Date: **July 18, 2022**

MORRISON HERSHFIELD

Morrison Hershfield
1455 Lincoln Parkway, Suite 500
Atlanta, GA 30346
(770) 379-8500

Subject:	**Structural Analysis Report**	
Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Site Number:	9066145
	Site Name:	NW Brown Road - A
Crown Castle Designation:	**BU Number:**	824653
	Site Name:	Hwy90 at NW Brown Rd
	JDE Job Number:	723015
	Work Order Number:	2138602
	Order Number:	623626 Rev. 0
Engineering Firm Designation:	**Morrison Hershfield Project Number:** CN3-182R4 / 2200039	
Site Data:	**297 NW Brown Rd, Lake City, Columbia County, FL 32055** **Latitude *30° 11' 25.95"*, Longitude *-82° 42' 56.38"*** **197 Foot – Valmont Monopole Tower**	

Morrison Hershfield is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above-mentioned tower.

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

LC5: Proposed Equipment Configuration — **Sufficient Capacity**

This analysis utilizes an ultimate 3-second gust wind speed of 118 mph as required by the 2020 Florida Building Code 7th Edition. Applicable Standard references and design criteria are listed in Section 2 - Analysis Criteria.

Respectfully submitted by:

G. LANCE COOKE LICENSE No 68787 STATE OF FLORIDA PROFESSIONAL ENGINEER

Digitally signed by G. Lance Cooke
Date: 2022.07.18 19:37:08+05'30'

G. Lance Cooke, P.E. (FL License No. 68787)
Senior Engineer

Certificate of Authorization # 8508

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1) INTRODUCTION

This tower is a 197 ft monopole tower designed by Valmont Microflect.

2) ANALYSIS CRITERIA

TIA-222 Revision:	TIA-222-H
Risk Category:	II
Wind Speed:	118 mph
Exposure Category:	C
Topographic Factor:	1
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)
170.0	170.0	4	jma wireless	MX06FIT865-02 w/ Mount Pipe	2	1-1/4
		3	ericsson	AIR 6449 B77 w/ Mount Pipe		
		2	jma wireless	MX06FIT845-02 w/ Mount Pipe		
		3	ericsson	RADIO 4449		
		3	ericsson	RADIO 8843		
		2	raycap	RRFDC-3315-PF-48		
		1		Top Rail [# VZWSAMRT-PLK1]		
		1	-	Platform Mount [LP 304-1]		

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)
192.0	195.0	3	commscope	FFVV-65C-R3-V1_TMO w/ Mount Pipe	12	1-5/8
		3	ericsson	AIR6449 B41_T-MOBILE w/ Mount Pipe		
		3	ericsson	RADIO 4460 B2/B25 B66_TMO		
		3	ericsson	RADIO 4480 B71_TMO		
	192.0	1	-	Platform Mount [LP 716-1]		
185.0	186.0	3	commscope	NNHH-65B-R4	12 6 3	1-5/8 3/4 3/8
		6	commscope	SBNHH-1D65B		
	185.0	9	ericsson	RRUS 11		
		3	ericsson	RRUS 32		
		3	ericsson	RRUS 4426 B66		
		3	ericsson	RRUS 4478 B14		
		6	powerwave technologies	LGP 17401		
		1	raycap	DC6-48-60-18-8C		
		2	raycap	DC6-48-60-18-8F		
		1	-	Platform Mount [LP 302-1]		

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
185.0	183.0	3	powerwave technologies	7772.00	-	-
163.0	163.0	3	argus technologies	TLLPX310M-E w/ Mount Pipe	12 3	3/8 1/4
		2	andrew	P3F-52		
		3	alvarion	BREEZEMAX ELITE NAU		
		2	dragonwave	HORIZON COMPACT		
		1	-	T-Arm Mount [TA 702-3]		
130.0	130.0	1	andrew	HP4-102	1	1-5/8
		1	-	Pipe Mount [PM 601-1]		

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Reference	Source
4-GEOTECHNICAL REPORTS	3531109	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	3531108	CCISITES
4-TOWER MANUFACTURER DRAWINGS	4007399	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. Morrison Hershfield 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	197 - 187.583	Pole	TP25.362x23.19x0.1875	1	-1.81	924.91	2.5	Pass
L2	187.583 - 138.667	Pole	TP36.227x24.0836x0.25	2	-18.00	1702.34	53.3	Pass
L3	138.667 - 91.5	Pole	TP46.583x34.5012x0.375	3	-29.69	3285.44	51.4	Pass
L4	91.5 - 45.083	Pole	TP56.513x44.3372x0.4375	4	-46.02	4655.91	52.7	Pass
L5	45.083 - 0	Pole	TP65.999x53.8739x0.5	5	-71.32	6417.13	51.7	Pass
							Summary	
						Pole (L2)	53.3	Pass
						Rating =	53.3	Pass

Table 5 - Tower Component Stresses vs. Capacity – LC5

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	37.9	Pass
1	Base Plate		32.9	Pass
1	Base Foundation (Structure)	0	40.0	Pass
1	Base Foundation (Soil Interaction)		16.5	Pass

Structure Rating (max from all components) =	53.3%*

Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.
2) *Rating per TIA-222-H, Section 15.5

4.1) Recommendations

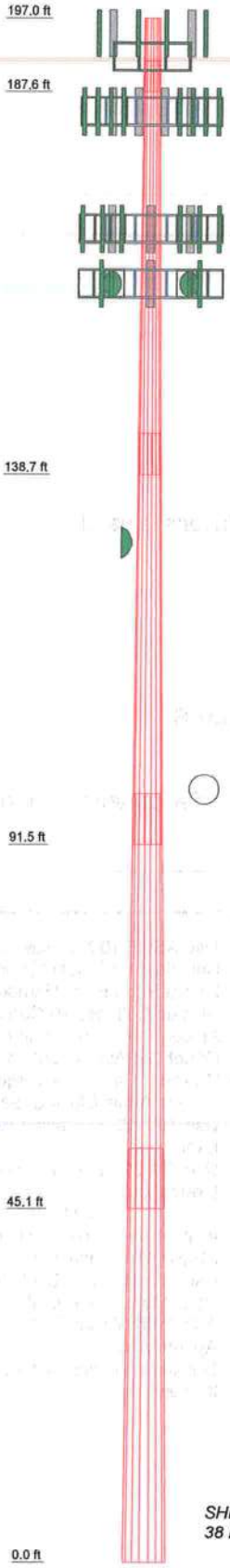
The tower and its foundation have sufficient capacity to carry the proposed load configuration. No modifications are required at this time.

APPENDIX A

TNXTOWER OUTPUT

Section	1	2	3	4	5
Length (ft)	9.42	52.83	52.50	52.92	52.75
Number of Sides	16	16	16	16	16
Thickness (in)	0.1875	0.2500	0.3750	0.4375	0.5000
Socket Length (ft)	3.92	5.33	6.50	7.67	
Top Dia (in)	23.1900	24.0836	34.5012	44.3372	53.8739
Bot Dia (in)	25.3620	36.2270	46.5830	56.5130	65.9990
Grade			A572-65		
Weight (K)	0.5	4.3	8.6	12.6	17.0

Total Weight: 42.9 K



ALL REACTIONS ARE FACTORED

AXIAL 71 K

SHEAR 38 K

MOMENT 4958 kip-ft

TORQUE 1 kip-ft

REACTIONS - 118 mph WIND

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Columbia County, Florida.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 118 mph basic wind in accordance with the TIA-222-H Standard.
4. Deflections are based upon a 60 mph wind.
5. Tower Risk Category II.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 53.3%

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Job: CN3-182R4 / 2200039			
Project: 824653 / Hwy90 at NW Brown Rd			
Client: Crown Castle USA	Drawn by: SV	App'd:	
Code: TIA-222-H	Date: 07/18/22	Scale: NTS	
Path:		Dwg No. E-1	

Tower Input Data

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

Tower is located in Columbia County, Florida.
Tower base elevation above sea level: 165.00 ft.
Basic wind speed of 118 mph.
Risk Category II.
Exposure Category C.
Simplified Topographic Factor Procedure for wind speed-up calculations is used.
Topographic Category: 1.
Crest Height: 0.00 ft.
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: $K_{es}(F_w) = 0.95$.
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	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	197.00-187.58	9.42	3.92	16	23.1900	25.3620	0.1875	0.7500	A572-65 (65 ksi)
L2	187.58-138.67	52.83	5.33	16	24.0836	36.2270	0.2500	1.0000	A572-65 (65 ksi)
L3	138.67-91.50	52.50	6.50	16	34.5012	46.5830	0.3750	1.5000	A572-65 (65 ksi)
L4	91.50-45.08	52.92	7.67	16	44.3372	56.5130	0.4375	1.7500	A572-65 (65 ksi)
L5	45.08-0.00	52.75		16	53.8739	65.9990	0.5000	2.0000	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	23.6076	13.7584	919.6688	8.1889	11.8269	77.7608	1853.2624	6.8028	4.2417	22.622
	25.8221	15.0575	1205.5601	8.9621	12.9346	93.2041	2429.3739	7.4451	4.6739	24.928
L2	25.4243	19.0073	1363.9914	8.4847	12.2826	111.0506	2748.6354	9.3981	4.2951	17.181
	36.8878	28.6917	4691.5883	12.8078	18.4758	253.9319	9454.2129	14.1865	6.7117	26.847
L3	36.3550	40.8235	6006.2213	12.1489	17.5956	341.3474	12103.384 1	20.1851	6.1195	16.319
	47.4221	55.2763	14910.349 7	16.4500	23.7573	627.6105	30046.460 2	27.3312	8.5238	22.73
L4	46.6450	61.2675	14916.489 7	15.6283	22.6120	659.6728	30058.833 2	30.2935	7.9525	18.177
	57.5344	78.2604	31088.700 4	19.9629	28.8216	1078.6586	62648.121 6	38.6956	10.3755	23.715
L5	56.6282	85.1313	30638.061 1	19.0011	27.4757	1115.0976	61740.019 7	42.0930	9.7259	19.452
	67.1940	104.4709	56621.198 6	23.3176	33.6595	1682.1764	114099.71 12	51.6554	12.1388	24.278

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 197.00-187.58				1	1	1			
L2 187.58-138.67				1	1	1			
L3 138.67-91.50				1	1	1			
L4 91.50-45.08				1	1	1			
L5 45.08-0.00				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
****										
Safety Line 3/8	A	No	Surface Ar (CaAa)	197.00 - 10.00	1	1	-0.100 -0.100	0.3750		0.22
Climbing Rungs	A	No	Surface Ar (CaAa)	197.00 - 10.00	1	1	-0.150 -0.050	0.7050		1.80
FB-L98B-034-	C	No	Surface Ar	185.00 -	2	2	-0.450	0.3937		0.05

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
XXXXXX(3/8)			(CaAa)	10.00			-0.420			
WR-VG86ST-BRD(3/4)	C	No	Surface Ar (CaAa)	185.00 - 10.00	6	6	-0.420 -0.280	0.7950		0.58
****										

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
****									
LDF7-50A(1-5/8)	C	No	No	Inside Pole	192.00 - 4.00	10	No Ice	0.00	0.82
HB158-21U6S24-xxM_TMO(1-5/8)	C	No	No	Inside Pole	192.00 - 4.00	2	No Ice	0.00	2.50
****									
LDF7-50A(1-5/8)	C	No	No	Inside Pole	185.00 - 10.00	12	No Ice	0.00	0.82
FB-L98B-034-XXXXXX(3/8)	C	No	No	Inside Pole	185.00 - 10.00	1	No Ice	0.00	0.05
****									
MLE HYBRID 3POWER/6FIBER RL 2(1-1/4)	B	No	No	Inside Pole	170.00 - 10.00	2	No Ice	0.00	0.68
****									
LDF1-50A(1/4)	C	No	No	Inside Pole	163.00 - 8.00	3	No Ice	0.00	0.06
LDF2-50(3/8)	C	No	No	Inside Pole	163.00 - 8.00	12	No Ice	0.00	0.08
****									
LDF7-50A(1-5/8)	C	No	No	Inside Pole	130.00 - 4.00	1	No Ice	0.00	0.82
****									

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	197.00-187.58	A	0.000	0.000	1.017	0.000	0.02
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.06
L2	187.58-138.67	A	0.000	0.000	5.283	0.000	0.10
		B	0.000	0.000	0.000	0.000	0.04
		C	0.000	0.000	25.749	0.000	1.30
L3	138.67-91.50	A	0.000	0.000	5.094	0.000	0.10
		B	0.000	0.000	0.000	0.000	0.06
		C	0.000	0.000	26.213	0.000	1.34
L4	91.50-45.08	A	0.000	0.000	5.013	0.000	0.09
		B	0.000	0.000	0.000	0.000	0.06
		C	0.000	0.000	25.796	0.000	1.33
L5	45.08-0.00	A	0.000	0.000	3.789	0.000	0.07
		B	0.000	0.000	0.000	0.000	0.05
		C	0.000	0.000	19.497	0.000	1.09

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	197.00-187.58	-0.7727	-0.2511	-0.4951	-0.1609
L2	187.58-138.67	1.5926	2.1367	1.0964	1.4710
L3	138.67-91.50	1.7806	2.3589	1.2042	1.5953

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
L4	91.50-45.08	1.8470	2.4472	1.2327	1.6332
L5	45.08-0.00	1.4945	1.9801	0.9772	1.2948

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	2	Safety Line 3/8	187.58 - 197.00	1.0000	1.0000
L1	3	Climbing Rungs	187.58 - 197.00	1.0000	1.0000
L2	2	Safety Line 3/8	138.67 - 187.58	1.0000	1.0000
L2	3	Climbing Rungs	138.67 - 187.58	1.0000	1.0000
L2	9	FB-L98B-034-XXXXXX(3/8)	138.67 - 185.00	1.0000	1.0000
L2	11	WR-VG86ST-BRD(3/4)	138.67 - 185.00	1.0000	1.0000
L3	2	Safety Line 3/8	91.50 - 138.67	1.0000	1.0000
L3	3	Climbing Rungs	91.50 - 138.67	1.0000	1.0000
L3	9	FB-L98B-034-XXXXXX(3/8)	91.50 - 138.67	1.0000	1.0000
L3	11	WR-VG86ST-BRD(3/4)	91.50 - 138.67	1.0000	1.0000
L4	2	Safety Line 3/8	45.08 - 91.50	1.0000	1.0000
L4	3	Climbing Rungs	45.08 - 91.50	1.0000	1.0000
L4	9	FB-L98B-034-XXXXXX(3/8)	45.08 - 91.50	1.0000	1.0000
L4	11	WR-VG86ST-BRD(3/4)	45.08 - 91.50	1.0000	1.0000
L5	2	Safety Line 3/8	10.00 - 45.08	1.0000	1.0000
L5	3	Climbing Rungs	10.00 - 45.08	1.0000	1.0000
L5	9	FB-L98B-034-XXXXXX(3/8)	10.00 - 45.08	1.0000	1.0000
L5	11	WR-VG86ST-BRD(3/4)	10.00 - 45.08	1.0000	1.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	Placement		C_AA_A Front	C_AA_A Side	Weight
			ft ft ft	°	ft		ft^2	ft^2	K
FFVV-65C-R3-V1_TMO w/ Mount Pipe	A	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	12.97	6.20	0.16
FFVV-65C-R3-V1_TMO w/ Mount Pipe	B	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	12.97	6.20	0.16
FFVV-65C-R3-V1_TMO w/ Mount Pipe	C	From Leg	4.00 0.00	0.0000	192.00	No Ice	12.97	6.20	0.16

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
AIR6449 B41_T-MOBILE w/ Mount Pipe	A	From Leg	3.00 4.00 0.00	0.0000	192.00	No Ice	5.19	2.71	0.13
AIR6449 B41_T-MOBILE w/ Mount Pipe	B	From Leg	3.00 4.00 0.00	0.0000	192.00	No Ice	5.19	2.71	0.13
AIR6449 B41_T-MOBILE w/ Mount Pipe	C	From Leg	3.00 4.00 0.00	0.0000	192.00	No Ice	5.19	2.71	0.13
RADIO 4460 B2/B25 B66_TMO	A	From Leg	3.00 4.00 0.00	0.0000	192.00	No Ice	2.14	1.69	0.11
RADIO 4460 B2/B25 B66_TMO	B	From Leg	3.00 4.00 0.00	0.0000	192.00	No Ice	2.14	1.69	0.11
RADIO 4460 B2/B25 B66_TMO	C	From Leg	3.00 4.00 0.00	0.0000	192.00	No Ice	2.14	1.69	0.11
RADIO 4480 B71_TMO	A	From Leg	3.00 4.00 0.00	0.0000	192.00	No Ice	2.85	1.38	0.09
RADIO 4480 B71_TMO	B	From Leg	3.00 4.00 0.00	0.0000	192.00	No Ice	2.85	1.38	0.09
RADIO 4480 B71_TMO	C	From Leg	3.00 4.00 0.00	0.0000	192.00	No Ice	2.85	1.38	0.09
8' x 2" Mount Pipe	A	From Leg	3.00 2.00 0.00	0.0000	192.00	No Ice	1.90	1.90	0.03
8' x 2" Mount Pipe	B	From Leg	0.00 2.00 0.00	0.0000	192.00	No Ice	1.90	1.90	0.03
8' x 2" Mount Pipe	C	From Leg	0.00 2.00 0.00	0.0000	192.00	No Ice	1.90	1.90	0.03
Platform Mount [LP 716-1] ****	A	None	0.00	0.0000	192.00	No Ice	26.80	26.80	1.51
7772.00	A	From Leg	4.00 0.00	0.0000	185.00	No Ice	4.68	2.13	0.04
7772.00	B	From Leg	-2.00 4.00 0.00	0.0000	185.00	No Ice	4.68	2.13	0.04
7772.00	C	From Leg	-2.00 4.00 0.00	0.0000	185.00	No Ice	4.68	2.13	0.04
(2) SBNHH-1D65B	A	From Leg	-2.00 4.00 0.00	0.0000	185.00	No Ice	4.16	2.49	0.04
(2) SBNHH-1D65B	B	From Leg	1.00 4.00 0.00	0.0000	185.00	No Ice	4.16	2.49	0.04
(2) SBNHH-1D65B	C	From Leg	1.00 4.00 0.00	0.0000	185.00	No Ice	4.16	2.49	0.04
NNHH-65B-R4	A	From Leg	1.00 4.00 0.00	0.0000	185.00	No Ice	7.62	3.01	0.08
NNHH-65B-R4	B	From Leg	1.00 4.00 0.00	0.0000	185.00	No Ice	7.62	3.01	0.08
NNHH-65B-R4	C	From Leg	1.00 4.00 0.00	0.0000	185.00	No Ice	7.62	3.01	0.08

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
(2) LGP 17401	A	From Leg	1.00 4.00 0.00 0.00	0.0000	185.00	No Ice	0.82	0.47	0.02
(2) LGP 17401	B	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	0.82	0.47	0.02
(2) LGP 17401	C	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	0.82	0.47	0.02
(2) RRUS 11	A	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.78	1.19	0.05
(2) RRUS 11	B	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.78	1.19	0.05
(2) RRUS 11	C	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.78	1.19	0.05
RRUS-11	A	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.78	1.19	0.05
RRUS-11	B	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.78	1.19	0.05
RRUS-11	C	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.78	1.19	0.05
RRUS 32	A	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.86	1.78	0.06
RRUS 32	B	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.86	1.78	0.06
RRUS 32	C	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.86	1.78	0.06
RRUS 4478 B14	A	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	1.84	1.06	0.06
RRUS 4478 B14	B	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	1.84	1.06	0.06
RRUS 4478 B14	C	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	1.84	1.06	0.06
RRUS 4426 B66	A	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	1.64	0.73	0.05
RRUS 4426 B66	B	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	1.64	0.73	0.05
RRUS 4426 B66	C	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	1.64	0.73	0.05
DC6-48-60-18-8F	A	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	0.92	0.92	0.02
DC6-48-60-18-8F	B	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	0.92	0.92	0.02
DC6-48-60-18-8C	B	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.74	2.74	0.03
Platform Mount [LP 302-1]	A	None		0.0000	185.00	No Ice	26.56	26.56	1.71

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
****									
(2) MX06FIT845-02 w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	8.97	7.62	0.11
(2) MX06FIT865-02 w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	4.54	4.71	0.10
(2) MX06FIT865-02 w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	4.54	4.71	0.10
(2) RADIO 8843	A	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	3.50	2.36	0.09
RADIO 8843	B	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	3.50	2.36	0.09
RADIO 4449	B	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	3.50	2.36	0.09
(2) RADIO 4449	C	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	3.50	2.36	0.09
(2) RRFDC-3315-PF-48	A	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	3.79	2.51	0.03
8' x 2" Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	1.90	1.90	0.03
8' x 2" Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	1.90	1.90	0.03
8' x 2" Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	1.90	1.90	0.03
Platform Mount [LP 304-1]	A	None		0.0000	170.00	No Ice	17.49	17.49	1.35
****									
AIR 6449 B77 w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	3.65	2.72	0.11
AIR 6449 B77 w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	3.65	2.72	0.11
AIR 6449 B77 w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	170.00	No Ice	3.65	2.72	0.11
Top Rail [# VZWSAMRT-PLK1]	A	None		0.0000	170.00	No Ice	4.56	4.56	0.25
****									
TLLPX310M-E w/ Mount Pipe	A	From Leg	3.00 0.00 0.00	0.0000	163.00	No Ice	3.88	2.36	0.06
TLLPX310M-E w/ Mount Pipe	B	From Leg	3.00 0.00 0.00	0.0000	163.00	No Ice	3.88	2.36	0.06
TLLPX310M-E w/ Mount Pipe	C	From Leg	3.00 0.00 0.00	0.0000	163.00	No Ice	3.88	2.36	0.06
BREEZEMAX ELITE NAU	A	From Leg	3.00 0.00 0.00	0.0000	163.00	No Ice	1.87	1.28	0.04
BREEZEMAX ELITE NAU	B	From Leg	3.00 0.00 0.00	0.0000	163.00	No Ice	1.87	1.28	0.04
BREEZEMAX ELITE NAU	C	From Leg	3.00 0.00	0.0000	163.00	No Ice	1.87	1.28	0.04

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
HORIZON COMPACT	B	From Leg	0.00 3.00 0.00 0.00	0.0000	163.00	No Ice	0.72	0.37	0.01
HORIZON COMPACT	C	From Leg	3.00 0.00 0.00	0.0000	163.00	No Ice	0.72	0.37	0.01
6' x 2" Mount Pipe	A	From Leg	3.00 0.00 0.00	0.0000	163.00	No Ice	1.43	1.43	0.02
6' x 2" Mount Pipe	B	From Leg	3.00 0.00 0.00	0.0000	163.00	No Ice	1.43	1.43	0.02
6' x 2" Mount Pipe	C	From Leg	3.00 0.00 0.00	0.0000	163.00	No Ice	1.43	1.43	0.02
T-Arm Mount [TA 702-3]	C	None		0.0000	163.00	No Ice	4.75	4.75	0.34
****									
Pipe Mount [PM 601-1]	C	From Leg	0.50 0.00 0.00	0.0000	130.00	No Ice	1.32	1.32	0.07
****									
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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
****											
P3F-52	B	Paraboloid w/Radome	From Leg	3.00 0.00 0.00	40.0000		163.00	3.33	No Ice	8.73	0.09
P3F-52	C	Paraboloid w/Radome	From Leg	3.00 0.00 0.00	60.0000		163.00	3.33	No Ice	8.73	0.09
****											
HP4-102	C	Grid	From Leg	1.00 0.00 0.00	40.0000		130.00	4.00	No Ice	12.57	0.08
****											

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

Comb. No.	Description
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	Dead+Wind 0 deg - Service
27	Dead+Wind 30 deg - Service
28	Dead+Wind 60 deg - Service
29	Dead+Wind 90 deg - Service
30	Dead+Wind 120 deg - Service
31	Dead+Wind 150 deg - Service
32	Dead+Wind 180 deg - Service
33	Dead+Wind 210 deg - Service
34	Dead+Wind 240 deg - Service
35	Dead+Wind 270 deg - Service
36	Dead+Wind 300 deg - Service
37	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	197 - 187.583	Pole	Max Tension	14	0.00	0.00	0.00
			Max. Compression	18	-3.62	8.44	-4.86
			Max. Mx	20	-1.81	12.57	0.01
			Max. My	2	-1.81	0.01	12.57
			Max. Vy	8	4.56	-9.72	0.01
			Max. Vx	14	4.56	0.01	-9.73
			Max. Torque	16			0.00
L2	187.583 - 138.667	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-18.06	596.63	-347.03
			Max. Mx	8	-18.04	-693.08	0.13
			Max. My	14	-18.01	-1.01	-699.40
			Max. Vy	8	20.39	-693.08	0.13
			Max. Vx	14	20.63	-1.01	-699.40
			Max. Torque	11			2.10
L3	138.667 - 91.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-29.73	1518.49	-881.02
			Max. Mx	8	-29.71	-1765.95	0.68
			Max. My	14	-29.70	-2.62	-1778.90
			Max. Vy	8	26.18	-1765.95	0.68
			Max. Vx	2	-26.26	0.91	1777.44
			Max. Torque	24			-1.33
L4	91.5 - 45.083	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-46.04	2647.56	-1533.87
			Max. Mx	8	-46.03	-3078.78	1.41
			Max. My	14	-46.03	-4.41	-3095.46
			Max. Vy	8	31.78	-3078.78	1.41
			Max. Vx	2	-31.86	2.38	3093.78
			Max. Torque	19			-0.89
L5	45.083 - 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	18	-71.32	4228.27	-2447.57
			Max. Mx	8	-71.32	-4914.41	2.26
			Max. My	14	-71.32	-6.47	-4935.20
			Max. Vy	8	37.48	-4914.41	2.26
			Max. Vx	2	-37.55	4.06	4933.33
			Max. Torque	19			-0.89

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	14	71.34	-0.04	-37.50
	Max. H_x	20	71.34	37.43	0.08
	Max. H_z	2	71.34	0.03	37.51
	Max. M_x	2	4933.33	0.03	37.51
	Max. M_z	8	4914.41	-37.44	0.02
	Max. Torsion	7	0.16	-32.36	18.76
	Min. Vert	19	53.50	32.25	-18.63
	Min. H_x	8	71.34	-37.44	0.02
	Min. H_z	14	71.34	-0.04	-37.50
	Min. M_x	14	-4935.20	-0.04	-37.50
	Min. M_z	20	-4912.76	37.43	0.08
	Min. Torsion	19	-0.89	32.25	-18.63

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	59.45	0.00	0.00	1.05	0.68	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	71.34	-0.03	-37.51	-4933.33	4.06	0.42
0.9 Dead+1.0 Wind 0 deg - No Ice	53.50	-0.03	-37.51	-4875.73	3.81	0.42
1.2 Dead+1.0 Wind 30 deg - No Ice	71.34	18.67	-32.44	-4264.15	-2450.33	0.15
0.9 Dead+1.0 Wind 30 deg - No Ice	53.50	18.67	-32.44	-4214.38	-2421.78	0.14
1.2 Dead+1.0 Wind 60 deg - No Ice	71.34	32.36	-18.76	-2466.41	-4245.45	-0.15
0.9 Dead+1.0 Wind 60 deg - No Ice	53.50	32.36	-18.76	-2437.77	-4195.85	-0.16
1.2 Dead+1.0 Wind 90 deg - No Ice	71.34	37.44	-0.02	-2.26	-4914.41	0.11
0.9 Dead+1.0 Wind 90 deg - No Ice	53.50	37.44	-0.02	-2.57	-4857.00	0.11
1.2 Dead+1.0 Wind 120 deg - No Ice	71.34	32.47	18.86	2484.55	-4264.09	0.29
0.9 Dead+1.0 Wind 120 deg - No Ice	53.50	32.47	18.86	2455.05	-4214.27	0.29
1.2 Dead+1.0 Wind 150 deg - No Ice	71.34	18.82	32.63	4296.89	-2473.45	0.22
0.9 Dead+1.0 Wind 150 deg - No Ice	53.50	18.82	32.63	4246.09	-2444.64	0.22
1.2 Dead+1.0 Wind 180 deg - No Ice	71.34	0.04	37.50	4935.20	-6.47	-0.04
0.9 Dead+1.0 Wind 180 deg - No Ice	53.50	0.04	37.50	4876.92	-6.60	-0.04
1.2 Dead+1.0 Wind 210 deg - No Ice	71.34	-18.56	32.36	4253.85	2431.69	0.55

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 210 deg - No Ice	53.50	-18.56	32.36	4203.55	2402.96	0.56
1.2 Dead+1.0 Wind 240 deg - No Ice	71.34	-32.25	18.63	2447.57	4228.27	0.88
0.9 Dead+1.0 Wind 240 deg - No Ice	53.50	-32.25	18.63	2418.50	4178.47	0.89
1.2 Dead+1.0 Wind 270 deg - No Ice	71.34	-37.43	-0.08	-11.73	4912.76	0.61
0.9 Dead+1.0 Wind 270 deg - No Ice	53.50	-37.43	-0.08	-11.92	4854.96	0.62
1.2 Dead+1.0 Wind 300 deg - No Ice	71.34	-32.54	-18.89	-2487.19	4277.30	0.25
0.9 Dead+1.0 Wind 300 deg - No Ice	53.50	-32.54	-18.89	-2458.32	4226.91	0.26
1.2 Dead+1.0 Wind 330 deg - No Ice	71.34	-18.79	-32.60	-4289.65	2469.43	0.44
0.9 Dead+1.0 Wind 330 deg - No Ice	53.50	-18.79	-32.60	-4239.59	2440.24	0.44
Dead+Wind 0 deg - Service	59.45	-0.01	-9.14	-1192.68	1.48	0.11
Dead+Wind 30 deg - Service	59.45	4.55	-7.90	-1030.78	-592.27	0.04
Dead+Wind 60 deg - Service	59.45	7.88	-4.57	-595.88	-1026.53	-0.04
Dead+Wind 90 deg - Service	59.45	9.12	-0.01	0.23	-1188.37	0.02
Dead+Wind 120 deg - Service	59.45	7.91	4.59	601.82	-1031.05	0.07
Dead+Wind 150 deg - Service	59.45	4.58	7.95	1040.26	-597.87	0.05
Dead+Wind 180 deg - Service	59.45	0.01	9.13	1194.68	-1.06	-0.01
Dead+Wind 210 deg - Service	59.45	-4.52	7.88	1029.83	588.76	0.13
Dead+Wind 240 deg - Service	59.45	-7.85	4.54	592.86	1023.37	0.22
Dead+Wind 270 deg - Service	59.45	-9.12	-0.02	-2.07	1188.97	0.15
Dead+Wind 300 deg - Service	59.45	-7.93	-4.60	-600.92	1035.25	0.07
Dead+Wind 330 deg - Service	59.45	-4.58	-7.94	-1036.96	597.90	0.11

Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.00	-59.45	0.00	0.00	59.45	0.00	0.000%
2	-0.03	-71.34	-37.51	0.03	71.34	37.51	0.000%
3	-0.03	-53.50	-37.51	0.03	53.50	37.51	0.000%
4	18.67	-71.34	-32.44	-18.67	71.34	32.44	0.000%
5	18.67	-53.50	-32.44	-18.67	53.50	32.44	0.000%
6	32.36	-71.34	-18.76	-32.36	71.34	18.76	0.000%
7	32.36	-53.50	-18.76	-32.36	53.50	18.76	0.000%
8	37.44	-71.34	-0.02	-37.44	71.34	0.02	0.000%
9	37.44	-53.50	-0.02	-37.44	53.50	0.02	0.000%
10	32.47	-71.34	18.86	-32.47	71.34	-18.86	0.000%
11	32.47	-53.50	18.86	-32.47	53.50	-18.86	0.000%
12	18.82	-71.34	32.63	-18.82	71.34	-32.63	0.000%
13	18.82	-53.50	32.63	-18.82	53.50	-32.63	0.000%
14	0.04	-71.34	37.50	-0.04	71.34	-37.50	0.000%
15	0.04	-53.50	37.50	-0.04	53.50	-37.50	0.000%
16	-18.56	-71.34	32.36	18.56	71.34	-32.36	0.000%
17	-18.56	-53.50	32.36	18.56	53.50	-32.36	0.000%
18	-32.25	-71.34	18.63	32.25	71.34	-18.63	0.000%
19	-32.25	-53.50	18.63	32.25	53.50	-18.63	0.000%
20	-37.43	-71.34	-0.08	37.43	71.34	0.08	0.000%
21	-37.43	-53.50	-0.08	37.43	53.50	0.08	0.000%
22	-32.54	-71.34	-18.89	32.54	71.34	18.89	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
23	-32.54	-53.50	-18.89	32.54	53.50	18.89	0.000%
24	-18.79	-71.34	-32.60	18.79	71.34	32.60	0.000%
25	-18.79	-53.50	-32.60	18.79	53.50	32.60	0.000%
26	-0.01	-59.45	-9.14	0.01	59.45	9.14	0.000%
27	4.55	-59.45	-7.90	-4.55	59.45	7.90	0.000%
28	7.88	-59.45	-4.57	-7.88	59.45	4.57	0.000%
29	9.12	-59.45	-0.01	-9.12	59.45	0.01	0.000%
30	7.91	-59.45	4.59	-7.91	59.45	-4.59	0.000%
31	4.58	-59.45	7.95	-4.58	59.45	-7.95	0.000%
32	0.01	-59.45	9.13	-0.01	59.45	-9.13	0.000%
33	-4.52	-59.45	7.88	4.52	59.45	-7.88	0.000%
34	-7.85	-59.45	4.54	7.85	59.45	-4.54	0.000%
35	-9.12	-59.45	-0.02	9.12	59.45	0.02	0.000%
36	-7.93	-59.45	-4.60	7.93	59.45	4.60	0.000%
37	-4.58	-59.45	-7.94	4.58	59.45	7.94	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	0.00071667
3	Yes	4	0.00000001	0.00036898
4	Yes	6	0.00000001	0.00007832
5	Yes	5	0.00000001	0.00062937
6	Yes	6	0.00000001	0.00007801
7	Yes	5	0.00000001	0.00062697
8	Yes	4	0.00000001	0.00056634
9	Yes	4	0.00000001	0.00022789
10	Yes	6	0.00000001	0.00007849
11	Yes	5	0.00000001	0.00063029
12	Yes	6	0.00000001	0.00007956
13	Yes	5	0.00000001	0.00063884
14	Yes	4	0.00000001	0.00065712
15	Yes	4	0.00000001	0.00031330
16	Yes	6	0.00000001	0.00007748
17	Yes	5	0.00000001	0.00062272
18	Yes	6	0.00000001	0.00007600
19	Yes	5	0.00000001	0.00061052
20	Yes	4	0.00000001	0.00084241
21	Yes	4	0.00000001	0.00047696
22	Yes	6	0.00000001	0.00007986
23	Yes	5	0.00000001	0.00064156
24	Yes	6	0.00000001	0.00007789
25	Yes	5	0.00000001	0.00062526
26	Yes	4	0.00000001	0.00006278
27	Yes	4	0.00000001	0.00039848
28	Yes	4	0.00000001	0.00039404
29	Yes	4	0.00000001	0.00005498
30	Yes	4	0.00000001	0.00039509
31	Yes	4	0.00000001	0.00040816
32	Yes	4	0.00000001	0.00005819
33	Yes	4	0.00000001	0.00039371
34	Yes	4	0.00000001	0.00037361
35	Yes	4	0.00000001	0.00006416
36	Yes	4	0.00000001	0.00041375
37	Yes	4	0.00000001	0.00038470

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	197 - 187.583	28.612	31	1.3442	0.0018
L2	191.5 - 138.667	27.064	31	1.3438	0.0018
L3	144 - 91.5	14.749	31	1.0391	0.0006
L4	98 - 45.083	6.495	31	0.6509	0.0003
L5	52.75 - 0	1.828	31	0.3174	0.0001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
192.00	FFVV-65C-R3-V1_TMO w/ Mount Pipe	31	27.205	1.3442	0.0018	42807
185.00	7772.00	31	25.247	1.3315	0.0018	21305
170.00	(2) MX06FIT845-02 w/ Mount Pipe	31	21.160	1.2559	0.0013	10686
163.00	P3F-52	31	19.332	1.2042	0.0011	8658
130.00	HP4-102	31	11.820	0.9159	0.0005	6213

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	197 - 187.583	118.301	12	5.5680	0.0073
L2	191.5 - 138.667	111.905	12	5.5663	0.0073
L3	144 - 91.5	61.008	12	4.3034	0.0027
L4	98 - 45.083	26.868	12	2.6946	0.0011
L5	52.75 - 0	7.558	12	1.3129	0.0004

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
192.00	FFVV-65C-R3-V1_TMO w/ Mount Pipe	12	112.486	5.5677	0.0073	10613
185.00	7772.00	12	104.396	5.5153	0.0070	5252
170.00	(2) MX06FIT845-02 w/ Mount Pipe	12	87.509	5.2022	0.0053	2620
163.00	P3F-52	12	79.953	4.9878	0.0043	2120
130.00	HP4-102	12	48.897	3.7931	0.0021	1514

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	197 - 187.583 (1)	TP25.362x23.19x0.1875	9.42	0.00	0.0	15.0575	-1.81	880.86	0.002
L2	187.583 - 138.667 (2)	TP36.227x24.0836x0.25	52.83	0.00	0.0	27.7141	-18.00	1621.28	0.011
L3	138.667 - 91.5 (3)	TP46.583x34.5012x0.375	52.50	0.00	0.0	53.4869	-29.69	3128.99	0.009
L4	91.5 - 45.083 (4)	TP56.513x44.3372x0.4375	52.92	0.00	0.0	75.7983	-46.02	4434.20	0.010
L5	45.083 - 0 (5)	TP65.999x53.8739x0.5	52.75	0.00	0.0	104.4710	-71.32	6111.55	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	197 - 187.583 (1)	TP25.362x23.19x0.1875	12.58	511.97	0.025	0.00	511.97	0.000
L2	187.583 - 138.667 (2)	TP36.227x24.0836x0.25	700.29	1282.14	0.546	0.00	1282.14	0.000
L3	138.667 - 91.5 (3)	TP46.583x34.5012x0.375	1785.71	3376.13	0.529	0.00	3376.13	0.000
L4	91.5 - 45.083 (4)	TP56.513x44.3372x0.4375	3109.69	5729.68	0.543	0.00	5729.68	0.000
L5	45.083 - 0 (5)	TP65.999x53.8739x0.5	4957.95	9333.00	0.531	0.00	9333.00	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	197 - 187.583 (1)	TP25.362x23.19x0.1875	2.27	264.26	0.009	0.00	583.35	0.000
L2	187.583 - 138.667 (2)	TP36.227x24.0836x0.25	20.69	486.38	0.043	0.68	1482.13	0.000
L3	138.667 - 91.5 (3)	TP46.583x34.5012x0.375	26.41	938.70	0.028	0.22	3680.33	0.000
L4	91.5 - 45.083 (4)	TP56.513x44.3372x0.4375	32.02	1330.26	0.024	0.22	6335.25	0.000
L5	45.083 - 0 (5)	TP65.999x53.8739x0.5	37.70	1833.46	0.021	0.22	10530.33	0.000

Pole Interaction Design Data

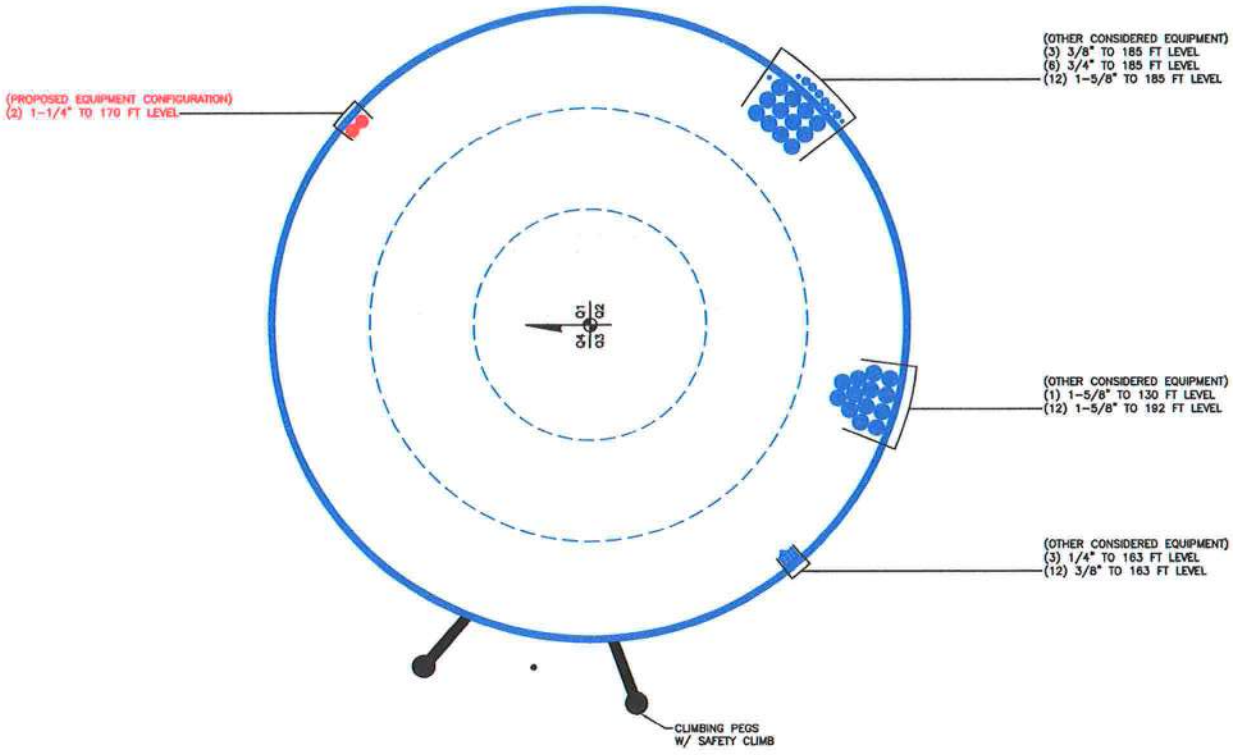
Section No.	Elevation ft	Ratio P_u / ϕP_n	Ratio M_{ux} / ϕM_{nx}	Ratio M_{uy} / ϕM_{ny}	Ratio V_u / ϕV_n	Ratio T_u / ϕT_n	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	197 - 187.583 (1)	0.002	0.025	0.000	0.009	0.000	0.027	1.050	4.8.2
L2	187.583 - 138.667 (2)	0.011	0.546	0.000	0.043	0.000	0.559	1.050	4.8.2
L3	138.667 - 91.5 (3)	0.009	0.529	0.000	0.028	0.000	0.539	1.050	4.8.2
L4	91.5 - 45.083 (4)	0.010	0.543	0.000	0.024	0.000	0.554	1.050	4.8.2
L5	45.083 - 0 (5)	0.012	0.531	0.000	0.021	0.000	0.543	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	197 - 187.583	Pole	TP25.362x23.19x0.1875	1	-1.81	924.91	2.5	Pass
L2	187.583 - 138.667	Pole	TP36.227x24.0836x0.25	2	-18.00	1702.34	53.3	Pass
L3	138.667 - 91.5	Pole	TP46.583x34.5012x0.375	3	-29.69	3285.44	51.4	Pass
L4	91.5 - 45.083	Pole	TP56.513x44.3372x0.4375	4	-46.02	4655.91	52.7	Pass
L5	45.083 - 0	Pole	TP65.999x53.8739x0.5	5	-71.32	6417.13	51.7	Pass
							Summary	
						Pole (L2)	53.3	Pass
						RATING =	**53.3**	**Pass**

APPENDIX B

BASE LEVEL DRAWING



BUSINESS UNIT: 824653 TOWER ID: C_BASELEVEL

APPENDIX C

ADDITIONAL CALCULATIONS

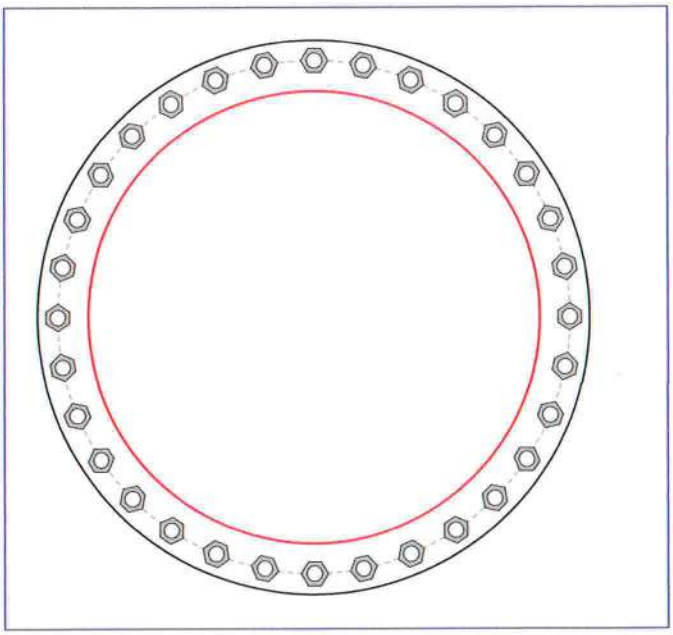
Monopole Base Plate Connection

Site Info	
BU #	824653
Site Name	Hwy90 at NW Brown R
Order #	623626 Rev. 0

Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	No
l_{ar} (in)	1.25

Applied Loads	
Moment (kip-ft)	4957.95
Axial Force (kips)	71.32
Shear Force (kips)	37.70

**TIA-222-H Section 15.5 Applied*



Connection Properties

Anchor Rod Data

(32) 2-1/4" ø bolts (A615-75 N; Fy=75 ksi, Fu=100 ksi) on 74.83" BC

Base Plate Data

80.83" OD x 3" Plate (A633 Gr. E; Fy=60 ksi, Fu=70 ksi)

Stiffener Data

N/A

Pole Data

65.999" x 0.5" 16-sided pole (A572-65; Fy=65 ksi, Fu=80 ksi)

Analysis Results

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

Pu_t = 97.12	ϕPn_t = 243.75	**Stress Rating**
Vu = 1.18	ϕVn = 149.1	**37.9%**
Mu = n/a	ϕMn = n/a	Pass

Base Plate Summary

Max Stress (ksi):	18.65	(Flexural)
Allowable Stress (ksi):	54	
Stress Rating:	**32.9%**	Pass

Drilled Pier Foundation

BU # :	824653
Site Name:	Hwy90 at NW Brown Rd
Order Number:	623626 Rev. 0
TIA-222 Revison:	H
Tower Type:	Monopole

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

Applied Loads	Comp.	Uplift
Moment (kip-ft)	5000.01	
Axial Force (kips)	71.22	
Shear Force (kips)	38.03	

Material Properties			Rebar 2, Fy Override (ksi)	Rebar 3, Fy Override (ksi)
Concrete Strength, f'c:	3	ksi		
Rebar Strength, Fy:	60	ksi		
Tie Yield Strength, Fyt:	40	ksi		

Pier Design Data		
Depth	39	ft
Ext. Above Grade	1	ft
Pier Section 1		
From 1' above grade to 39' below grade		
Pier Diameter	9	ft
Rebar Quantity	68	
Rebar Size	9	
Clear Cover to Ties	4	in
Tie Size	4	
Tie Spacing	12	in

Rebar & Pier Options

Embedded Pole Inputs

Belled Pier Inputs

Analysis Results		
Soil Lateral Check	*Compression*	*Uplift*
$D_{y=0}$ (ft from TOC)	10.70	-
Soil Safety Factor	7.66	-
Max Moment (kip-ft)	5349.82	-
Rating*	*16.5%*	-
Soil Vertical Check	*Compression*	*Uplift*
Skin Friction (kips)	1081.49	-
End Bearing (kips)	1717.67	-
Weight of Concrete (kips)	315.13	-
Total Capacity (kips)	2799.16	-
Axial (kips)	386.35	-
Rating*	*13.1%*	-
Reinforced Concrete Flexure	*Compression*	*Uplift*
Critical Depth (ft from TOC)	10.50	-
Critical Moment (kip-ft)	5349.61	-
Critical Moment Capacity	13836.25	-
Rating*	*36.8%*	-
Reinforced Concrete Shear	*Compression*	*Uplift*
Critical Depth (ft from TOC)	29.04	-
Critical Shear (kip)	384.76	-
Critical Shear Capacity	917.13	-
Rating*	*40.0%*	-

Structural Foundation Rating*	**40.0%**
Soil Interaction Rating*	**16.5%**

*Rating per TIA-222-H Section 15.5

Soil Profile

Groundwater Depth	9	# of Layers	8

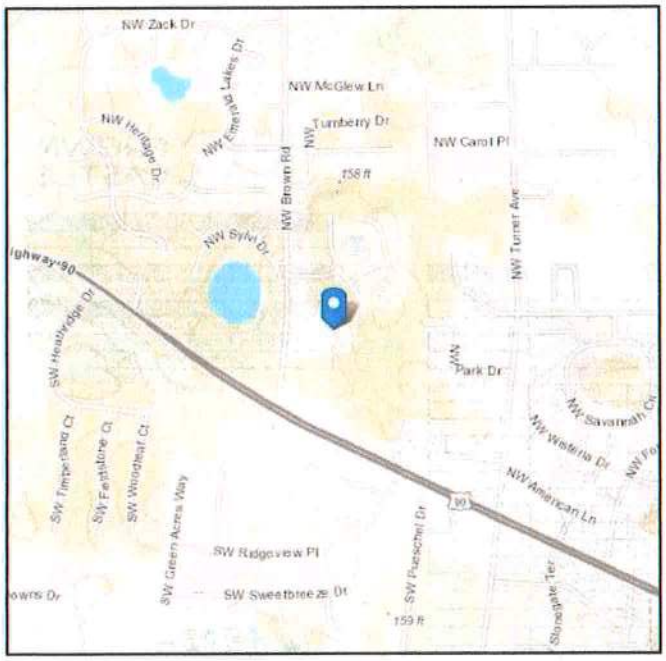
Layer	Top (ft)	Bottom (ft)	Thickness (ft)	γ_{soil} (pcf)	$\gamma_{concrete}$ (pcf)	Cohesion (ksf)	Angle of Friction (degrees)	Calculated Ultimate Skin Friction Comp (ksf)	Calculated Ultimate Skin Friction Uplift (ksf)	Ultimate Skin Friction Comp Override (ksf)	Ultimate Skin Friction Uplift Override (ksf)	Ult. Gross Bearing Capacity (ksf)	SPT Blow Count	Soil Type
1	0	5	5	105	150	0	0	0.000	0.000	0.00	0.00			Cohesionless
2	5	8	3	105	150	0	29	0.000	0.000	0.40	0.40			Cohesionless
3	8	9	1	110	150	0	31	0.000	0.000	1.00	1.00			Cohesionless
4	9	10	1	47.6	87.6	0	31	0.000	0.000	1.00	1.00			Cohesionless
5	10	16	6	57.6	87.6	0	39	0.000	0.000	1.10	1.10			Cohesionless
6	16	22	6	47.6	87.6	0	32	0.000	0.000	1.30	1.30			Cohesionless
7	22	30	8	47.6	87.6	3	0	1.65	1.65	1.70	1.70			Cohesive
8	30	39	9	52.6	87.6	4	0	2.05	2.05	2.20	2.20	36		Cohesive

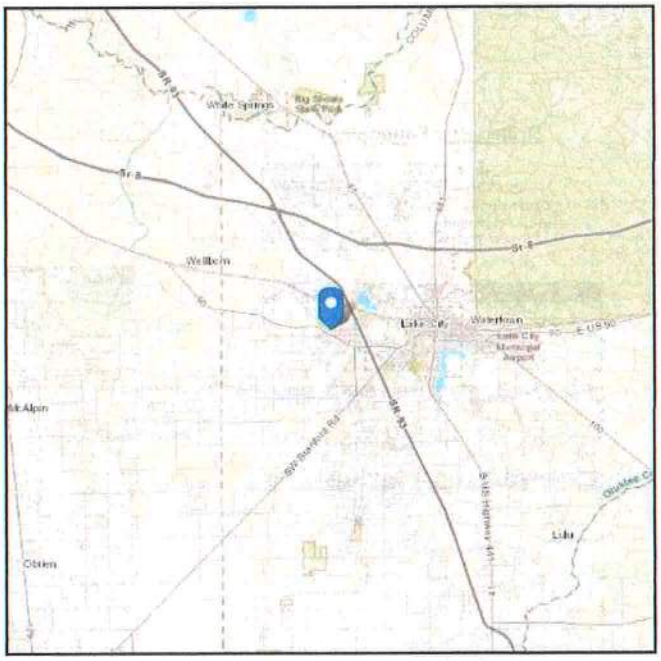
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Stiff Soil

Elevation: 165.29 ft (NAVD 88)
Latitude: 30.190542
Longitude: -82.715661





Wind

Results:

Wind Speed	118 Vmph
10-year MRI	75 Vmph
25-year MRI	83 Vmph
50-year MRI	90 Vmph
100-year MRI	97 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Fri Jul 15 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 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2. Glazed openings need not be protected against wind-borne debris.

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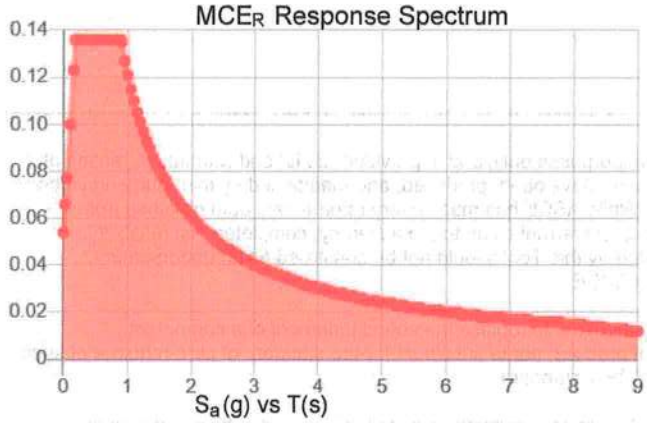
Seismic

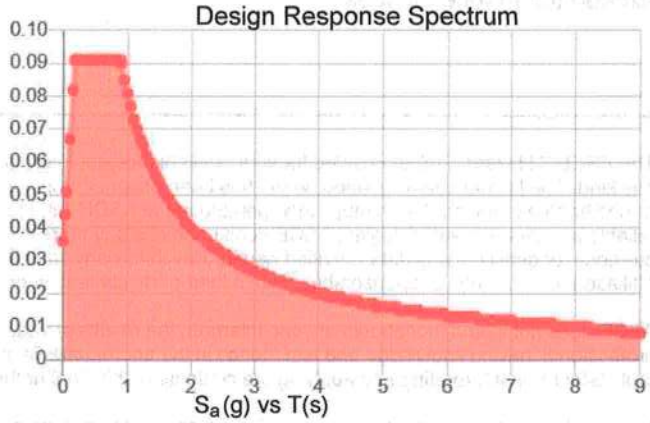
Site Soil Class: D - Stiff Soil

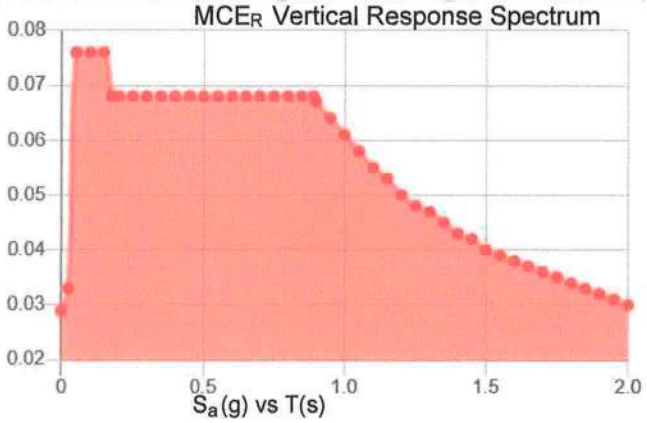
Results:

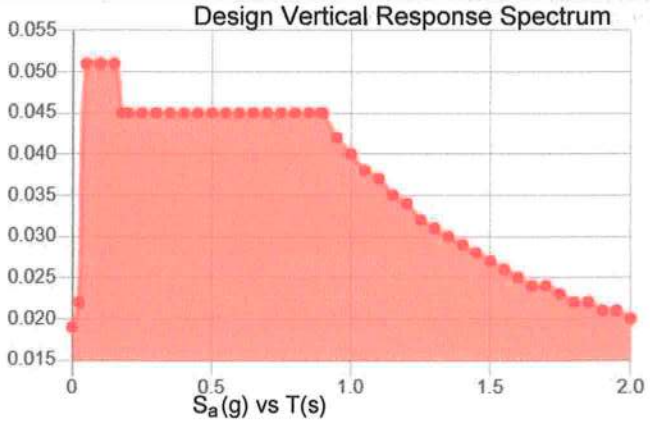
S_S :	0.085	S_{D1} :	0.081
S_1 :	0.05	T_L :	8
F_a :	1.6	PGA :	0.04
F_v :	2.4	PGA_M :	0.065
S_{MS} :	0.136	F_{PGA} :	1.6
S_{M1} :	0.121	I_e :	1
S_{DS} :	0.091	C_v :	0.7

Seismic Design Category B









Data Accessed: **Fri Jul 15 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.

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Ice

Results:

Ice Thickness:	0.25 in.
Concurrent Temperature:	25 F
Gust Speed	30 mph
Data Source:	Standard ASCE/SEI 7-16, Figs. 10-2 through 10-8
Date Accessed:	Fri Jul 15 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.