



MORRISON HERSHFIELD

Date: **November 15, 2022**

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

Structural Analysis Report

1 1

- 1 Co-Locate

Site Number: 10096114
Site Name: West Lake City
FA Number: 10096114

1 1

BU Number: 824653
Site Name: Hwy90 at NW Brown Rd
JDE Job Number: 735331
Work Order Number: 2180921
Order Number: 638092 Rev. 0

1 1

Morrison Hershfield Project Number: CN3-182R5 / 2300001

1

297 NW Brown Rd, Lake City, Columbia County, FL 32055
Latitude 1 8 Longitude 1 8 8
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:

LC7: 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, P.E. (FL License No. 68787)
Senior Engineer

Certificate of Authorization # 8508



Digitally signed by
G. Lance Cooke
Date: 2022.11.15
16:16:27+05'30'

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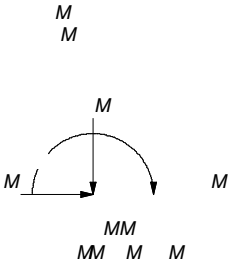
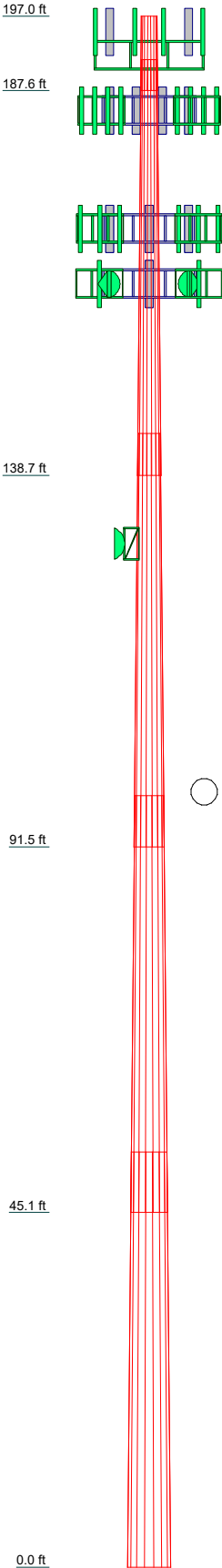
Base Level Drawing

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Additional Calculations

APPENDIX A
TNXTOWER OUTPUT

Section	5	4	3	2	1
Length (ft)	52.75	52.92	52.50	52.83	9.42
Number of Sides	16	16	16	16	16
Thickness (in)	0.5000	0.4375	0.3750	0.2500	0.1875
Socket Length (ft)		7.67	6.50	5.33	3.92
Top Dia (in)	53.8739	44.3372	34.5012	24.0836	23.1900
Bot Dia (in)	65.9990	56.5130	46.5830	36.2270	25.3620
Grade			A572-65		
Weight (K)	42.9	17.0	12.6	8.6	4.3
					0.5



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: 55%



1455 Lincoln Parkway, Suite 500
Atlanta, GA 30346
Phone: (770) 379-8500
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Job:

Project:

Client: Crown Castle USA

Drawn by: NN

App'd:

Code: TIA-222-H

Date: 11/15/22

Scale: NTS

Path: C:\Users\N\Naidu\Desktop\Daily Jobs\MP\CN3-182R5\CN3-182R5 BU_824653 WO_2180921.dwg

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	Retention Guys To Initial Tension	Offset Girt At Foundation
Escalate Ice	✓ Bypass Mast Stability Checks	✓ Consider Feed Line Torque
Always Use Max Kz	✓ Use Azimuth Dish Coefficients	Include Angle Block Shear Check
Use Special Wind Profile	✓ Project Wind Area of Appurt.	Use TIA-222-H Bracing Resist.
		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	
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

C	C V	C	C	C	C	C X	C	C X	C	C
	C	C	C	C	C	C	C	C	C	C
L1	197.00-187.58	9.42	3.92	16	23.1900	25.3620	0.1875	0.7500	A572-65	
L2	187.58-138.67	52.83	5.33	16	24.0836	36.2270	0.2500	1.0000	(65 ksi)	
L3	138.67-91.50	52.50	6.50	16	34.5012	46.5830	0.3750	1.5000	A572-65	
L4	91.50-45.08	52.92	7.67	16	44.3372	56.5130	0.4375	1.7500	(65 ksi)	
L5	45.08-0.00	52.75		16	53.8739	65.9990	0.5000	2.0000	A572-65	

Device	Power (W)	Frequency (MHz)	Location	Altitude (m)	Latitude	Longitude	Height (m)	Temperature (°C)	Humidity (%)	Pressure (hPa)
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	10	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

C	C	°	C	K _C	K _C	Z _K K _{KC}	Z _K K _{KC}	C
C	C			C	C	C	C	C
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	34.617	0.000	1.31	
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	35.240	0.000	1.35	
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	34.680	0.000	1.34	
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	26.212	0.000	1.10	

C	C	V	$\mathcal{C}$	Z^c	Z^c	Z^c	Z^c
		C	C	C	C	C	C
L1		197.00-187.58		-0.7727	-0.2511	-0.4951	-0.1609
L2		187.58-138.67		2.3706	2.5565	1.6661	1.7967
L3		138.67-91.50		2.6622	2.8507	1.8331	1.9629
L4		91.50-45.08		2.7857	2.9835	1.8884	2.0225
L5		45.08-0.00		2.2860	2.4486	1.5119	1.6195

tnxTower Report - version 8.1.1.0

tnxTower Report - version 8.1.1.0

C f JGC C C C h 0. L WGLh EEEF /C C h. ELL/C EC ZZ 1X C CLDKVh Cf

AIR6449 B41_T-MOBILE w/ Mount Pipe	A	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	5.19	2.71	0.13
AIR6449 B41_T-MOBILE w/ Mount Pipe	B	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	5.19	2.71	0.13
AIR6449 B41_T-MOBILE w/ Mount Pipe	C	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	5.19	2.71	0.13
RADIO 4460 B2/B25 B66_TMO	A	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	2.14	1.69	0.11
RADIO 4460 B2/B25 B66_TMO	B	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	2.14	1.69	0.11
RADIO 4460 B2/B25 B66_TMO	C	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	2.14	1.69	0.11
RADIO 4480 B71_TMO	A	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	2.85	1.38	0.09
RADIO 4480 B71_TMO	B	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	2.85	1.38	0.09
RADIO 4480 B71_TMO	C	From Leg	4.00 0.00 3.00	0.0000	192.00	No Ice	2.85	1.38	0.09
8' x 2" Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	192.00	No Ice	1.90	1.90	0.03
8' x 2" Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	192.00	No Ice	1.90	1.90	0.03
8' x 2" Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	192.00	No Ice	1.90	1.90	0.03
Platform Mount [LP 716-1] ****	A	None		0.0000	192.00	No Ice	26.80	26.80	1.51
SBNHH-1D65B w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	185.00	No Ice	4.09	3.30	0.07
SBNHH-1D65B w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	185.00	No Ice	4.09	3.30	0.07
SBNHH-1D65B w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	185.00	No Ice	4.09	3.30	0.07
NNHH-65B-R4 w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	185.00	No Ice	7.55	4.23	0.11
NNHH-65B-R4 w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	185.00	No Ice	7.55	4.23	0.11
NNHH-65B-R4 w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	185.00	No Ice	7.55	4.23	0.11
RRUS 4478 B14	B	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	1.84	1.06	0.06
(2) 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-11	A	From Leg	4.00 0.00 0.00	0.0000	185.00	No Ice	2.78	1.19	0.05

	C	°	C	C	Y	C	C	C	C
			C	C	C	C	C	C	C
			C	C	C	C	C	C	C
			C	C	C	C	C	C	C
			C	C	C	C	C	C	C
(2) RRUS-11	C	From Leg	4.00	0.0000	185.00	No Ice	2.78	1.19	0.05
			0.00						
			0.00						
RRUS 32	A	From Leg	4.00	0.0000	185.00	No Ice	2.86	1.78	0.06
			0.00						
			0.00						
RRUS 32	B	From Leg	4.00	0.0000	185.00	No Ice	2.86	1.78	0.06
			0.00						
			0.00						
RRUS 32	C	From Leg	4.00	0.0000	185.00	No Ice	2.86	1.78	0.06
			0.00						
			0.00						
RRUS 4426 B66	A	From Leg	4.00	0.0000	185.00	No Ice	1.64	0.73	0.05
			0.00						
			0.00						
(2) RRUS 4426 B66	B	From Leg	4.00	0.0000	185.00	No Ice	1.64	0.73	0.05
			0.00						
			0.00						
DC6-48-60-18-8C	A	From Leg	4.00	0.0000	185.00	No Ice	2.74	2.74	0.03
			0.00						
			0.00						
Platform Mount [LP 304-1_HR-1]	A	None		0.0000	185.00	No Ice	21.41	21.41	1.60
AIR 6449 B77D C-BAND w/ Mount Pipe	A	From Leg	4.00	0.0000	185.00	No Ice	3.58	2.31	0.10
			0.00						
			1.00						
AIR 6449 B77D C-BAND w/ Mount Pipe	B	From Leg	4.00	0.0000	185.00	No Ice	3.58	2.31	0.10
			0.00						
			1.00						
AIR 6449 B77D C-BAND w/ Mount Pipe	C	From Leg	4.00	0.0000	185.00	No Ice	3.58	2.31	0.10
			0.00						
			1.00						
NNHH-65B-R4 w/ Mount Pipe	A	From Leg	4.00	0.0000	185.00	No Ice	7.55	4.23	0.11
			0.00						
			1.00						
NNHH-65B-R4 w/ Mount Pipe	B	From Leg	4.00	0.0000	185.00	No Ice	7.55	4.23	0.11
			0.00						
			1.00						
NNHH-65B-R4 w/ Mount Pipe	C	From Leg	4.00	0.0000	185.00	No Ice	7.55	4.23	0.11
			0.00						
			1.00						
AIR 6419 B77G w/ Mount Pipe	A	From Leg	4.00	0.0000	185.00	No Ice	4.32	2.49	0.08
			0.00						
			1.00						
AIR 6419 B77G w/ Mount Pipe	B	From Leg	4.00	0.0000	185.00	No Ice	4.32	2.49	0.08
			0.00						
			1.00						
AIR 6419 B77G w/ Mount Pipe	C	From Leg	4.00	0.0000	185.00	No Ice	4.32	2.49	0.08
			0.00						
			1.00						
RRUS 4415 B25	A	From Leg	4.00	0.0000	185.00	No Ice	1.64	0.68	0.04
			0.00						
			1.00						
RRUS 4415 B25	B	From Leg	4.00	0.0000	185.00	No Ice	1.64	0.68	0.04
			0.00						
			1.00						
RRUS 4415 B25	C	From Leg	4.00	0.0000	185.00	No Ice	1.64	0.68	0.04
			0.00						
			1.00						
RRUS 4449 B5/B12	A	From Leg	4.00	0.0000	185.00	No Ice	1.97	1.41	0.07
			0.00						
			1.00						
RRUS 4449 B5/B12	B	From Leg	4.00	0.0000	185.00	No Ice	1.97	1.41	0.07
			0.00						

C f JGC C C C h 0. L WGLh EEEF /C C h. ELL/C EC ZZ 1X C CLDKVh CD

	C	°	C	C	Y	C	K	C	C
			C	C	C	C	C	C	C
			C	C	C	C	C	C	C
			C	C	C	C	C	C	C
Pipe					0.00				
					0.00				
BREEZEMAX ELITE NAU	A	From Leg			3.00	0.0000	163.00	No Ice	1.87
					0.00				1.28
					0.00				0.04
BREEZEMAX ELITE NAU	B	From Leg			3.00	0.0000	163.00	No Ice	1.87
					0.00				1.28
					0.00				0.04
BREEZEMAX ELITE NAU	C	From Leg			3.00	0.0000	163.00	No Ice	1.87
					0.00				1.28
					0.00				0.04
Horizon Compact	B	From Leg			3.00	0.0000	163.00	No Ice	0.72
					0.00				0.37
					0.00				0.01
Horizon Compact	C	From Leg			3.00	0.0000	163.00	No Ice	0.72
					0.00				0.37
					0.00				0.01
6' x 2" Mount Pipe	A	From Leg			3.00	0.0000	163.00	No Ice	1.43
					0.00				1.43
					0.00				0.02
6' x 2" Mount Pipe	B	From Leg			3.00	0.0000	163.00	No Ice	1.43
					0.00				1.43
					0.00				0.02
6' x 2" Mount Pipe	C	From Leg			3.00	0.0000	163.00	No Ice	1.43
					0.00				1.43
					0.00				0.02
T-Arm Mount [TA 702-3]	C	None				0.0000	163.00	No Ice	4.75
****									4.75
****									0.34
Side Arm Mount [SO 301-1]	C	From Leg			1.00	0.0000	130.00	No Ice	0.46
					0.00				0.91
					0.00				0.02

Dishes

	C	°	C	C	Y	C	K	C	C	C
			C	C	C	C	C	C	C	C
			C	C	C	C	C	C	C	C
			C	C	C	C	C	C	C	C

P3F-52	B	Paraboloid w/Radome	From Leg		3.00	40.0000	163.00	3.33	No Ice	8.73
					0.00					0.09
					0.00					
P3F-52	C	Paraboloid w/Radome	From Leg		3.00	60.0000	163.00	3.33	No Ice	8.73
					0.00					0.09
					0.00					

HP4-102	C	Grid	From Leg		2.00	40.0000	130.00	4.00	No Ice	12.57
					0.00					0.08
					0.00					

Load Combinations

Z	αC		C
1	Dead Only		
2	1.2 Dead+1.0 Wind 0 deg - No Ice		

C W CELL
 ZZXX C CLDKW
 C W

Z	σ_C	:	C
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	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

C	V	C	Z	C	Z	C	%	C	K	C	C	C	C
C	C			C			Z	C	C		C	C	C
L1	197 - 187.583		Pole		Max Tension		14		0.00		0.00		0.00
					Max. Compression		18		-3.61		8.45		-4.86
					Max. Mx		20		-1.80		12.59		0.01
					Max. My		2		-1.80		0.00		12.59
					Max. Vy		20		-4.57		9.75		0.01
					Max. Vx		14		4.57		0.01		-9.73
					Max. Torque		9						0.00
L2	187.583 - 138.667		Pole		Max Tension		1		0.00		0.00		0.00
					Max. Compression		18		-18.72		622.71		-362.18
					Max. Mx		8		-18.70		-720.44		2.95
					Max. My		14		-18.69		2.68		-723.65
					Max. Vy		8		21.00		-720.44		2.95
					Max. Vx		14		21.14		2.68		-723.65
					Max. Torque		9						2.95
L3	138.667 - 91.5		Pole		Max Tension		1		0.00		0.00		0.00
					Max. Compression		18		-30.38		1568.88		-910.26
					Max. Mx		8		-30.36		-1819.43		6.66
					Max. My		14		-30.36		4.41		-1825.47
					Max. Vy		8		26.72		-1819.43		6.66
					Max. Vx		2		-26.72		-5.22		1822.85
					Max. Torque		21						-2.02
L4	91.5 - 45.083		Pole		Max Tension		1		0.00		0.00		0.00

C	Z	C	% C	C	Y	/C C	Y	/C C
Pole	Max. Vert	14	72.07	0.02	-37.90			
	Max. H _x	21	54.05	37.90	0.01			
	Max. H _z	2	72.07	-0.04	37.91			
	Max. M _x	2	5020.53	-0.04	37.91			
	Max. M _z	8	5018.20	-37.91	0.09			
	Max. Torsion	7	0.98	-32.80	19.02			
	Min. Vert	19	54.05	32.69	-18.89			
	Min. H _x	9	54.05	-37.91	0.09			
	Min. H _z	14	72.07	0.02	-37.90			
	Min. M _x	14	-5024.48	0.02	-37.90			
	Min. M _z	20	-5017.48	37.90	0.01			
	Min. Torsion	19	-1.70	32.69	-18.89			

Z	C	C	C	C	C	C	C
					/C	/C	C
Dead Only		60.06	0.00	0.00	1.86	1.03	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice		72.07	0.04	-37.91	-5020.53	-8.64	0.10
0.9 Dead+1.0 Wind 0 deg - No Ice		54.05	0.04	-37.91	-4960.13	-8.82	0.10
1.2 Dead+1.0 Wind 30 deg - No Ice		72.07	18.96	-32.81	-4346.07	-2513.38	-0.51
0.9 Dead+1.0 Wind 30 deg - No Ice		54.05	18.96	-32.81	-4293.81	-2483.13	-0.51
1.2 Dead+1.0 Wind 60 deg - No Ice		72.07	32.80	-19.02	-2520.86	-4341.79	-0.97
0.9 Dead+1.0 Wind 60 deg - No Ice		54.05	32.80	-19.02	-2490.79	-4289.36	-0.98
1.2 Dead+1.0 Wind 90 deg - No Ice		72.07	37.91	-0.09	-14.39	-5018.20	-0.63
0.9 Dead+1.0 Wind 90 deg - No Ice		54.05	37.91	-0.09	-14.78	-4957.56	-0.64
1.2 Dead+1.0 Wind 120 deg - No Ice		72.07	32.85	19.01	2518.33	-4347.33	-0.13
0.9 Dead+1.0 Wind 120 deg - No Ice		54.05	32.85	19.01	2487.18	-4294.87	-0.15
1.2 Dead+1.0 Wind 150 deg - No Ice		72.07	19.00	32.94	4367.82	-2513.73	0.16
0.9 Dead+1.0 Wind 150 deg - No Ice		54.05	19.00	32.94	4314.16	-2483.55	0.15
1.2 Dead+1.0 Wind 180 deg - No Ice		72.07	-0.02	37.90	5024.48	7.17	0.25
0.9 Dead+1.0 Wind 180 deg - No Ice		54.05	-0.02	37.90	4962.85	6.72	0.24
1.2 Dead+1.0 Wind 210 deg - No Ice		72.07	-18.85	32.74	4337.84	2495.64	1.20
0.9 Dead+1.0 Wind 210 deg - No Ice		54.05	-18.85	32.74	4284.51	2464.98	1.20
1.2 Dead+1.0 Wind 240 deg - No Ice		72.07	-32.69	18.89	2504.09	4325.52	1.69
0.9 Dead+1.0 Wind 240 deg - No Ice		54.05	-32.69	18.89	2473.04	4272.64	1.70
1.2 Dead+1.0 Wind 270 deg - No Ice		72.07	-37.90	-0.01	2.48	5017.48	1.32
0.9 Dead+1.0 Wind 270 deg - No Ice		54.05	-37.90	-0.01	1.82	4956.20	1.33
1.2 Dead+1.0 Wind 300 deg - No Ice		72.07	-32.92	-19.04	-2518.88	4361.51	0.67
0.9 Dead+1.0 Wind 300 deg - No Ice		54.05	-32.92	-19.04	-2488.90	4308.21	0.68
1.2 Dead+1.0 Wind 330 deg - No Ice		72.07	-18.97	-32.91	-4358.49	2510.65	0.51

Z	C	C	C	C	C	C	C	C	C
0.9 Dead+1.0 Wind 330 deg - No Ice	54.05	-18.97	-32.91	-4306.12	2479.85	0.52			
Dead+Wind 0 deg - Service	60.06	0.01	-9.23	-1212.60	-1.31	0.02			
Dead+Wind 30 deg - Service	60.06	4.62	-7.99	-1049.50	-606.96	-0.13			
Dead+Wind 60 deg - Service	60.06	7.99	-4.63	-608.16	-1049.08	-0.24			
Dead+Wind 90 deg - Service	60.06	9.23	-0.02	-2.10	-1212.63	-0.16			
Dead+Wind 120 deg - Service	60.06	8.00	4.63	610.32	-1050.42	-0.04			
Dead+Wind 150 deg - Service	60.06	4.63	8.02	1057.53	-607.06	0.04			
Dead+Wind 180 deg - Service	60.06	-0.01	9.23	1216.32	2.50	0.06			
Dead+Wind 210 deg - Service	60.06	-4.59	7.97	1050.27	604.22	0.29			
Dead+Wind 240 deg - Service	60.06	-7.96	4.60	606.86	1046.68	0.42			
Dead+Wind 270 deg - Service	60.06	-9.23	-0.00	1.97	1214.01	0.33			
Dead+Wind 300 deg - Service	60.06	-8.02	-4.64	-607.70	1055.40	0.17			
Dead+Wind 330 deg - Service	60.06	-4.62	-8.01	-1052.51	607.86	0.13			

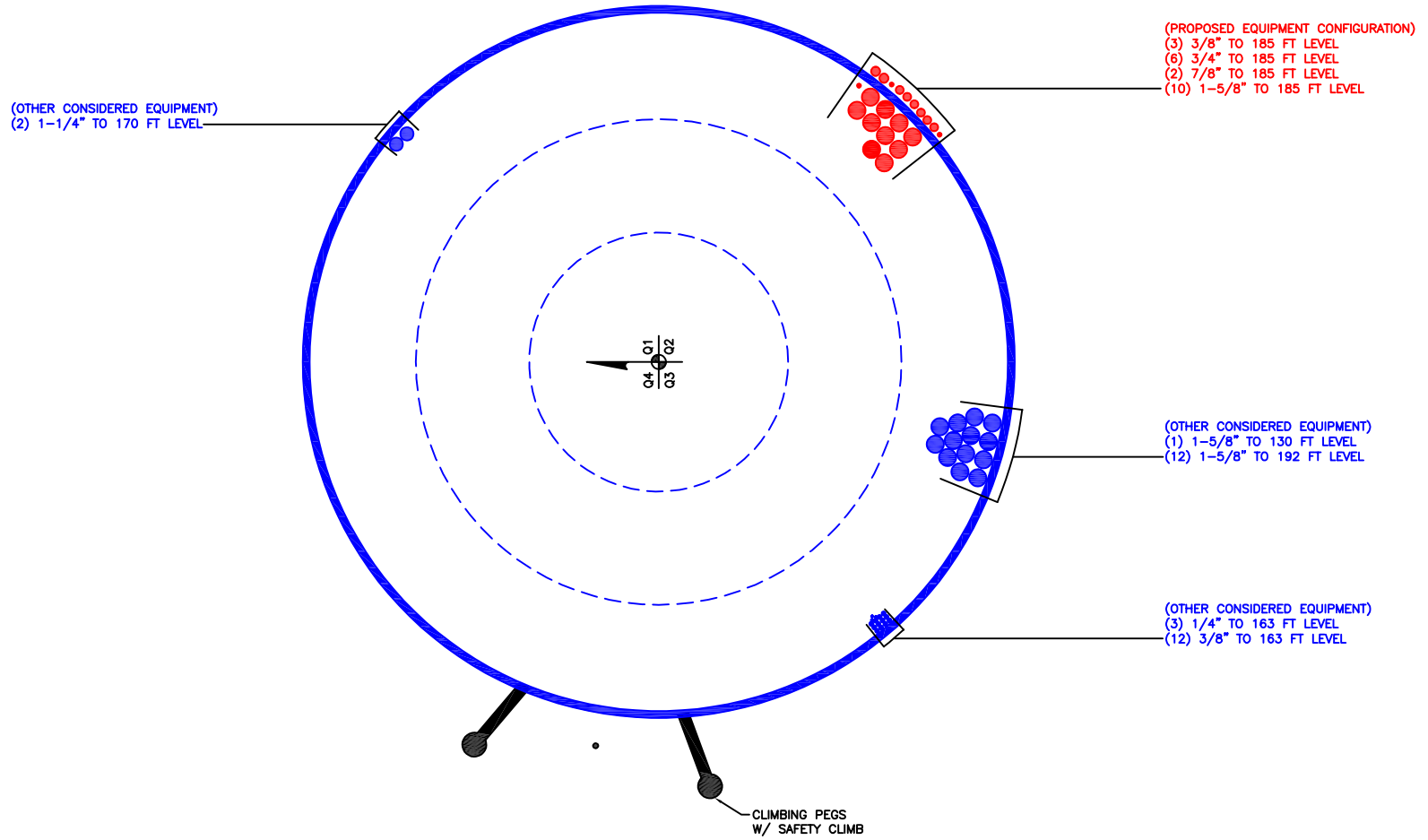
C	C	C	C	C	C	C	C	C
Z	C	C	C	C	C	C	C	C
1		0.00	-60.06	0.00	0.00	60.06	0.00	0.000%
2		0.04	-72.07	-37.91	-0.04	72.07	37.91	0.000%
3		0.04	-54.05	-37.91	-0.04	54.05	37.91	0.000%
4		18.96	-72.07	-32.81	-18.96	72.07	32.81	0.000%
5		18.96	-54.05	-32.81	-18.96	54.05	32.81	0.000%
6		32.80	-72.07	-19.02	-32.80	72.07	19.02	0.000%
7		32.80	-54.05	-19.02	-32.80	54.05	19.02	0.000%
8		37.91	-72.07	-0.09	-37.91	72.07	0.09	0.000%
9		37.91	-54.05	-0.09	-37.91	54.05	0.09	0.000%
10		32.85	-72.07	19.01	-32.85	72.07	-19.01	0.000%
11		32.85	-54.05	19.01	-32.85	54.05	-19.01	0.000%
12		19.00	-72.07	32.94	-19.00	72.07	-32.94	0.000%
13		19.00	-54.05	32.94	-19.00	54.05	-32.94	0.000%
14		-0.02	-72.07	37.90	0.02	72.07	-37.90	0.000%
15		-0.02	-54.05	37.90	0.02	54.05	-37.90	0.000%
16		-18.85	-72.07	32.74	18.85	72.07	-32.74	0.000%
17		-18.85	-54.05	32.74	18.85	54.05	-32.74	0.000%
18		-32.69	-72.07	18.89	32.69	72.07	-18.89	0.000%
19		-32.69	-54.05	18.89	32.69	54.05	-18.89	0.000%
20		-37.90	-72.07	-0.01	37.90	72.07	0.01	0.000%
21		-37.90	-54.05	-0.01	37.90	54.05	0.01	0.000%
22		-32.92	-72.07	-19.04	32.92	72.07	19.04	0.000%
23		-32.92	-54.05	-19.04	32.92	54.05	19.04	0.000%
24		-18.97	-72.07	-32.91	18.97	72.07	32.91	0.000%
25		-18.97	-54.05	-32.91	18.97	54.05	32.91	0.000%
26		0.01	-60.06	-9.23	-0.01	60.06	9.23	0.000%
27		4.62	-60.06	-7.99	-4.62	60.06	7.99	0.000%
28		7.99	-60.06	-4.63	-7.99	60.06	4.63	0.000%
29		9.23	-60.06	-0.02	-9.23	60.06	0.02	0.000%
30		8.00	-60.06	4.63	-8.00	60.06	-4.63	0.000%
31		4.63	-60.06	8.02	-4.63	60.06	-8.02	0.000%
32		-0.01	-60.06	9.23	0.01	60.06	-9.23	0.000%
33		-4.59	-60.06	7.97	4.59	60.06	-7.97	0.000%
34		-7.96	-60.06	4.60	7.96	60.06	-4.60	0.000%
35		-9.23	-60.06	-0.00	9.23	60.06	0.00	0.000%
36		-8.02	-60.06	-4.64	8.02	60.06	4.64	0.000%
37		-4.62	-60.06	-8.01	4.62	60.06	8.01	0.000%

$\frac{C}{Z}$	$\frac{Z}{C}$	$\frac{x C}{C}$	$\frac{C}{C}$	$\frac{C}{C}$	$\frac{C}{C}$	$\frac{C}{C}$
1	Yes	4	0.00000001	0.00000001		

Maximum Tower Deflections - Service Wind

Critical Deflections and Radius of Curvature - Service Wind

APPENDIX B
BASE LEVEL DRAWING



BUSINESS UNIT: 824653 TOWER ID: C_BASELEVEL

APPENDIX C
ADDITIONAL CALCULATIONS

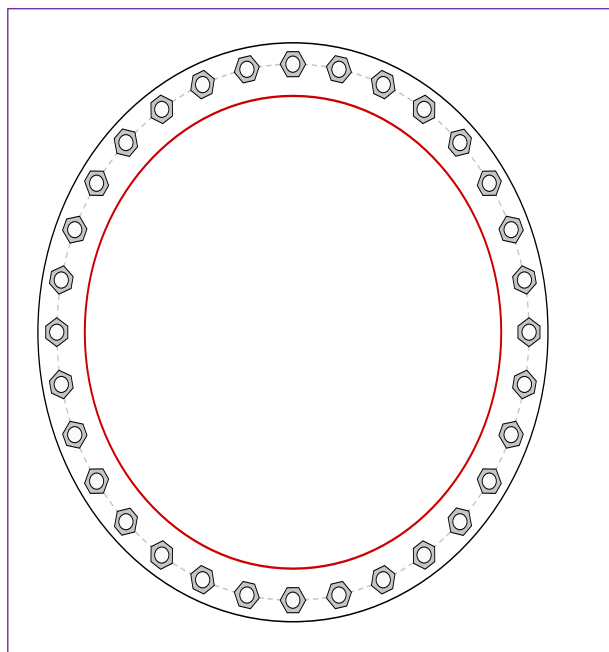
Monopole Base Plate Connection

Site Info	
BU #	824653
Site Name	Hwy90 at NW Brown Rd
Order #	638092 Rev. 0

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

Applied Loads	
Moment (kip-ft)	5039.51
Axial Force (kips)	72.05
Shear Force (kips)	38.06

*TIA-222-H Section 15.5 Applied



Connection Properties		Analysis Results	
Anchor Rod Data		Anchor Rod Summary <i>(units of kips, kip-in)</i>	
(32) 2-1/4" ϕ bolts (A615-75 N; $F_y=75$ ksi, $F_u=100$ ksi) on 74.83" BC		$Pu_t = 98.73$	$\phi Pn_t = 243.75$ Stress Rating
Base Plate Data		$Vu = 1.19$	$\phi Vn = 149.1$ 38.6%
80.83" OD x 3" Plate (A633 Gr. E; $F_y=60$ ksi, $F_u=70$ ksi)		$Mu = n/a$	$\phi Mn = n/a$ Pass
Stiffener Data		Base Plate Summary	
N/A		Max Stress (ksi):	18.96 (Flexural)
Pole Data		Allowable Stress (ksi):	54
65.999" x 0.5" 16-sided pole (A572-65; $F_y=65$ ksi, $F_u=80$ ksi)		Stress Rating:	33.4% Pass

Drilled Pier Foundation

BU # :	824653
Site Name:	Hwy90 at NW Brown Rd
Order Number:	638092 Rev. 0
TIA-222 Revision:	H
Tower Type:	Monopole



Applied Loads		
	Comp.	Uplift
Moment (kip-ft)	5039.51	
Axial Force (kips)	72.07	
Shear Force (kips)	38.03	

Material Properties		
Concrete Strength, f _c :	3	ksi
Rebar Strength, F _y :	60	ksi
Tie Yield Strength, F _y :	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 2, F _y	Rebar 3, F _y
Override (ksi)	Override (ksi)

Rebar & Pier Options
Embedded Pole Inputs
Belled Pier Inputs

Analysis Results		
Soil Lateral Check	Compression	Uplift
D _{v=0} (ft from TOC)	10.70	-
Soil Safety Factor	7.63	-
Max Moment (kip-ft)	5369.24	-
Rating*	16.6%	-
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)	387.20	-
Rating*	13.2%	-
Reinforced Concrete Flexure	Compression	Uplift
Critical Depth (ft from TOC)	10.50	-
Critical Moment (kip-ft)	5369.03	-
Critical Moment Capacity	13838.48	-
Rating*	37.0%	-
Reinforced Concrete Shear	Compression	Uplift
Critical Depth (ft from TOC)	29.04	-
Critical Shear (kip)	384.76	-
Critical Shear Capacity	916.36	-
Rating*	40.0%	-

Structural Foundation Rating*	40.0%
Soil Interaction Rating*	16.6%

*Rating per TIA-222-H Section 15.5

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

[Go to Soil Calculations](#)

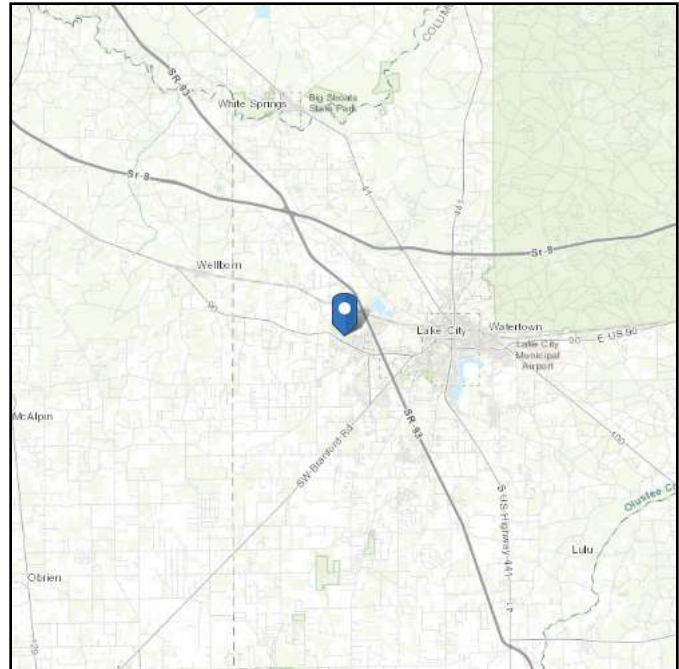
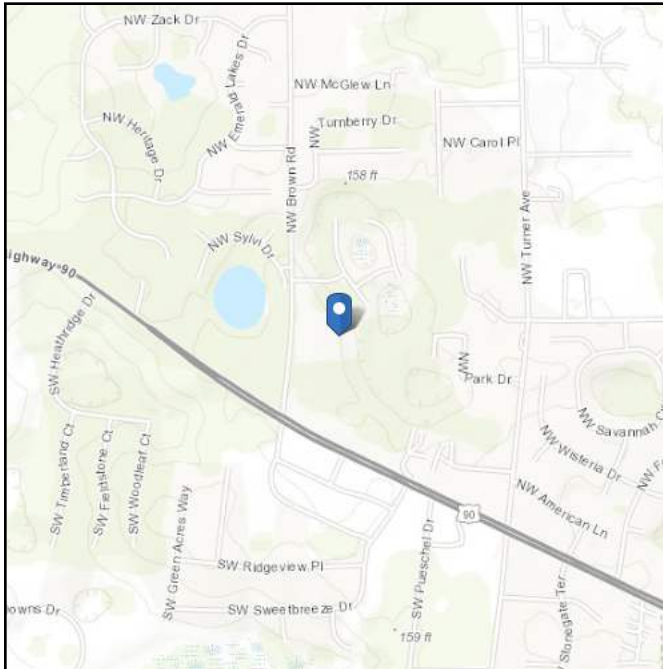
Soil Profile														
Groundwater Depth		9	# of Layers		8									
Layer	Top (ft)	Bottom (ft)	Thickness (ft)	Y _{soil} (pcf)	Y _{concrete} (pcf)	Cohesion (ksf)	Angle of Friction (degrees)	Calculated Ultimate Skin Friction Comp (ksf)	Calculated Ultimate Skin Friction Uplift (ksf)	Ultimate Skin Friction Comp Override (ksf)	Ultimate Skin Friction Uplift Override (ksf)	Ult. Gross Bearing Capacity (ksf)	SPT Blow Count	Soil Type
1	0	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: Tue Nov 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).

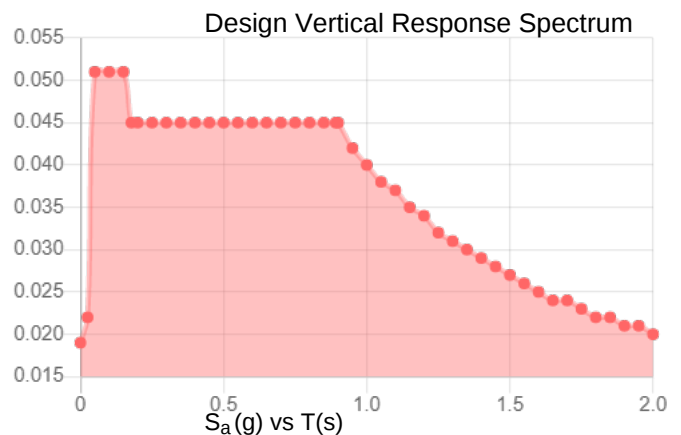
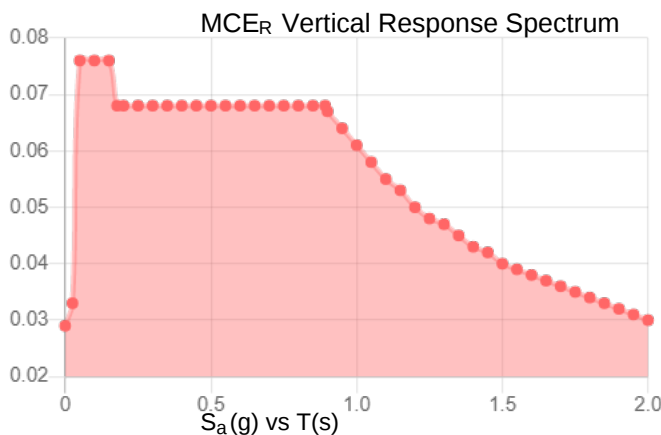
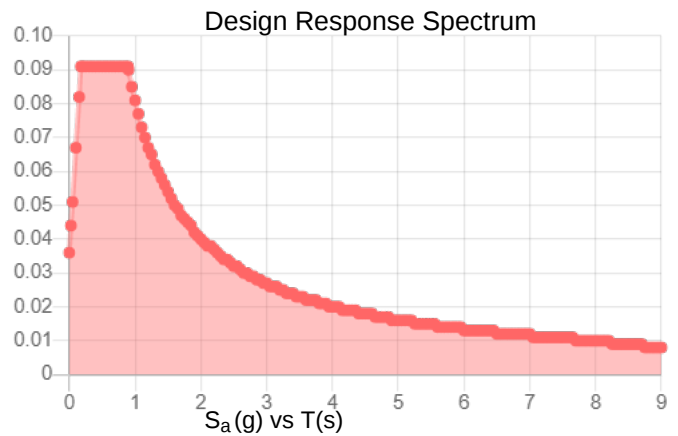
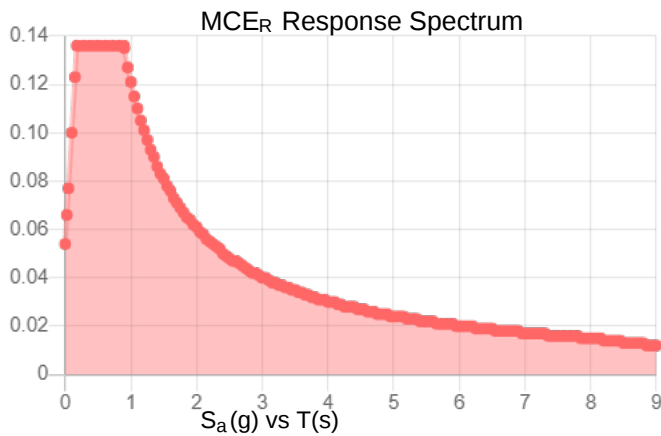
Site is in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2. Glazed openings need not be protected against wind-borne debris.

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: Tue Nov 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.

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: Tue Nov 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.

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