2 Dead+1.0 Wind 180 deg - No Ice	59.49	0.01	35.41	3992.62	2.75	1.01
0.9 Dead+1.0 Wind 180 deg - No Ice	44.61	0.01	35.42	3961.34	2.45	1.01
1.2 Dead+1.0 Wind 210 deg - No Ice	59.49	-17.57	30.67	3460.50	1983.48	2.60
0.9 Dead+1.0 Wind 210 deg - No Ice	44.61	-17.57	30.67	3433.05	1968.04	2.60
1.2 Dead+1.0 Wind 240 deg - No Ice	59.49	-30.73	17.67	1996.75	3471.59	3.58
0.9 Dead+1.0 Wind 240 deg - No Ice	44.61	-30.73	17.67	1980.46	3444.76	3.58
1.2 Dead+1.0 Wind 270 deg - No Ice	59.49	-36.30	-0.15	-13.05	4130.70	3.60
0.9 Dead+1.0 Wind 270 deg - No Ice	44.61	-36.30	-0.15	-13.98	4098.67	3.60
1.2 Dead+1.0 Wind 300 deg - No Ice	59.49	-30.69	-17.74	-1991.44	3463.05	2.53
0.9 Dead+1.0 Wind 300 deg - No Ice	44.61	-30.69	-17.74	-1977.26	3436.32	2.53
1.2 Dead+1.0 Wind 330 deg - No Ice	59.49	-17.84	-30.61	-3440.59	2014.54	0.77
0.9 Dead+1.0 Wind 330 deg - No Ice	44.61	-17.84	-30.61	-3415.33	1998.89	0.77
1.2 Dead+1.0 Ice+1.0 Temp	95.85	0.00	-0.00	11.83	1.83	-0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	95.85	-0.04	-6.55	-752.22	6.35	-0.24
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	95.85	3.26	-5.64	-646.23	-379.63	-0.56
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	95.85	5.64	-3.26	-368.49	-658.10	-0.73
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	95.85	6.52	-0.00	11.27	-759.84	-0.71
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	95.85	5.65	3.30	396.93	-658.84	-0.51
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	95.85	3.25	5.68	675.04	-377.59	-0.17
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	95.85	0.01	6.54	776.14	1.53	0.21
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	95.85	-3.24	5.66	673.75	380.67	0.54
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	95.85	-5.67	3.26	393.23	665.13	0.74
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	95.85	-6.53	-0.03	8.66	765.33	0.74
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	95.85	-5.67	-3.28	-370.28	664.27	0.52
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	95.85	-3.29	-5.66	-647.65	387.29	0.16
Dead+Wind 0 deg - Service	49.57	-0.05	-10.11	-1130.80	7.13	-0.33
Dead+Wind 30 deg - Service	49.57	5.05	-8.72	-973.70	-566.55	-0.78

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 60 deg - Service	49.57	8.73	-5.04	-562.32	-979.59	-1.01
Dead+Wind 90 deg - Service	49.57	10.34	-0.01	0.61	-1169.29	-0.97
Dead+Wind 120 deg - Service	49.57	8.74	5.09	573.52	-979.57	-0.69
Dead+Wind 150 deg - Service	49.57	5.02	8.77	986.05	-561.46	-0.24
Dead+Wind 180 deg - Service	49.57	0.00	10.11	1136.37	1.35	0.29
Dead+Wind 210 deg - Service	49.57	-5.01	8.75	985.03	563.90	0.74
Dead+Wind 240 deg - Service	49.57	-8.77	5.04	569.31	986.54	1.03
Dead+Wind 270 deg - Service	49.57	-10.36	-0.04	-1.49	1173.78	1.03
Dead+Wind 300 deg - Service	49.57	-8.76	-5.06	-563.37	984.11	0.73
Dead+Wind 330 deg - Service	49.57	-5.09	-8.74	-974.94	572.72	0.22

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-49.57	0.00	0.00	49.57	-0.00	0.000%
2	-0.18	-59.49	-35.45	0.18	59.49	35.44	0.007%
3	-0.18	-44.61	-35.45	0.18	44.61	35.44	0.006%
4	17.69	-59.49	-30.56	-17.69	59.49	30.56	0.000%
5	17.69	-44.61	-30.56	-17.68	44.61	30.56	0.000%
6	30.60	-59.49	-17.67	-30.60	59.49	17.67	0.000%
7	30.60	-44.61	-17.67	-30.60	44.61	17.67	0.000%
8	36.24	-59.49	-0.04	-36.24	59.49	0.04	0.001%
9	36.24	-44.61	-0.04	-36.23	44.61	0.04	0.002%
10	30.62	-59.49	17.82	-30.62	59.49	-17.82	0.000%
11	30.62	-44.61	17.82	-30.62	44.61	-17.82	0.000%
12	17.60	-59.49	30.72	-17.60	59.49	-30.72	0.000%
13	17.60	-44.61	30.72	-17.60	44.61	-30.72	0.000%
14	0.01	-59.49	35.42	-0.01	59.49	-35.41	0.007%
15	0.01	-44.61	35.42	-0.01	44.61	-35.42	0.006%
16	-17.57	-59.49	30.67	17.57	59.49	-30.67	0.000%
17	-17.57	-44.61	30.67	17.57	44.61	-30.67	0.000%
18	-30.73	-59.49	17.67	30.73	59.49	-17.67	0.000%
19	-30.73	-44.61	17.67	30.73	44.61	-17.67	0.000%
20	-36.30	-59.49	-0.15	36.30	59.49	0.15	0.001%
21	-36.30	-44.61	-0.15	36.30	44.61	0.15	0.002%
22	-30.69	-59.49	-17.74	30.69	59.49	17.74	0.000%
23	-30.69	-44.61	-17.74	30.69	44.61	17.74	0.000%
24	-17.84	-59.49	-30.61	17.84	59.49	30.61	0.000%
25	-17.84	-44.61	-30.61	17.84	44.61	30.61	0.000%
26	0.00	-95.85	0.00	-0.00	95.85	0.00	0.001%
27	-0.04	-95.85	-6.55	0.04	95.85	6.55	0.000%
28	3.26	-95.85	-5.64	-3.26	95.85	5.64	0.000%
29	5.64	-95.85	-3.26	-5.64	95.85	3.26	0.000%
30	6.52	-95.85	-0.00	-6.52	95.85	0.00	0.000%
31	5.65	-95.85	3.30	-5.65	95.85	-3.30	0.000%
32	3.25	-95.85	5.68	-3.25	95.85	-5.68	0.000%
33	0.01	-95.85	6.54	-0.01	95.85	-6.54	0.000%
34	-3.24	-95.85	5.66	3.24	95.85	-5.66	0.000%
35	-5.67	-95.85	3.26	5.67	95.85	-3.26	0.000%
36	-6.53	-95.85	-0.03	6.53	95.85	0.03	0.000%
37	-5.67	-95.85	-3.28	5.67	95.85	3.28	0.000%
38	-3.30	-95.85	-5.66	3.29	95.85	5.66	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
39	-0.05	-49.57	-10.12	0.05	49.57	10.11	0.002%
40	5.05	-49.57	-8.72	-5.05	49.57	8.72	0.002%
41	8.73	-49.57	-5.04	-8.73	49.57	5.04	0.002%
42	10.34	-49.57	-0.01	-10.34	49.57	0.01	0.002%
43	8.74	-49.57	5.09	-8.74	49.57	-5.09	0.002%
44	5.02	-49.57	8.77	-5.02	49.57	-8.77	0.002%
45	0.00	-49.57	10.11	-0.00	49.57	-10.11	0.002%
46	-5.02	-49.57	8.75	5.01	49.57	-8.75	0.002%
47	-8.77	-49.57	5.04	8.77	49.57	-5.04	0.002%
48	-10.36	-49.57	-0.04	10.36	49.57	0.04	0.002%
49	-8.76	-49.57	-5.06	8.76	49.57	5.06	0.002%
50	-5.09	-49.57	-8.74	5.09	49.57	8.74	0.002%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	13	0.00011904	0.00011432
3	Yes	13	0.00008318	0.00010335
4	Yes	17	0.00000001	0.00007709
5	Yes	16	0.00000001	0.00014863
6	Yes	17	0.00000001	0.00008612
7	Yes	17	0.00000001	0.00006750
8	Yes	15	0.00000001	0.00007235
9	Yes	14	0.00003411	0.00013822
10	Yes	17	0.00000001	0.00007651
11	Yes	16	0.00000001	0.00014721
12	Yes	17	0.00000001	0.00008294
13	Yes	17	0.00000001	0.00006486
14	Yes	13	0.00011903	0.00010548
15	Yes	13	0.00008318	0.00009653
16	Yes	17	0.00000001	0.00008358
17	Yes	17	0.00000001	0.00006536
18	Yes	17	0.00000001	0.00007651
19	Yes	16	0.00000001	0.00014714
20	Yes	15	0.00000001	0.00007713
21	Yes	14	0.00003410	0.00014703
22	Yes	17	0.00000001	0.00008626
23	Yes	17	0.00000001	0.00006756
24	Yes	17	0.00000001	0.00007814
25	Yes	17	0.00000001	0.00006100
26	Yes	7	0.00000001	0.00001833
27	Yes	15	0.00000001	0.00007555
28	Yes	15	0.00000001	0.00007994
29	Yes	15	0.00000001	0.00008067
30	Yes	15	0.00000001	0.00007648
31	Yes	15	0.00000001	0.00008211
32	Yes	15	0.00000001	0.00008239
33	Yes	15	0.00000001	0.00007767
34	Yes	15	0.00000001	0.00008255
35	Yes	15	0.00000001	0.00008251
36	Yes	15	0.00000001	0.00007699
37	Yes	15	0.00000001	0.00008123
38	Yes	15	0.00000001	0.00008047
39	Yes	13	0.00000001	0.00003684
40	Yes	13	0.00000001	0.00004553
41	Yes	13	0.00000001	0.00007231
42	Yes	13	0.00009668	0.00004947
43	Yes	13	0.00000001	0.00004470
44	Yes	13	0.00000001	0.00006304
45	Yes	13	0.00000001	0.00003692
46	Yes	13	0.00000001	0.00006403
47	Yes	13	0.00000001	0.00004470
48	Yes	13	0.00009667	0.00005083
49	Yes	13	0.00000001	0.00007232
50	Yes	13	0.00000001	0.00004681

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 149.65	21.723	48	1.0029	0.0036
L2	149.65 - 106.76	15.452	48	0.9506	0.0031
L3	112.79 - 76.41	8.837	48	0.7381	0.0019
L4	83.14 - 35.93	4.798	48	0.5408	0.0011
L5	43.61 - 0	1.338	48	0.2730	0.0004

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.000	(2) APXVSPP18-C w/ Mount Pipe	48	21.723	1.0029	0.0036	89069
160.000	Nokia AAHF	48	17.544	0.9790	0.0033	22267
138.000	VHLP2-18	48	13.201	0.8977	0.0027	11852
136.000	VHLP2-18	48	12.828	0.8868	0.0027	11473
134.000	LLPX310R-V1 w/ Mount Pipe	48	12.459	0.8753	0.0026	11118
100.000	SRL235-2	48	6.947	0.6529	0.0015	8705
98.000	OGB4-900D	48	6.672	0.6397	0.0015	8759
69.000	918-2	48	3.291	0.4446	0.0008	8212
45.000	OGB4-900D	48	1.418	0.2821	0.0004	7020
42.000	VG-1060	48	1.250	0.2624	0.0004	7215
29.000	SRL224NM*5	48	0.685	0.1789	0.0002	10367

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 149.65	76.539	20	3.5362	0.0128
L2	149.65 - 106.76	54.441	20	3.3519	0.0109
L3	112.79 - 76.41	31.128	20	2.6017	0.0067
L4	83.14 - 35.93	16.899	20	1.9055	0.0040
L5	43.61 - 0	4.711	20	0.9612	0.0014

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.000	(2) APXVSPP18-C w/ Mount Pipe	20	76.539	3.5362	0.0128	25421
160.000	Nokia AAHF	20	61.812	3.4520	0.0117	6354
138.000	VHLP2-18	20	46.509	3.1652	0.0097	3377
136.000	VHLP2-18	20	45.193	3.1264	0.0095	3269
134.000	LLPX310R-V1 w/ Mount Pipe	20	43.893	3.0861	0.0092	3167
100.000	SRL235-2	20	24.468	2.3012	0.0054	2474

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
98.000	OGB4-900D	20	23.499	2.2545	0.0052	2489
69.000	918-2	20	11.589	1.5664	0.0029	2332
45.000	OGB4-900D	20	4.991	0.9935	0.0014	1994
42.000	VG-1060	20	4.402	0.9239	0.0013	2049
29.000	SRL224NM*5	20	2.412	0.6299	0.0008	2943

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
L1	180 - 149.65 (1)	TP35.249x29x0.25	30.350	0.000	0.0	28.1742	-10.80	1647.27	0.007
L2	149.65 - 106.76 (2)	TP44.081x35.249x0.281	42.890	0.000	0.0	38.5076	-18.88	2135.38	0.009
L3	106.76 - 76.41 (3)	TP49.768x42.2773x0.344	36.380	0.000	0.0	53.2110	-26.64	3112.85	0.009
L4	76.41 - 35.93 (4)	TP57.414x47.6943x0.406	47.210	0.000	0.0	72.4606	-40.05	4238.94	0.009
L5	35.93 - 0 (5)	TP64x55.0208x0.469	43.610	0.000	0.0	95.9432	-59.47	5612.68	0.011

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 - 149.65 (1)	TP35.249x29x0.25	218.69	1175.45	0.186	0.00	1175.45	0.000
L2	149.65 - 106.76 (2)	TP44.081x35.249x0.281	841.90	1853.86	0.454	0.00	1853.86	0.000
L3	106.76 - 76.41 (3)	TP49.768x42.2773x0.344	1533.83	3051.84	0.503	0.00	3051.84	0.000
L4	76.41 - 35.93 (4)	TP57.414x47.6943x0.406	2653.26	4861.63	0.546	0.00	4861.63	0.000
L5	35.93 - 0 (5)	TP64x55.0208x0.469	4130.72	7412.56	0.557	0.00	7412.56	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 - 149.65 (1)	TP35.249x29x0.25	12.73	494.46	0.026	1.97	1522.24	0.001
L2	149.65 - 106.76 (2)	TP44.081x35.249x0.281	20.56	675.81	0.030	2.07	2529.93	0.001
L3	106.76 - 76.41 (3)	TP49.768x42.2773x0.344	25.53	933.85	0.027	4.56	3946.08	0.001
L4	76.41 - 35.93 (4)	TP57.414x47.6943x0.406	31.01	1271.68	0.024	4.46	6200.10	0.001
L5	35.93 - 0 (5)	TP64x55.0208x0.469	36.33	1683.80	0.022	3.60	9409.75	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	180 - 149.65 (1)	0.007	0.186	0.000	0.026	0.001	0.193	1.050	4.8.2
L2	149.65 - 106.76 (2)	0.009	0.454	0.000	0.030	0.001	0.464	1.050	4.8.2
L3	106.76 - 76.41 (3)	0.009	0.503	0.000	0.027	0.001	0.512	1.050	4.8.2
L4	76.41 - 35.93 (4)	0.009	0.546	0.000	0.024	0.001	0.556	1.050	4.8.2
L5	35.93 - 0 (5)	0.011	0.557	0.000	0.022	0.000	0.568	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 - 149.65	Pole	TP35.249x29x0.25	1	-10.80	1729.63	18.4	Pass
L2	149.65 - 106.76	Pole	TP44.081x35.249x0.281	2	-18.88	2242.15	44.2	Pass
L3	106.76 - 76.41	Pole	TP49.768x42.2773x0.344	3	-26.64	3268.49	48.8	Pass
L4	76.41 - 35.93	Pole	TP57.414x47.6943x0.406	4	-40.05	4450.89	52.9	Pass
L5	35.93 - 0	Pole	TP64x55.0208x0.469	5	-59.47	5893.31	54.1	Pass
							Summary	
						Pole (L5)	54.1	Pass
						RATING =	**54.1**	**Pass**

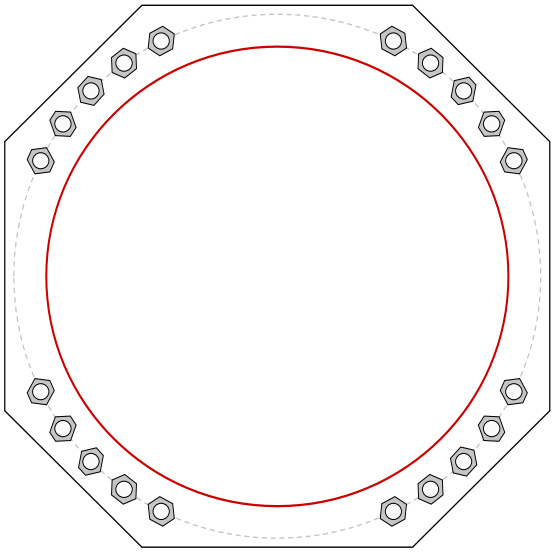
Monopole Base Plate Connection

Site Info	
BU #	
Site Name	A5C0028A AAS
Order #	

Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	No
l_{ar} (in)	0

Applied Loads	
Moment (kip-ft)	4130.72
Axial Force (kips)	59.47
Shear Force (kips)	36.33

**TIA-222-H Section 15.5 Applied*



Connection Properties

Anchor Rod Data

(20) 2-1/4" ø bolts (A615-75 N; Fy=75 ksi, Fu=100 ksi) on 73" BC

Anchor Spacing: 6 in

Base Plate Data

75.5" OD x 2.75" Plate (A572-60; Fy=60 ksi, Fu=75 ksi)

Stiffener Data

N/A

Pole Data

64" x 0.469" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Analysis Results

Anchor Rod Summary *(units of kips, kip-in)*

Pu_c = 138.73	ϕPn_c = 243.75	**Stress Rating**
Vu = 1.82	ϕVn = 73.13	**54.3%**
Mu = n/a	ϕMn = n/a	**Pass**

Base Plate Summary

Max Stress (ksi):	29.54	(Flexural)
Allowable Stress (ksi):	54	
Stress Rating:	**52.1%**	**Pass**

Monopole Flange Plate Connection

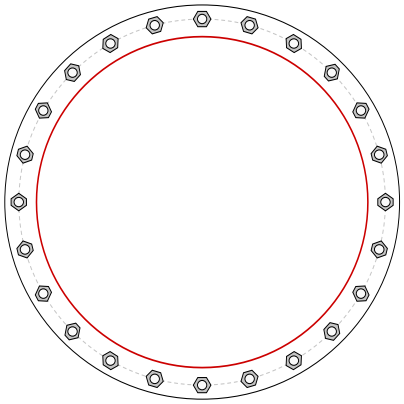
Elevation = 149.65 ft.

BU #	
Site Name	A5C0028A AAS
Order #	
TIA-222 Revision	H

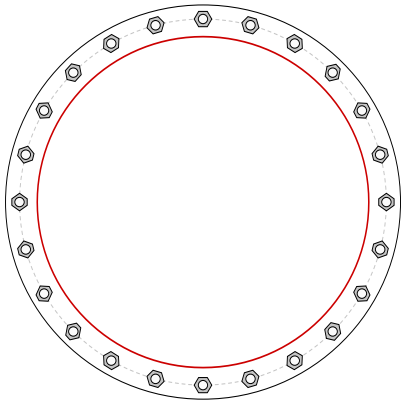
Applied Loads	
Moment (kip-ft)	218.69
Axial Force (kips)	10.80
Shear Force (kips)	12.73

**TIA-222-H Section 15.5 Applied*

Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(24) 1" ø bolts (A325 N; 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)

Bottom Plate Data

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

Top Stiffener Data

N/A

Bottom Stiffener Data

N/A

Top Pole Data

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

Bottom Pole Data

35.249" x 0.281" 12-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	10.76	
Allowable (kips)	54.53	
Stress Rating:	**18.8%**	**Pass**

Top Plate Capacity

Max Stress (ksi):	5.24	(Flexural)
Allowable Stress (ksi):	54.00	
Stress Rating:	**9.2%**	**Pass**
Tension Side Stress Rating:	**4.5%**	**Pass**

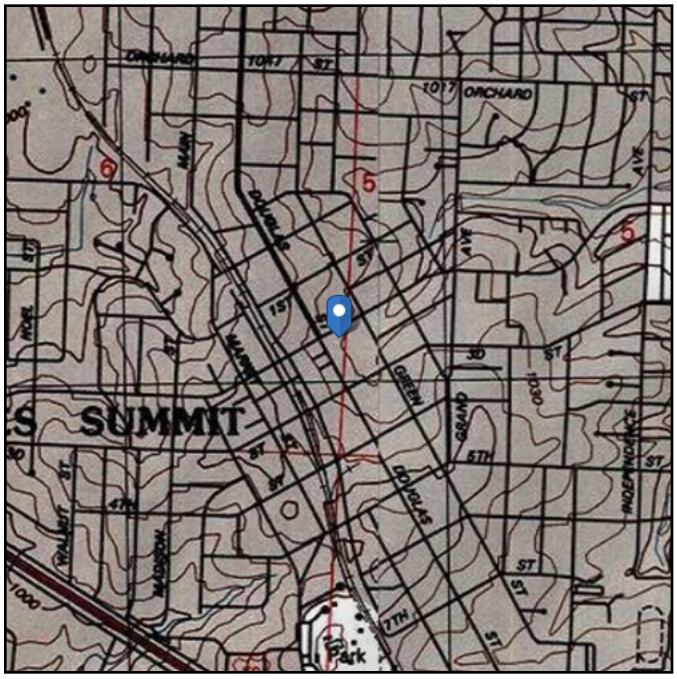
Bottom Plate Capacity

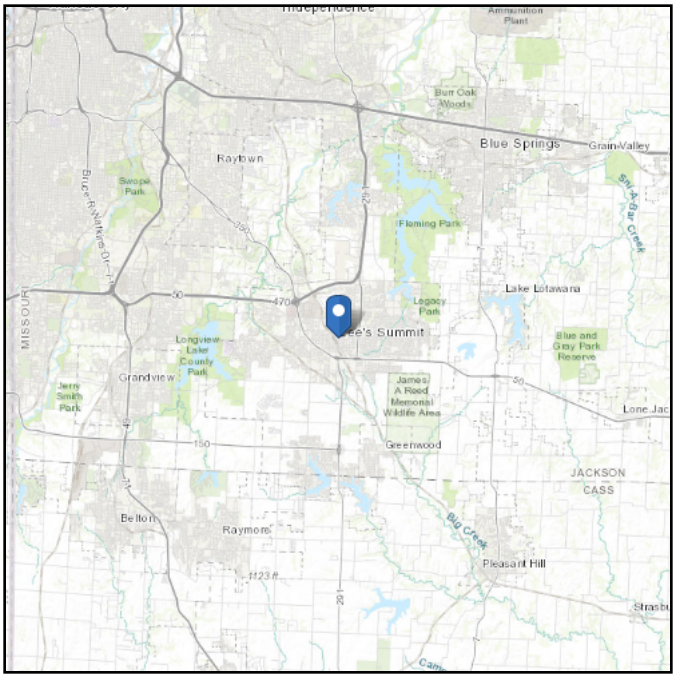
Max Stress (ksi):	5.24	(Flexural)
Allowable Stress (ksi):	54.00	
Stress Rating:	**9.2%**	**Pass**
Tension Side Stress Rating:	**4.5%**	**Pass**

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Elevation:**	1021.67 ft (NAVD 88)
Risk Category:	II	**Latitude:**	38.913922
Soil Class:	D - Stiff Soil	**Longitude:**	-94.376417





Wind

Results:

Wind Speed:	109 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. 26.5-1B and Figs. CC.2-1–CC.2-4
Date Accessed:	Mon Jul 29 2019

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 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

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

Mountainous terrain, gorges, ocean promontories, and special wind regions should be examined for unusual wind conditions.

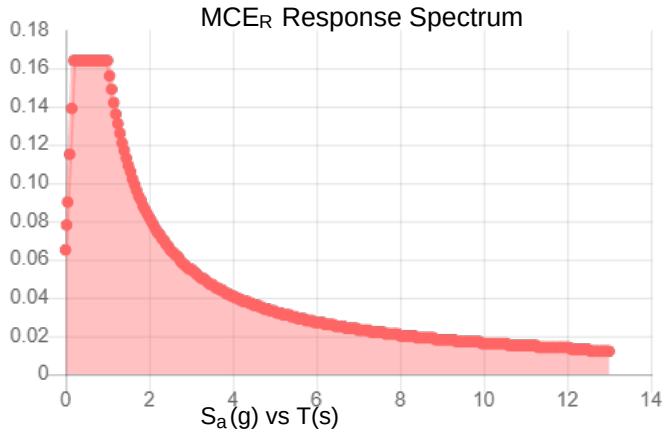
Seismic

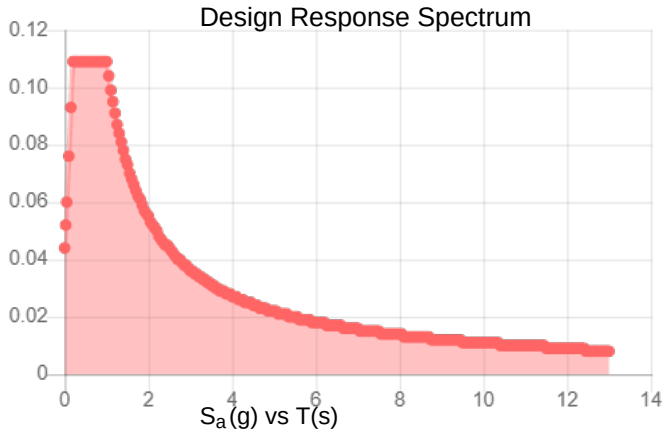
Site Soil Class: D - Stiff Soil

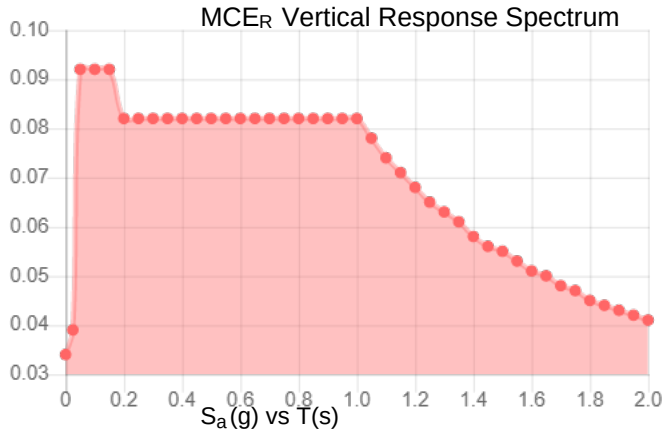
Results:

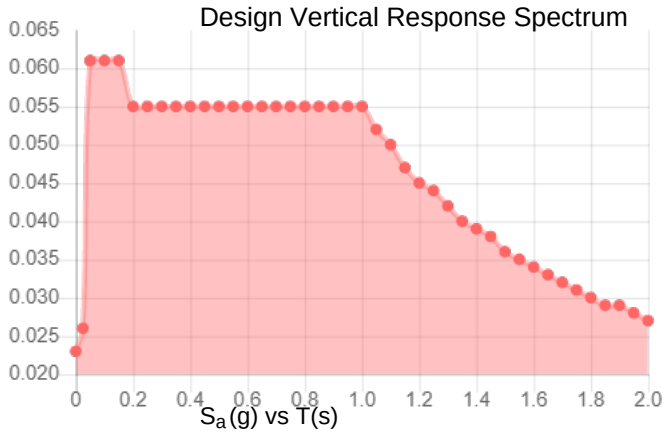
S_S :	0.1	S_{D1} :	0.109
S_1 :	0.068	T_L :	12
F_a :	1.6	PGA :	0.047
F_v :	2.4	PGA_M :	0.076
S_{MS} :	0.16	F_{PGA} :	1.6
S_{M1} :	0.164	I_e :	1
S_{DS} :	0.106	C_v :	0.7

Seismic Design Category B









Data Accessed: Mon Jul 29 2019

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.

Ice

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:	Mon Jul 29 2019

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.