

May 27, 2021

John Scandura
Verizon Wireless
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FL COA# 31011

Tower Engineering Professionals
326 Tryon Road
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Subject: Structural Analysis Report

Carrier Designation:

Verizon Wireless Reconfiguration

Carrier Site Number: 278205

Carrier Site Name: Jones SE Lake City

Engineering Firm Designation:

TEP Project Number: 252165.498987

Site Data:

4210 S.E. Country Club Rd., Lake City, Columbia County, FL 32025
Latitude 30° 7' 48.10", Longitude -82° 36' 20.81"
190 ± Foot - Self Supporting Tower

Dear John Scandura,

Tower Engineering Professionals 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:

LC1: Existing + Proposed + Reserved Loading

Note: See Table 1 for the existing, proposed, and reserved loading

Sufficient Capacity

Structure Capacity	Foundation Capacity
81.9%	75.4%

The analysis has been performed in accordance with the ANSI/TIA-222-H Structural Standard for Antenna Supporting Structures, Antennas, and Small Wind Turbine Support Structures and the 2020 Florida Building Code, 7th Edition.

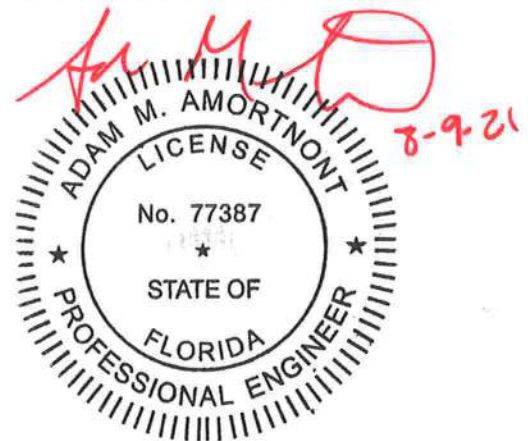
All modifications and equipment proposed in this report shall be installed in accordance with the appurtenances listed in Table 1 for the determined available structural capacity to be effective.

We at Tower Engineering Professionals appreciate the opportunity of providing our continuing professional services to you and Verizon Wireless. If you have any questions or need further assistance on this or any other projects please give us a call.

Structural analysis prepared by: Jonathan D. Bushwty, P.E. / PHX

Respectfully submitted by:

Adam M. Amortnont, P.E.



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1) INTRODUCTION

This tower is a 190-ft self supporting tower designed by Rohn in November of 2014. The tower was originally designed for a 3-second gust wind speed of 119 mph with no ice, and 60 mph under service loads using Structure Class II, Exposure Category C, and Topographic Category 1. All other information provided to TEP was assumed to be accurate and complete.

2) ANALYSIS CRITERIA

TIA-222 Revision:	ANSI/TIA-222-H
Type of Analysis:	Rigorous
Risk Category:	II
Wind Speed:	119 mph (Ultimate)
Exposure Category:	C
Topographic Category:	1 (Kzt = 1.0)
Seismic Design Category:	B
Service Wind Speed:	60 mph

Table 1 - Existing, Proposed, and Reserved Antenna and Cable Information

Existing/ Proposed/ Reserved	Mount Level (ft)	Ant CL (ft)	Qty	Antenna Model	Mount Type	Qty Coax	Coax Size	Coax Location	Owner/ Tenant
Proposed	190.0	190.0	6	JMA Wireless MX06FIT865-02	VZWSMART- SFK1 Tie- Backs	2	Hybrid	BC-Face	Verizon
			3	nL-Sub6 Antenna					
			3	Ericsson 4449					
			6	Ericsson 8843					
			2	Raycap OVP-12					
Existing	190.0	190.0	-	-	Sector Mount	12	1-5/8	BC-Face	Verizon
To Be Removed	190.0	190.0	9	CSS X7CQAP-665-V	-	2	Hybrid	BC-Face	Verizon
			3	Ericsson RRUS12 B4+A2					
			2	Raycap OVP-6					
			3	Generic BAIST					

3) ANALYSIS PROCEDURE

Table 2 - Documents Provided

Document	Remarks	Source
Geotechnical Report	Madrid Engineering Group, Inc., dated May 30, 2014 Project No. 11403	Verizon
Tower and Foundation Design	Rohn, dated November 24, 2014 DWG No. 212482CP	TEP
Correspondence	Correspondence from Verizon Wireless with regards to the existing and proposed loading. RFDS dated January 5, 2021.	Verizon

3.1) Analysis Method

tnxTower (version 8.0.9.0), 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.

3.2) Assumptions

- 1) The tower and foundation were built and maintained in accordance with the manufacturer's specification.
- 2) Unless specified by the client or tower mapping, the location of the existing and proposed coax is assumed by TEP and listed in Table 1.
- 3) All tower components are in sufficient condition to carry their full design capacity.
- 4) Serviceability with respect to antenna twist, tilt, roll, or lateral translation, is not checked and is left to the carrier or tower owner to ensure conformance. See Table 5.
- 5) All antenna mounts and mounting hardware are structurally sufficient to carry the full design capacity requirements of appurtenance wind area and weight as provided by the original manufacturer specifications. It is the carrier's responsibility to ensure compliance to the structural limitations of the existing and/or proposed antenna mounts. TEP did not analyze antennas supporting mounts as part of this structural analysis report.

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

4) ANALYSIS RESULTS

Table 3 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (k)	ϕP_{allow} (k)	% Capacity	Pass / Fail
T1	190 - 180	Leg	2 1/4	1	-10.92	81.76	13.4	Pass
T2	180 - 160	Leg	2 1/4	21	-44.77	110.31	40.6	Pass
T3	160 - 140	Leg	2 3/4	54	-89.02	196.50	45.3	Pass
T4	140 - 120	Leg	3	87	-106.94	247.30	43.2	Pass
T5	120 - 90	Leg	3 1/2	120	-129.23	321.97	40.1	Pass
T6	90 - 60	Leg	3 3/4	159	-154.75	386.42	40.0	Pass
T7	60 - 30	Leg	3 3/4	198	-178.97	378.75	47.3	Pass
T8	30 - 10	Leg	4	228	-197.48	448.95	44.0	Pass
T9	10 - 0	Leg	4	249	-202.81	455.95	44.5	Pass
T1	190 - 180	Diagonal	L1 3/4x1 3/4x3/16	11	-2.83	14.56	19.4	Pass
T2	180 - 160	Diagonal	L1 3/4x1 3/4x3/16	26	-3.62	16.93	21.4	Pass
T3	160 - 140	Diagonal	L1 3/4x1 3/4x3/16	59	-5.29	17.10	31.0	Pass
T4	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	92	-2.16	11.13	19.5	Pass
T5	120 - 90	Diagonal	L2x2x3/16	125	-2.96	8.40	35.3	Pass
T6	90 - 60	Diagonal	L2 1/2x2 1/2x3/16	164	-3.68	10.56	34.8	Pass
T7	60 - 30	Diagonal	L3x3x3/16	203	-5.58	11.65	47.9	Pass
T8	30 - 10	Diagonal	L3x3x1/4	233	-6.06	12.87	47.1	Pass
T9	10 - 0	Diagonal	L3x3x1/4	265	-7.53	15.02	50.1	Pass
T9	10 - 0	Horizontal	L3 1/2x3 1/2x1/4	264	-4.80	25.46	18.8	Pass
T7	60 - 30	Secondary Horizontal	L2x2x1/4	206	-3.33	5.50	60.6	Pass
T8	30 - 10	Secondary Horizontal	L2x2x1/4	236	-3.50	4.27	81.9	Pass

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (k)	ϕP_{allow} (k)	% Capacity	Pass / Fail
T1	190 - 180	Top Girt	L1 3/4x1 3/4x3/16	4	-0.85	8.36	10.2	Pass
T9	10 - 0	Redund Horiz 1 Bracing	L2 1/2x2 1/2x1/4	262	-3.52	29.83	11.8	Pass
T9	10 - 0	Redund Diag 1 Bracing	L2 1/2x2 1/2x1/4	263	-2.58	16.42	15.7	Pass
T9	10 - 0	Inner Bracing	L2 1/2x2 1/2x1/4	272	-0.01	7.53	0.1	Pass
							Summary	
						Leg (T7)	47.3	Pass
						Diagonal (T9)	50.1	Pass
						Horizontal (T9)	18.8	Pass
						Secondary Horizontal (T8)	81.9	Pass
						Top Girt (T1)	10.2	Pass
						Redund Horiz 1 Bracing (T9)	11.8	Pass
						Redund Diag 1 Bracing (T9)	15.7	Pass
						Inner Bracing (T9)	0.1	Pass
						Bolt Checks	61.4	Pass
						Rating =	81.9	Pass

Table 4 - Tower Component Stresses vs. Capacity

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1,2	Anchor Rods	-	25.4	Pass
1,2	Base Foundation Soil Interaction	-	75.4	Pass
1,2	Base Foundation Structural	-	12.7	Pass

Structure Rating (max from all components) =	81.9%
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Notes:

1) Rating per TIA-222-H, Section 15.5

2) See additional documentation in "Appendix B - Additional Calculations" for calculations supporting the % capacity listed.

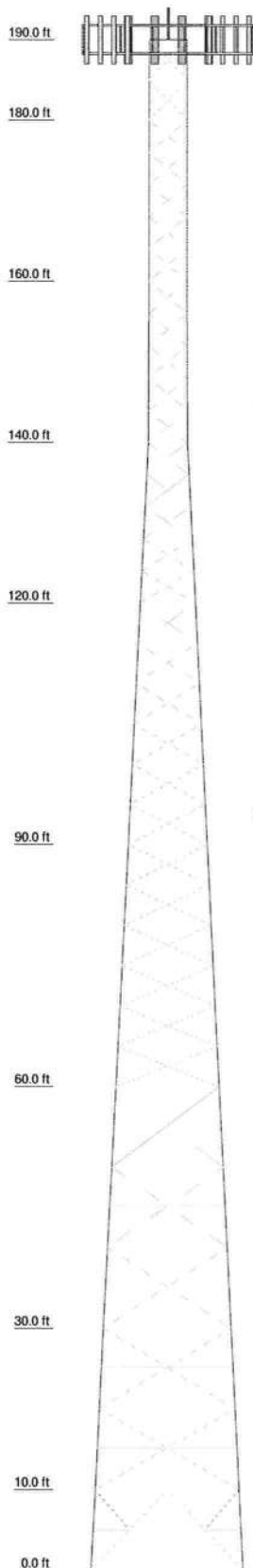
4.1) Recommendations

- 1) If the load differs from that described in Table 1 of this report or the provisions of this analysis are found to be invalid, another structural analysis should be performed.
- 2) 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	T1	T2	T3	T4	T5	T6	T7	T8	T9	
Legs		SR 2 1/4							SR 4	
Leg Grade			SR 2 3/4		SR 3 1/2	SR 3 3/4				
Diagonals			L1 3/4x1 3/4x3/16		L2x2x3/16	L2 1/2x2 1/2x3/16	L3x3x3/16	L3x3x1/4		
Diagonal Grade					A572-50					
Top Chords					A572-50					
Horizontals					N.A.					
Sec. Horizontals					N.A.					
Red. Horizontals					N.A.					
Red. Diagonals					N.A.					
Inner Bracing					N.A.					
Face Width (ft)	4.70313		4.73958	4.75521	6.79167	12.8125	15.8281	17.8281	18.8281	
# Panels @ (ft)	2 @ 5		15 @ 4	28	4.0	5.0	6 @ 10	4.2	2.5	
Weight (K)	0.6	1.3	1.7	2.8	4.0	5.0	5.3	4.2	2.5	26.5



SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	L1 3/4x1 3/4x3/16	C	L2 1/2x2 1/2x1/4
B	L3 1/2x3 1/2x1/4		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 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 119 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'
7. TOWER RATING: 81.9%

ALL REACTIONS
ARE FACTORED

MAX. CORNER REACTIONS AT BASE:

DOWN: 211 K
SHEAR: 19 K

UPLIFT: -176 K
SHEAR: 16 K

AXIAL
41 K
SHEAR
31 K
MOMENT
3218 kip-ft
TORQUE 38 kip-ft
REACTIONS - 119 mph WIND

 Tower Engineering Professionals	Tower Engineering Professionals 326 Tryon Road Raleigh, NC 27603 Phone: (919) 661-6351 FAX: (919) 661-6350			Job: Jones SE Lake City (278205) Project: TEP No. 252165.498987 Client: Verizon Wireless Code: TIA-222-H Path:			Drawn by: JDB Date: 05/25/21 App'd: NTS Dwg No. E-1		

tnxTower Tower Engineering Professionals 326 Tryon Road Raleigh, NC 27603 Phone: (919) 661-6351 FAX: (919) 661-6350	Job	Jones SE Lake City (278205)	Page	1 of 19
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Tower Input Data

The main tower is a 3x free standing tower with an overall height of 190' above the ground line.

The base of the tower is set at an elevation of 0' above the ground line.

The face width of the tower is 4'8-7/16" at the top and 18'9-15/16" at the base.

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: 109'.

Basic wind speed of 119 mph.

Risk Category II.

Exposure Category C.

Simplified Topographic Factor Procedure for wind speed-up calculations is used.

Topographic Category: 1.

Crest Height: 0'.

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 tower member design is 1.

Tower analysis based on target reliabilities in accordance with Annex S.

Load Modification Factors used: $K_{es}(F_w) = 0.95$.

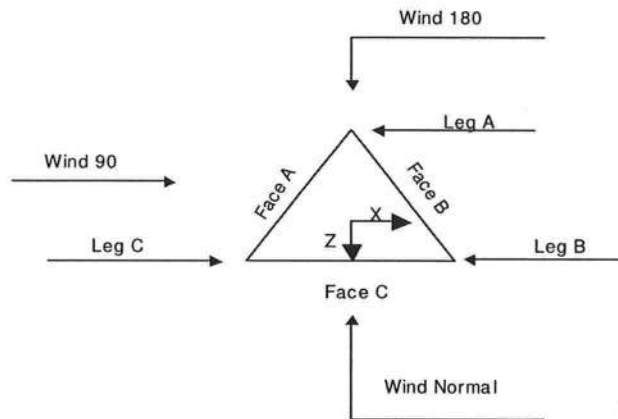
Maximum demand-capacity ratio is: 1.05.

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/r For 60 Deg. Angle Legs	Pole Without Linear Attachments
		Pole With Shroud Or No Appurtenances
		Outside and Inside Corner Radii Are
		Known

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Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	190'-180'			4'8-7/16"	1	10'
T2	180'-160'			4'8-7/16"	1	20'
T3	160'-140'			4'8-7/8"	1	20'
T4	140'-120'			4'9-1/16"	1	20'
T5	120'-90'			6'9-1/2"	1	30'
T6	90'-60'			9'9-3/4"	1	30'
T7	60'-30'			12'9-3/4"	1	30'
T8	30'-10'			15'9-15/16"	1	20'
T9	10'-0'			17'9-15/16"	1	10'

Tower Section Geometry (cont'd)

Tower Section	Tower Elevation	Diagonal Spacing	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset	Bottom Girt Offset
	ft	ft				in	in
T1	190'-180'	5'	X Brace	No	No	0.000	0.000
T2	180'-160'	4'	X Brace	No	No	0.000	0.000
T3	160'-140'	4'	X Brace	No	No	0.000	0.000
T4	140'-120'	4'	X Brace	No	No	0.000	0.000
T5	120'-90'	5'	X Brace	No	No	0.000	0.000
T6	90'-60'	5'	X Brace	No	No	0.000	0.000

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Tower Section	Tower Elevation	Diagonal Spacing	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset	Bottom Girt Offset
	ft	ft				in	in
T7	60'-30'	10'	X Brace	No	Yes	0.000	0.000
T8	30'-10'	10'	X Brace	No	Yes	0.000	0.000
T9	10'-0'	10'	K1 Down	No	Yes	0.000	0.000

Tower Section Geometry (cont'd)

Tower Elevation	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
ft						
T1 190'-180'	Solid Round	2 1/4	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A572-50 (50 ksi)
T2 180'-160'	Solid Round	2 1/4	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A572-50 (50 ksi)
T3 160'-140'	Solid Round	2 3/4	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A572-50 (50 ksi)
T4 140'-120'	Solid Round	3	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A572-50 (50 ksi)
T5 120'-90'	Solid Round	3 1/2	A572-50 (50 ksi)	Equal Angle	L2x2x3/16	A572-50 (50 ksi)
T6 90'-60'	Solid Round	3 3/4	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A572-50 (50 ksi)
T7 60'-30'	Solid Round	3 3/4	A572-50 (50 ksi)	Equal Angle	L3x3x3/16	A572-50 (50 ksi)
T8 30'-10'	Solid Round	4	A572-50 (50 ksi)	Equal Angle	L3x3x1/4	A572-50 (50 ksi)
T9 10'-0'	Solid Round	4	A572-50 (50 ksi)	Equal Angle	L3x3x1/4	A572-50 (50 ksi)

Tower Section Geometry (cont'd)

Tower Elevation	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
ft						
T1 190'-180'	Equal Angle	L1 3/4x1 3/4x3/16	A572-50 (50 ksi)	Solid Round		A36 (36 ksi)

Tower Section Geometry (cont'd)

Tower Elevation	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
ft							
T9 10'-0'	None	Flat Bar		A36 (36 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A572-50 (50 ksi)

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Tower Section Geometry (cont'd)

Tower Elevation	Secondary Horizontal Type	Secondary Horizontal Size	Secondary Horizontal Grade	Inner Bracing Type	Inner Bracing Size	Inner Bracing Grade
ft						
T7 60'-30'	Equal Angle	L2x2x1/4	A572-50 (50 ksi)	Equal Angle		A572-50 (50 ksi)
T8 30'-10'	Equal Angle	L2x2x1/4	A572-50 (50 ksi)	Equal Angle		A572-50 (50 ksi)
T9 10'-0'	Equal Angle		A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x1/4	A572-50 (50 ksi)

Tower Section Geometry (cont'd)

Tower Elevation	Redundant Bracing Grade	Redundant Type	Redundant Size	K Factor
ft				
T9 10'-0'	A572-50 (50 ksi)	Horizontal (1) Diagonal (1)	Equal Angle Equal Angle	L2 1/2x2 1/2x1/4 L2 1/2x2 1/2x1/4
				1 1

Tower Section Geometry (cont'd)

Tower Elevation	Gusset Area (per face)	Gusset Thickness	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
ft	ft ²	in							
T1 190'-180'	0.00	0.250	A36 (36 ksi)	1.03	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T2 180'-160'	0.00	0.250	A36 (36 ksi)	1.03	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T3 160'-140'	0.00	0.250	A36 (36 ksi)	1.03	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T4 140'-120'	0.00	0.250	A36 (36 ksi)	1.03	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T5 120'-90'	0.00	0.250	A36 (36 ksi)	1.03	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T6 90'-60'	0.00	0.250	A36 (36 ksi)	1.03	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T7 60'-30'	0.00	0.250	A36 (36 ksi)	1.03	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T8 30'-10'	0.00	0.250	A36 (36 ksi)	1.03	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T9 10'-0'	0.00	0.250	A36 (36 ksi)	1.03	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt

Tower Section Geometry (cont'd)

K Factors¹

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Tower Elevation ft	Redundant Horizontal		Redundant Diagonal		Redundant Sub-Diagonal		Redundant Sub-Horizontal		Redundant Vertical		Redundant Hip		Redundant Hip Diagonal	
	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T6 90'-60'	0.625 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0
T7 60'-30'	0.625 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0
T8 30'-10'	0.625 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0
T9 10'-0'	0.625 A325N	1	0.625 A325N	1	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0	0.000 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
Step Pegs (5/8" SR) 7-in. w/30" step	C	No	No	Ar (CaAa)	190' - 0'	0.000	0.5	1	1	0.350	0.350		0.487
Safety Line 3/8	C	No	No	Ar (CaAa)	190' - 0'	0.000	0.5	1	1	0.375	0.375		0.220
Feedline Ladder (Af)	C	No	No	Af (CaAa)	190' - 0'	0.000	0.4	1	1	3.000	3.000		8.400
LDF7-50A(1- 5/8")	C	No	No	Ar (CaAa)	190' - 0'	0.000	0.4	12	6	0.500	1.980		0.820
HB158-U12S2 4-XXX-LI(1-5 /8) *** *** ***	C	No	No	Ar (CaAa)	190' - 0'	0.000	0.45	2	2	0.500	1.976		3.200

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number	C _{AA} ft ² /ft	Weight plf
*** *** ***								

Feed Line/Linear Appurtenances Section Areas

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Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
T1	190'-180'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	33.437	0.000	0.25
T2	180'-160'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	66.874	0.000	0.51
T3	160'-140'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	66.874	0.000	0.51
T4	140'-120'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	66.874	0.000	0.51
T5	120'-90'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	100.311	0.000	0.76
T6	90'-60'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	100.311	0.000	0.76
T7	60'-30'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	100.311	0.000	0.76
T8	30'-10'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	66.874	0.000	0.51
T9	10'-0'	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	33.437	0.000	0.25

Feed Line Center of Pressure

Section	Elevation ft	CP _x in	CP _z in	CP _x Ice in	CP _z Ice in
T1	190'-180'	-10.757	5.641	-10.757	5.641
T2	180'-160'	-10.920	5.737	-10.920	5.737
T3	160'-140'	-10.697	5.545	-10.697	5.545
T4	140'-120'	-12.083	6.050	-12.083	6.050
T5	120'-90'	-15.026	7.125	-15.023	7.123
T6	90'-60'	-16.166	7.320	-16.135	7.302
T7	60'-30'	-19.119	8.513	-19.119	8.513
T8	30'-10'	-20.553	9.012	-20.553	9.012
T9	10'-0'	-19.160	8.283	-19.160	8.283

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K _a No Ice	K _a Ice
T1	1	Step Pegs (5/8" SR) 7-in. w/30" step	180.00 - 190.00	0.6000	0.6000
T1	2	Safety Line 3/8	180.00 - 190.00	0.6000	0.6000
T1	3	Feedline Ladder (Af)	180.00 -	0.6000	0.6000

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Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K _a No Ice	K _a Ice
			190.00		
T1	4	LDF7-50A(1-5/8")	180.00 - 190.00	0.6000	0.6000
T1	5	HB158-U12S24-XXX-LI(1-5/8)	180.00 - 190.00	0.6000	0.6000
T2	1	Step Pegs (5/8" SR) 7-in. w/30" step	160.00 - 180.00	0.6000	0.6000
T2	2	Safety Line 3/8	160.00 - 180.00	0.6000	0.6000
T2	3	Feedline Ladder (Af)	160.00 - 180.00	0.6000	0.6000
T2	4	LDF7-50A(1-5/8")	160.00 - 180.00	0.6000	0.6000
T2	5	HB158-U12S24-XXX-LI(1-5/8)	160.00 - 180.00	0.6000	0.6000
T3	1	Step Pegs (5/8" SR) 7-in. w/30" step	140.00 - 160.00	0.6000	0.6000
T3	2	Safety Line 3/8	140.00 - 160.00	0.6000	0.6000
T3	3	Feedline Ladder (Af)	140.00 - 160.00	0.6000	0.6000
T3	4	LDF7-50A(1-5/8")	140.00 - 160.00	0.6000	0.6000
T3	5	HB158-U12S24-XXX-LI(1-5/8)	140.00 - 160.00	0.6000	0.6000
T4	1	Step Pegs (5/8" SR) 7-in. w/30" step	120.00 - 140.00	0.6000	0.6000
T4	2	Safety Line 3/8	120.00 - 140.00	0.6000	0.6000
T4	3	Feedline Ladder (Af)	120.00 - 140.00	0.6000	0.6000
T4	4	LDF7-50A(1-5/8")	120.00 - 140.00	0.6000	0.6000
T4	5	HB158-U12S24-XXX-LI(1-5/8)	120.00 - 140.00	0.6000	0.6000
T5	1	Step Pegs (5/8" SR) 7-in. w/30" step	90.00 - 120.00	0.6000	0.6000
T5	2	Safety Line 3/8	90.00 - 120.00	0.6000	0.6000
T5	3	Feedline Ladder (Af)	90.00 - 120.00	0.6000	0.6000
T5	4	LDF7-50A(1-5/8")	90.00 - 120.00	0.6000	0.6000
T5	5	HB158-U12S24-XXX-LI(1-5/8)	90.00 - 120.00	0.6000	0.6000
T6	1	Step Pegs (5/8" SR) 7-in. w/30" step	60.00 - 90.00	0.6000	0.6000
T6	2	Safety Line 3/8	60.00 - 90.00	0.6000	0.6000
T6	3	Feedline Ladder (Af)	60.00 - 90.00	0.6000	0.6000
T6	4	LDF7-50A(1-5/8")	60.00 - 90.00	0.6000	0.6000
T6	5	HB158-U12S24-XXX-LI(1-5/8)	60.00 - 90.00	0.6000	0.6000
T7	1	Step Pegs (5/8" SR) 7-in. w/30" step	30.00 - 60.00	0.6000	0.6000
T7	2	Safety Line 3/8	30.00 - 60.00	0.6000	0.6000
T7	3	Feedline Ladder (Af)	30.00 - 60.00	0.6000	0.6000
T7	4	LDF7-50A(1-5/8")	30.00 - 60.00	0.6000	0.6000
T7	5	HB158-U12S24-XXX-LI(1-5/8)	30.00 - 60.00	0.6000	0.6000
T8	1	Step Pegs (5/8" SR) 7-in. w/30" step	10.00 - 30.00	0.6000	0.6000
T8	2	Safety Line 3/8	10.00 - 30.00	0.6000	0.6000
T8	3	Feedline Ladder (Af)	10.00 - 30.00	0.6000	0.6000
T8	4	LDF7-50A(1-5/8")	10.00 - 30.00	0.6000	0.6000
T8	5	HB158-U12S24-XXX-LI(1-5/8)	10.00 - 30.00	0.6000	0.6000

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Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K _a No Ice	K _a Ice
T9	1	Step Pegs (5/8" SR) 7-in. w/30" step	0.00 - 10.00	0.6000	0.6000
T9	2	Safety Line 3/8	0.00 - 10.00	0.6000	0.6000
T9	3	Feedline Ladder (AF)	0.00 - 10.00	0.6000	0.6000
T9	4	LDF7-50A(1-5/8")	0.00 - 10.00	0.6000	0.6000
T9	5	HB158-U12S24-XXX-LI(1-5/8)	0.00 - 10.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horiz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K
1/2" x 4' L Rod	A	From Leg	0.00 0' 2'	0.000	190'	No Ice	0.20	0.20	0.00
190									
(2) MX06FIT865-02 w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.000	190'	No Ice	11.85	12.58	0.08
(2) MX06FIT865-02 w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.000	190'	No Ice	11.85	12.58	0.08
(2) MX06FIT865-02 w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.000	190'	No Ice	11.85	12.58	0.08
Sub6 Antenna w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.000	190'	No Ice	4.34	3.55	0.10
Sub6 Antenna w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.000	190'	No Ice	4.34	3.55	0.10
Sub6 Antenna w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.000	190'	No Ice	4.34	3.55	0.10
4449	A	From Leg	4.00 0' 0'	0.000	190'	No Ice	1.97	1.40	0.07
4449	B	From Leg	4.00 0' 0'	0.000	190'	No Ice	1.97	1.40	0.07
4449	C	From Leg	4.00 0' 0'	0.000	190'	No Ice	1.97	1.40	0.07
(2) 8843	A	From Leg	4.00 0' 0'	0.000	190'	No Ice	1.65	1.36	0.07
(2) 8843	B	From Leg	4.00 0' 0'	0.000	190'	No Ice	1.65	1.36	0.07

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Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K
(2) 8843	C	From Leg	4.00 0' 0'	0.000	190'	No Ice	1.65	1.36	0.07
RHSDC-6627-PF-48	A	From Leg	4.00 0' 0'	0.000	190'	No Ice	4.06	3.10	0.03
RHSDC-6627-PF-48	C	From Leg	4.00 0' 0'	0.000	190'	No Ice	4.06	3.10	0.03
Sector Mount [SM 502-3] *** *** ***	C	None		0.000	190'	No Ice	29.82	29.82	1.67

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice
3	1.2D+1.0W (pattern 1) 0 deg - No Ice
4	1.2D+1.0W (pattern 2) 0 deg - No Ice
5	0.9 Dead+1.0 Wind 0 deg - No Ice
6	1.2 Dead+1.0 Wind 30 deg - No Ice
7	1.2D+1.0W (pattern 1) 30 deg - No Ice
8	1.2D+1.0W (pattern 2) 30 deg - No Ice
9	0.9 Dead+1.0 Wind 30 deg - No Ice
10	1.2 Dead+1.0 Wind 60 deg - No Ice
11	1.2D+1.0W (pattern 1) 60 deg - No Ice
12	1.2D+1.0W (pattern 2) 60 deg - No Ice
13	0.9 Dead+1.0 Wind 60 deg - No Ice
14	1.2 Dead+1.0 Wind 90 deg - No Ice
15	1.2D+1.0W (pattern 1) 90 deg - No Ice
16	1.2D+1.0W (pattern 2) 90 deg - No Ice
17	0.9 Dead+1.0 Wind 90 deg - No Ice
18	1.2 Dead+1.0 Wind 120 deg - No Ice
19	1.2D+1.0W (pattern 1) 120 deg - No Ice
20	1.2D+1.0W (pattern 2) 120 deg - No Ice
21	0.9 Dead+1.0 Wind 120 deg - No Ice
22	1.2 Dead+1.0 Wind 150 deg - No Ice
23	1.2D+1.0W (pattern 1) 150 deg - No Ice
24	1.2D+1.0W (pattern 2) 150 deg - No Ice
25	0.9 Dead+1.0 Wind 150 deg - No Ice
26	1.2 Dead+1.0 Wind 180 deg - No Ice
27	1.2D+1.0W (pattern 1) 180 deg - No Ice
28	1.2D+1.0W (pattern 2) 180 deg - No Ice
29	0.9 Dead+1.0 Wind 180 deg - No Ice
30	1.2 Dead+1.0 Wind 210 deg - No Ice
31	1.2D+1.0W (pattern 1) 210 deg - No Ice
32	1.2D+1.0W (pattern 2) 210 deg - No Ice
33	0.9 Dead+1.0 Wind 210 deg - No Ice

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Comb. No.	Description
34	1.2 Dead+1.0 Wind 240 deg - No Ice
35	1.2D+1.0W (pattern 1) 240 deg - No Ice
36	1.2D+1.0W (pattern 2) 240 deg - No Ice
37	0.9 Dead+1.0 Wind 240 deg - No Ice
38	1.2 Dead+1.0 Wind 270 deg - No Ice
39	1.2D+1.0W (pattern 1) 270 deg - No Ice
40	1.2D+1.0W (pattern 2) 270 deg - No Ice
41	0.9 Dead+1.0 Wind 270 deg - No Ice
42	1.2 Dead+1.0 Wind 300 deg - No Ice
43	1.2D+1.0W (pattern 1) 300 deg - No Ice
44	1.2D+1.0W (pattern 2) 300 deg - No Ice
45	0.9 Dead+1.0 Wind 300 deg - No Ice
46	1.2 Dead+1.0 Wind 330 deg - No Ice
47	1.2D+1.0W (pattern 1) 330 deg - No Ice
48	1.2D+1.0W (pattern 2) 330 deg - No Ice
49	0.9 Dead+1.0 Wind 330 deg - No Ice
50	Dead+Wind 0 deg - Service
51	Dead+Wind 30 deg - Service
52	Dead+Wind 60 deg - Service
53	Dead+Wind 90 deg - Service
54	Dead+Wind 120 deg - Service
55	Dead+Wind 150 deg - Service
56	Dead+Wind 180 deg - Service
57	Dead+Wind 210 deg - Service
58	Dead+Wind 240 deg - Service
59	Dead+Wind 270 deg - Service
60	Dead+Wind 300 deg - Service
61	Dead+Wind 330 deg - Service

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	190 - 180	4.201	50	0.233	0.106
T2	180 - 160	3.707	50	0.230	0.104
T3	160 - 140	2.769	50	0.202	0.093
T4	140 - 120	1.975	50	0.159	0.073
T5	120 - 90	1.393	50	0.116	0.052
T6	90 - 60	0.767	50	0.078	0.032
T7	60 - 30	0.341	50	0.049	0.017
T8	30 - 10	0.091	50	0.022	0.008
T9	10 - 0	0.013	50	0.007	0.003

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
190'	1/2" x 4' LRod	50	4.201	0.233	0.106	160159

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Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	190 - 180	15.899	2	0.882	0.398
T2	180 - 160	14.026	2	0.871	0.390
T3	160 - 140	10.473	2	0.766	0.349
T4	140 - 120	7.466	2	0.602	0.272
T5	120 - 90	5.262	2	0.439	0.195
T6	90 - 60	2.897	2	0.295	0.119
T7	60 - 30	1.287	2	0.186	0.064
T8	30 - 10	0.340	2	0.085	0.028
T9	10 - 0	0.046	2	0.028	0.012

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
190'	1/2" x 4' L Rod	2	15.899	0.882	0.398	44011

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load Allowable	Allowable Ratio	Criteria
T1	190	Leg	A325N	0.875	4	2.04	41.56	0.049	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	2.83	7.66	0.370	1.05	Member Block Shear
		Top Girt	A325N	0.625	1	0.85	7.66	0.111	1.05	Member Block Shear
T2	180	Leg	A325N	0.875	4	10.10	41.56	0.243	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	3.59	7.66	0.469	1.05	Member Block Shear
T3	160	Leg	A325N	1.000	5	16.41	54.52	0.301	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	4.93	7.66	0.644	1.05	Member Block Shear
T4	140	Leg	A325N	1.000	7	13.86	54.52	0.254	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	2.21	7.66	0.289	1.05	Member Block Shear
T5	120	Leg	A325N	1.000	7	16.38	54.52	0.300	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	2.83	8.78	0.322	1.05	Member Bearing
T6	90	Leg	A325N	1.000	7	19.19	54.52	0.352	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	3.86	8.78	0.440	1.05	Member Bearing
T7	60	Leg	A325N	1.500	5	30.56	126.47	0.242	1.05	Bolt Tension
		Diagonal	A325N	0.625	2	2.42	9.77	0.248	1.05	Member Block Shear
		Secondary Horizontal	A325N	0.625	1	3.33	11.70	0.285	1.05	Member Bearing
T8	30	Diagonal	A325N	0.625	2	3.03	13.81	0.219	1.05	Bolt Shear
		Secondary Horizontal	A325N	0.625	1	3.50	11.70	0.299	1.05	Member Bearing

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Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load Allowable	Allowable Ratio	Criteria
T9	10	Diagonal	A325N	0.625	2	3.76	13.81	0.273	1.05	Bolt Shear
		Horizontal	A325N	0.625	2	2.53	13.03	0.194	1.05	Member Block Shear
		Redund Horz 1 Bracing	A325N	0.625	1	3.52	11.70	0.301	1.05	Member Bearing
		Redund Diag 1 Bracing	A325N	0.625	1	2.58	11.70	0.221	1.05	Member Bearing

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L _n ft	Kl/r	A in ²	P _u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	190 - 180	2 1/4	10'	5'	106.7 K=1.00	3.976	-10.92	77.87	0.140 ¹
T2	180 - 160	2 1/4	20'	4'	85.3 K=1.00	3.976	-44.77	105.06	0.426 ¹
T3	160 - 140	2 3/4	20'	4'	69.8 K=1.00	5.940	-89.02	187.15	0.476 ¹
T4	140 - 120	3	20'3/8"	4'1/8"	64.1 K=1.00	7.069	-106.94	235.52	0.454 ¹
T5	120 - 90	3 1/2	30'19/32"	5'1/8"	68.7 K=1.00	9.621	-129.23	306.64	0.421 ¹
T6	90 - 60	3 3/4	30'19/32"	5'1/8"	64.1 K=1.00	11.045	-154.75	368.01	0.420 ¹
T7	60 - 30	3 3/4	30'19/32"	5'2-1/32"	66.2 K=1.00	11.045	-178.97	360.71	0.496 ¹
T8	30 - 10	4	20'3/8"	5'1-13/16"	61.8 K=1.00	12.566	-197.48	427.57	0.462 ¹
T9	10 - 0	4	10'1/4"	5'1/8"	60.1 K=1.00	12.566	-202.81	434.24	0.467 ¹

¹ $P_u / \phi P_n$ controls

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L _n ft	Kl/r	A in ²	P _u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	190 - 180	L1 3/4x1 3/4x3/16	6'10-5/16"	3'2-5/32"	113.2 K=1.02	0.621	-2.83	13.87	0.204 ¹
T2	180 - 160	L1 3/4x1 3/4x3/16	6'2-13/16"	2'10-5/16"	104.9 K=1.05	0.621	-3.62	16.12	0.224 ¹
T3	160 - 140	L1 3/4x1 3/4x3/16	6'2-17/16"	2'10-3/16"	104.4 K=1.05	0.621	-5.29	16.28	0.325 ¹

tnxTower Tower Engineering Professionals 326 Tryon Road Raleigh, NC 27603 Phone: (919) 661-6351 FAX: (919) 661-6350	Job	Jones SE Lake City (278205)	Page	15 of 19
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Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T4	140 - 120	L1 3/4x1 3/4x3/16	7'8-17/32"	3'8-17/32"	129.5 K=1.00	0.621	-2.16	10.60	0.204 ¹
T5	120 - 90	L2x2x3/16	10'9-15/32"	5'3"	160.0 K=1.00	0.715	-2.96	8.00	0.371 ¹
T6	90 - 60	L2 1/2x2 1/2x3/16	13'6-1/4"	6'7-5/16"	160.2 K=1.00	0.902	-3.68	10.06	0.366 ¹
T7	60 - 30	L3x3x3/16	18'3-19/32"	9'27/32"	167.7 K=0.92	1.090	-5.58	11.09	0.503 ¹
T8	30 - 10	L3x3x1/4	20'1/8"	9'10-13/16"	183.4 K=0.90	1.440	-6.06	12.26	0.494 ¹
T9	10 - 0	L3x3x1/4	13'8-7/8"	13'1-3/16"	169.7 K=1.00	1.440	-7.53	14.31	0.526 ¹

¹ P_u / φP_n controls

Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T9	10 - 0	L3 1/2x3 1/2x1/4	17'9-31/32"	8'6-19/32"	141.2 K=0.96	1.690	-4.80	24.25	0.198 ¹

¹ P_u / φP_n controls

Secondary Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T7	60 - 30	L2x2x1/4	15'3-23/32"	7'4-9/16"	226.4 K=1.00	0.938	-3.33	5.24	0.636 ¹
T8	30 - 10	L2x2x1/4	17'3-23/32"	8'4-7/16"	256.9 K=1.00	0.938	-3.50	4.07	0.860 ¹

KL/R > 250 (C) - 236

¹ P_u / φP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T1	190 - 180	L1 3/4x1 3/4x3/16	4'8-13/32"	4'3-3/8"	149.4 K=1.00	0.621	-0.85	7.96	0.107 ¹

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¹ $P_u / \phi P_n$ controls

Redundant Horizontal (1) Design Data (Compression)

Section No.	Elevation	Size	L	L _u	Kl/r	A	P _u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in ²	K	K	
T9	10 - 0	L2 1/2x2 1/2x1/4	4'5-17/32"	4'19/32"	109.5 K=1.11	1.190	-3.52	28.41	0.124 ¹

¹ $P_u / \phi P_n$ controls

Redundant Diagonal (1) Design Data (Compression)

Section No.	Elevation	Size	L	L _u	Kl/r	A	P _u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in ²	K	K	
T9	10 - 0	L2 1/2x2 1/2x1/4	6'6-15/32"	6'15/32"	147.6 K=1.00	1.190	-2.58	15.64	0.165 ¹

¹ $P_u / \phi P_n$ controls

Inner Bracing Design Data (Compression)

Section No.	Elevation	Size	L	L _u	Kl/r	A	P _u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in ²	K	K	
T9	10 - 0	L2 1/2x2 1/2x1/4	8'10-29/32"	8'10-29/32"	217.9 K=1.00	1.190	-0.01	7.18	0.001 ¹

¹ $P_u / \phi P_n$ controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation	Size	L	L _u	Kl/r	A	P _u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in ²	K	K	
T1	190 - 180	2 1/4	10'	5'	106.7	3.976	8.14	178.92	0.046 ¹
T2	180 - 160	2 1/4	20'	4'	85.3	3.976	40.42	178.92	0.226 ¹
T3	160 - 140	2 3/4	20'	4'	69.8	5.940	82.03	267.28	0.307 ¹
T4	140 - 120	3	20'3/8"	4'1/8"	64.1	7.069	97.05	318.09	0.305 ¹

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Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T5	120 - 90	3 1/2	30'19/32"	5'1/8"	68.7	9.621	114.65	432.95	0.265 ¹
T6	90 - 60	3 3/4	30'19/32"	5'1/8"	64.1	11.045	134.35	497.01	0.270 ¹
T7	60 - 30	3 3/4	30'19/32"	4'10-3/32"	62.0	11.045	152.96	497.01	0.308 ¹
T8	30 - 10	4	20'3/8"	4'10-5/16"	58.4	12.566	166.75	565.49	0.295 ¹
T9	10 - 0	4	10'1/4"	5'1/8"	60.1	12.566	169.80	565.49	0.300 ¹

¹ P_u / φP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T1	190 - 180	L1 3/4x1 3/4x3/16	6'10-5/16"	3'2-5/32'	73.6	0.360	2.83	17.57	0.161 ¹
T2	180 - 160	L1 3/4x1 3/4x3/16	6'2-13/32"	2'10-5/16"	66.6	0.360	3.59	17.57	0.204 ¹
T3	160 - 140	L1 3/4x1 3/4x3/16	6'2-17/32"	2'10-3/32"	66.1	0.360	4.93	17.57	0.281 ¹
T4	140 - 120	L1 3/4x1 3/4x3/16	6'8-9/32"	3'2-17/32"	74.4	0.360	2.21	17.57	0.126 ¹
T5	120 - 90	L2x2x3/16	10'9-15/32"	5'3"	104.5	0.431	2.83	21.00	0.135 ¹
T6	90 - 60	L2 1/2x2 1/2x3/16	13'6-1/4"	6'7-5/16"	103.7	0.571	3.86	27.85	0.139 ¹
T7	60 - 30	L3x3x3/16	17'5-5/8"	8'7-29/32"	113.2	0.712	4.85	34.71	0.140 ¹
T8	30 - 10	L3x3x1/4	19'1-13/16"	9'5-3/4"	125.4	0.939	5.26	45.79	0.115 ¹
T9	10 - 0	L3x3x1/4	13'8-7/8"	13'1-3/16"	174.9	0.939	7.10	45.79	0.155 ¹

¹ P_u / φP_n controls

Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T9	10 - 0	L3 1/2x3 1/2x1/4	17'9-31/32"	8'6-19/32"	96.3	1.127	5.07	54.94	0.092 ¹

¹ P_u / φP_n controls

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Secondary Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T7	60 - 30	L2x2x1/4	15'3-23/32"	7'4-9/16'	295.5	0.563	3.33	27.44	0.121 ¹
T8	30 - 10	L2x2x1/4	17'3-23/32"	8'4-7/16'	334.6	0.563	3.50	27.44	0.127 ¹

¹ P_u / φP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T1	190 - 180	L1 3/4x1 3/4x3/16	4'8-13/32"	4'3-3/8"	100.9	0.360	0.85	17.57	0.048 ¹

¹ P_u / φP_n controls

Redundant Horizontal (1) Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T9	10 - 0	L2 1/2x2 1/2x1/4	4'5-17/32"	4'19/32"	66.9	0.752	3.52	36.65	0.096 ¹

¹ P_u / φP_n controls

Redundant Diagonal (1) Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
T9	10 - 0	L2 1/2x2 1/2x1/4	6'6-15/32"	6'15/32"	98.0	0.752	2.58	36.65	0.070 ¹

¹ P_u / φP_n controls

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Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T1	190 - 180	Leg	2 1/4	1	-10.92	81.76	13.4	Pass
T2	180 - 160	Leg	2 1/4	21	-44.77	110.31	40.6	Pass
T3	160 - 140	Leg	2 3/4	54	-89.02	196.50	45.3	Pass
T4	140 - 120	Leg	3	87	-106.94	247.30	43.2	Pass
T5	120 - 90	Leg	3 1/2	120	-129.23	321.97	40.1	Pass
T6	90 - 60	Leg	3 3/4	159	-154.75	386.42	40.0	Pass
T7	60 - 30	Leg	3 3/4	198	-178.97	378.75	47.3	Pass
T8	30 - 10	Leg	4	228	-197.48	448.95	44.0	Pass
T9	10 - 0	Leg	4	249	-202.81	455.95	44.5	Pass
T1	190 - 180	Diagonal	L1 3/4x1 3/4x3/16	11	-2.83	14.56	19.4	Pass
T2	180 - 160	Diagonal	L1 3/4x1 3/4x3/16	26	-3.62	16.93	21.4	Pass
T3	160 - 140	Diagonal	L1 3/4x1 3/4x3/16	59	-5.29	17.10	31.0	Pass
T4	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	92	-2.16	11.13	19.5	Pass
T5	120 - 90	Diagonal	L2x2x3/16	125	-2.96	8.40	35.3	Pass
T6	90 - 60	Diagonal	L2 1/2x2 1/2x3/16	164	-3.68	10.56	34.8	Pass
T7	60 - 30	Diagonal	L3x3x3/16	203	-5.58	11.65	47.9	Pass
T8	30 - 10	Diagonal	L3x3x1/4	233	-6.06	12.87	47.1	Pass
T9	10 - 0	Diagonal	L3x3x1/4	265	-7.53	15.02	50.1	Pass
T9	10 - 0	Horizontal	L3 1/2x3 1/2x1/4	264	-4.80	25.46	18.8	Pass
T7	60 - 30	Secondary Horizontal	L2x2x1/4	206	-3.33	5.50	60.6	Pass
T8	30 - 10	Secondary Horizontal	L2x2x1/4	236	-3.50	4.27	81.9	Pass
T1	190 - 180	Top Girt	L1 3/4x1 3/4x3/16	4	-0.85	8.36	10.2	Pass
T9	10 - 0	Redund Horz 1 Bracing	L2 1/2x2 1/2x1/4	262	-3.52	29.83	11.8	Pass
T9	10 - 0	Redund Diag 1 Bracing	L2 1/2x2 1/2x1/4	263	-2.58	16.42	15.7	Pass
T9	10 - 0	Inner Bracing	L2 1/2x2 1/2x1/4	272	-0.01	7.53	0.1	Pass
							Summary	
							Leg (T7)	47.3 Pass
							Diagonal (T9)	50.1 Pass
							Horizontal (T9)	18.8 Pass
							Secondary Horizontal (T8)	81.9 Pass
							Top Girt (T1)	10.2 Pass
							Redund Horz 1 Bracing (T9)	11.8 Pass
							Redund Diag 1 Bracing (T9)	15.7 Pass
							Inner Bracing (T9)	0.1 Pass
							Bolt Checks	61.4 Pass
							Rating =	81.9 Pass

APPENDIX B

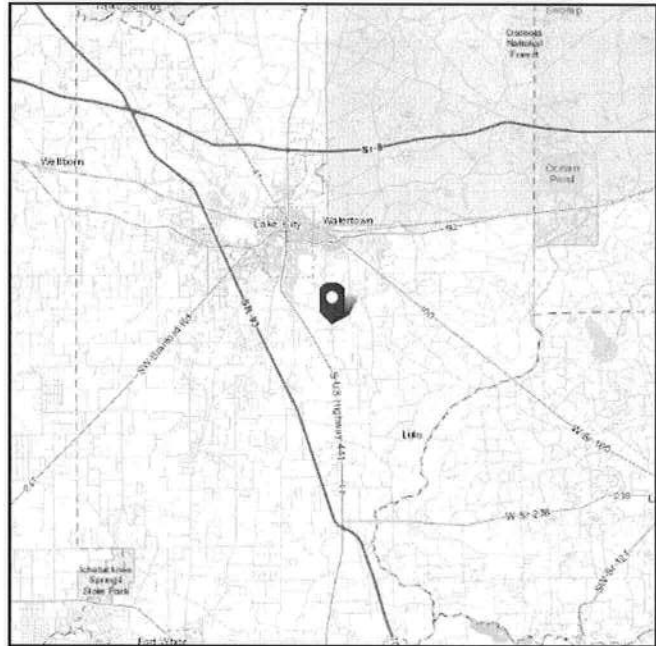
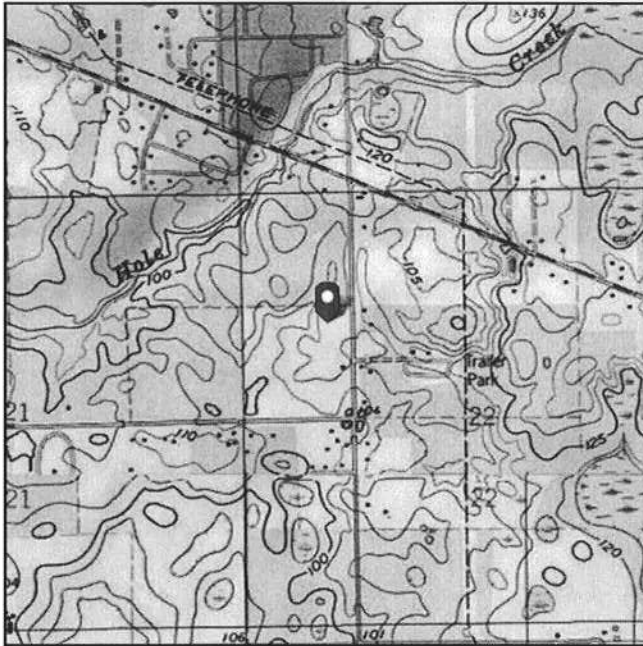
ADDITIONAL CALCULATIONS

ASCE 7 Hazards Report

Address:
No Address at This
Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Default (see
Section 11.4.3)

Elevation: 108.73 ft (NAVD 88)
Latitude: 30.130028
Longitude: -82.605781



Wind

Results:

Wind Speed:	119 Vmph
10-year MRI	75 Vmph
25-year MRI	84 Vmph
50-year MRI	90 Vmph
100-year MRI	98 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: Thu May 20 2021

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).

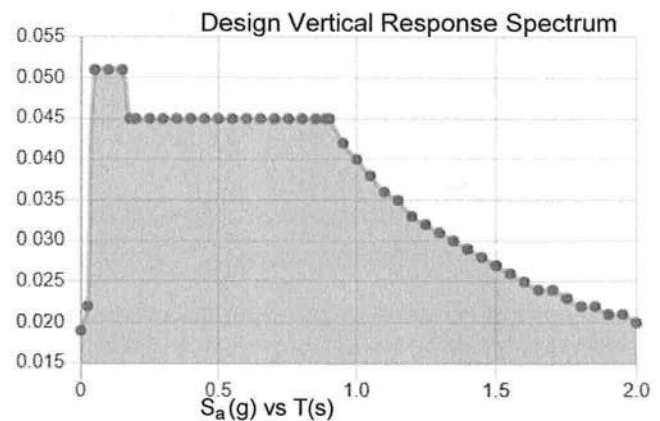
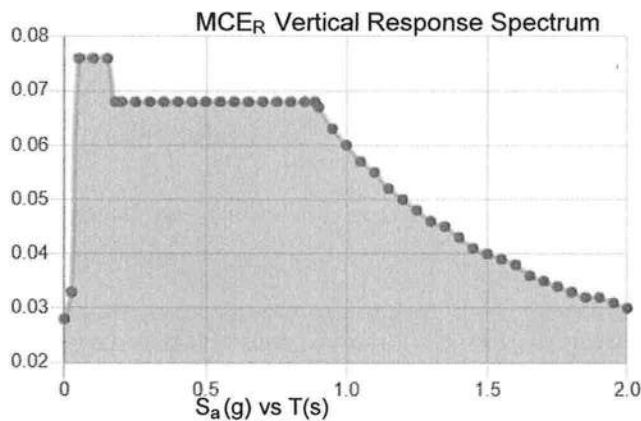
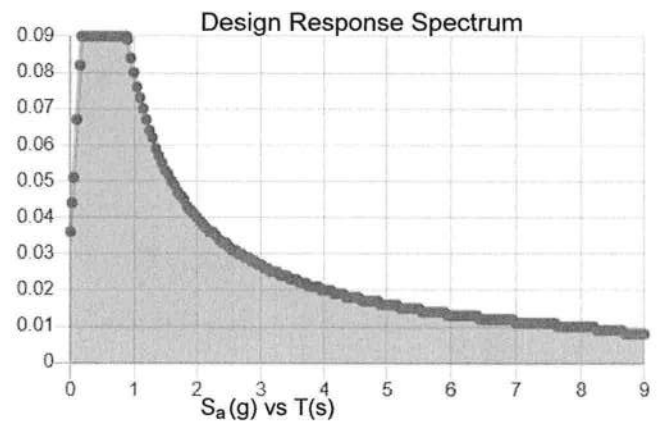
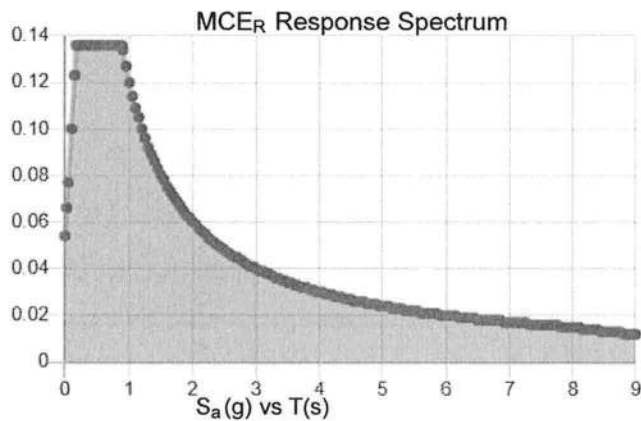
Site is in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2. Glazed openings need not be protected against wind-borne debris.

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	0.085	S_{D1} :	0.08
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} :	0.12	I_e :	1
S_{DS} :	0.09	C_v :	0.7

Seismic Design Category B



Data Accessed:

Thu May 20 2021

Date Source:

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

Results:

Ice Thickness: 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: Thu May 20 2021

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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Self Support Anchor Rod Capacity

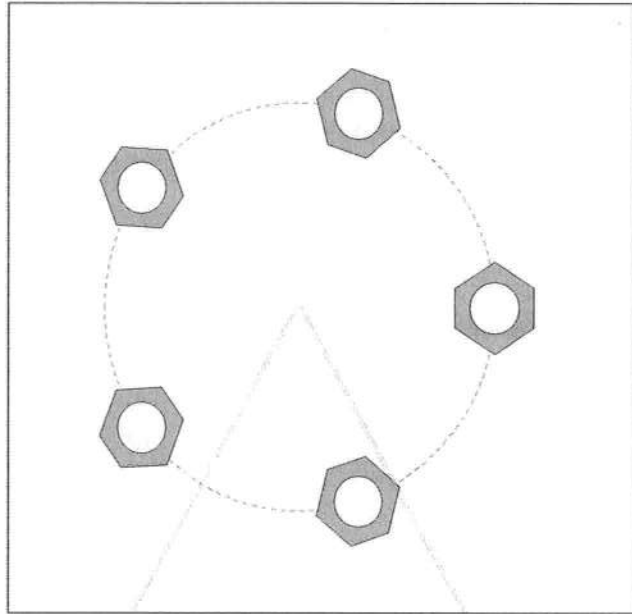
Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	No
l_{ar} (in)	1.5

Applied Loads		
	Comp.	Uplift
Axial Force (kips)	211	176
Shear Force (kips)	19	16

*TIA-222-H Section 15.5 Applied

Considered Eccentricity	
Leg Mod Eccentricity (in)	0.000
Anchor Rod N.A Shift (in)	0.000
Total Eccentricity (in)	0.000

*Anchor Rod Eccentricity Applied



Connection Properties		Analysis Results	
Anchor Rod Data		Anchor Rod Summary	
(5) 1-1/2" ϕ bolts (F1554-105 N; $F_y=105$ ksi, $F_u=125$ ksi)		(units of kips, kip-in)	
l_{ar} (in): 1.5		$Pu_t = 35.2$	$\phi Pn_t = 132.19$
		$Vu = 3.2$	$\phi Vn = 82.83$
		$Mu = n/a$	$\phi Mn = n/a$
			Stress Rating
			25.4%
			Pass

Drilled Pier Foundation

TIA-222 Revision: H
Tower Type: Self Support

Applied Loads		
	Comp.	Uplift
Moment (kip-ft)		
Axial Force (kips)	211	176
Shear Force (kips)	19	16

Material Properties	
Concrete Strength, f_c :	4.5 ksi
Rebar Strength, F_y :	60 ksi
Tie Yield Strength, F_{yt} :	60 ksi

Pier Design Data	
Depth	40 ft
Ext. Above Grade	0.5 ft
Pier Section 1	
From 0.5' above grade to 40' below grade	
Pier Diameter	5 ft
Rebar Quantity	16
Rebar Size	9
Rebar Cage Diameter	48 in
Tie Size	4
Tie Spacing	12 in

Rebar & Pier Options
Embedded Pole Inputs
Bellied Pier Inputs

Analysis Results	
Soil Lateral Check	
D_{red} (ft from TOC)	18.81
Soil Safety Factor	44.85
Max Moment (kip-ft)	254.55
Rating*	2.8%
Soil Vertical Check	
Skin Friction (kips)	470.86
End Bearing (kips)	128.12
Weight of Concrete (kips)	87.26
Total Capacity (kips)	598.97
Axial (kips)	298.26
Rating*	47.4%
Reinforced Concrete Flexure	
Critical Depth (ft from TOC)	19.38
Critical Moment (kip-ft)	254.22
Critical Moment Capacity	2064.43
Rating*	11.7%
Reinforced Concrete Shear	
Critical Depth (ft from TOC)	30.94
Critical Shear (kip)	23.02
Critical Shear Capacity	513.79
Rating*	4.3%

Go to Soil Calculations

Soil Interaction Rating*	75.4%
Structural Foundation Rating*	12.7%

*Rating per TIA-222-H Section 15.5

Groundwater Depth			2		Soil Profile									
					# of Layers		7							
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	2	2	110	150	0	0	0.000	0.000	0.00	0.00			Cohesionless
2	2	2.5	0.5	59	87.6	0	0	0.000	0.000	0.00	0.00			Cohesionless
3	2.5	3	0.5	59	87.6		27	0.000	0.000	0.00	0.00			Cohesionless
4	3	5	2	64	87.6	0.1	30	0.000	0.000	0.00	0.00			Cohesionless
5	5	12	7	64	87.6	0.1	30	0.000	0.000	0.59	0.20			Cohesionless
6	12	22	10	61	87.6	2.3		1.265	1.265	1.26	0.42			Cohesive
7	22	40	18	64	87.6	0.1	30	0.00	0.00	1.29	0.43	8.7		Cohesionless