ROBINSON & COLE

EM-VER-065-120319B

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March 16, 2012

Linda Roberts
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Antenna Swap**
22 Welsh Road, Hartland, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 170-foot level on an existing 180-foot tower at the above-referenced address. The tower and underlying property are owned by the Town of Hartland. Cellco's use of the tower was approved by the Council in 2008. Cellco now intends to replace six (6) of its existing antennas with three (3) model BXA-171085-12BF PCS antennas and three (3) model BXA-70063-6CF LTE antennas, all at the same 170-foot level. Cellco also intends to install six (6) additional coax cables. Attached behind Tab 1 are the specifications for the replacement antennas.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Wade E. Cole, First Selectman of the Town of Hartland.

The planned modifications to the facility fall squarely within those activities explicitly provided for in R.C.S.A. § 16-50j-72(b)(2).

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's replacement antennas will be located at the 170-foot level on the existing 180-foot tower.

2. The proposed modifications will not involve any change to ground-mounted equipment and, therefore, will not require the extension of the site boundaries.

3. The proposed modifications will not increase noise levels at the facility by six decibels or more.

4. The operation of the replacement antennas will not increase radio frequency (RF) power density levels at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A cumulative power density table for Cellco's modified facility is included behind Tab 2.

Also attached is a Structural Analysis Report confirming that the tower and foundation can support Cellco's proposed modifications. (See Tab 3).

For the foregoing reasons, Cellco respectfully submits that the proposed modifications to the above-referenced telecommunications facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2).

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Wade E. Cole, Hartland First Selectman
Sandy M. Carter

BXA-171085-12BF-EDIN-X

Replace "X" with desired electrical downtilt

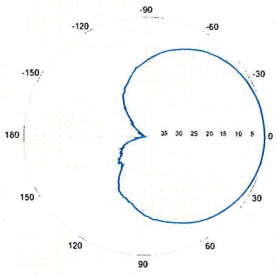
X-Pol | FET Panel | 85° | 18.0 dBi

Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	88°	85°	80°
Vertical beamwidth	4.5°	4.5°	4.5°
Gain	15.1 dBd / 17.2 dBi	15.5 dBd / 17.6 dBi	15.9 dBd / 18.0 dBi
Electrical downtilt (X)	0, 2, 4		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back ratio	> 30 dB		
In-band isolation	> 28 dB		
IM3 (20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN / Female / Bottom		
Operating temperature	-40° to +60° C / -40° to +140° F		

Mechanical Characteristics		
Dimensions Length x Width x Depth	1820 x 154 x 105 mm	71.7 x 6.1 x 4.1 in
Depth with z-brackets	133 mm	5.2 in
Weight without mounting brackets	6.8 kg	15 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.28 m² Side: 0.19 m²	Front: 3.1 ft² Side: 2.1 ft²
Wind load @ 161 km/hr (100 mph)	Front: 460 N Side: 304 N	Front: 103 lbf Side: 68 lbf

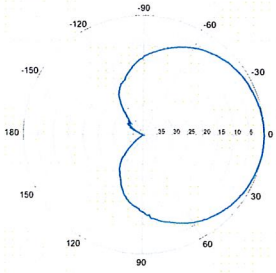
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171085-12BF-EDIN-X-FP		

BXA-171085-12BF-EDIN-X



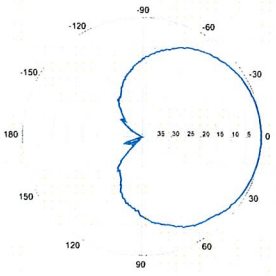
Horizontal | 1710-1880 MHz

BXA-171085-12BF-EDIN-X



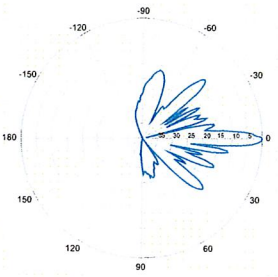
Horizontal | 1850-1990 MHz

BXA-171085-12BF-EDIN-X



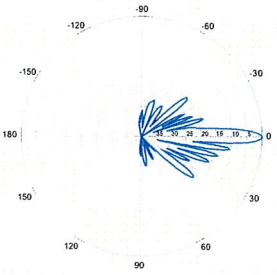
Horizontal | 1920-2170 MHz

BXA-171085-12BF-EDIN-0



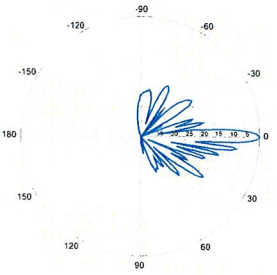
0° | Vertical | 1710-1880 MHz

BXA-171085-12BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171085-12BF-EDIN-0

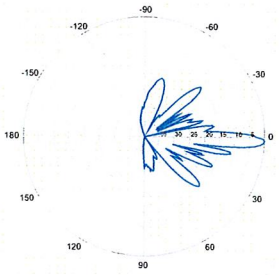


0° | Vertical | 1920-2170 MHz

BXA-171085-12BF-EDIN-X

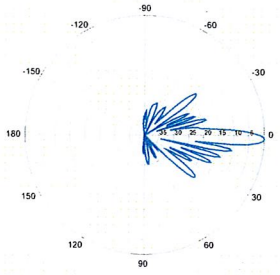
X-Pol | FET Panel | 85° | 18.0 dBi

BXA-171085-12BF-EDIN-2



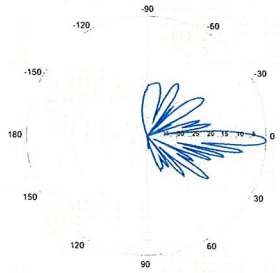
2° | Vertical | 1710-1880 MHz

BXA-171085-12BF-EDIN-2



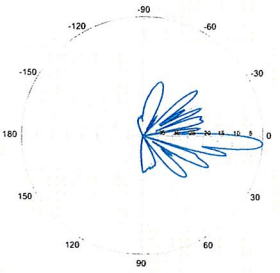
2° | Vertical | 1850-1990 MHz

BXA-171085-12BF-EDIN-2



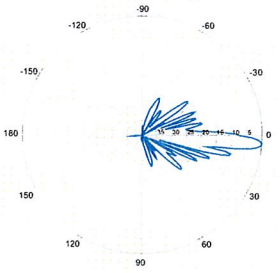
2° | Vertical | 1920-2170 MHz

BXA-171085-12BF-EDIN-4



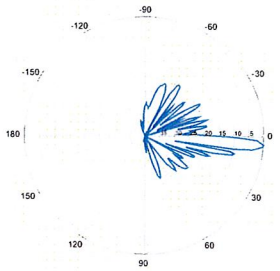
4° | Vertical | 1710-1880 MHz

BXA-171085-12BF-EDIN-4



4° | Vertical | 1850-1990 MHz

BXA-171085-12BF-EDIN-4



4° | Vertical | 1920-2170 MHz

Amphenol ANTENNA SOLUTIONS

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

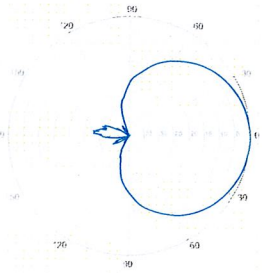
Replace "X" with desired electrical downtilt.

Antenna is also available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

Electrical Characteristics	696-900 MHz	
Frequency bands	696-806 MHz	806-900 MHz
Polarization	±45°	
Horizontal beamwidth	65°	63°
Vertical beamwidth	13°	11°
Gain	14.0 dBd (16.1 dBi)	14.5 dBd (16.6 dBi)
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 10	
Impedance	50Ω	
VSWR	≤1.35:1	
Upper sidelobe suppression (0°)	-18.3 dB	-18.2 dB
Front-to-back ratio (+/-30°)	-33.4 dB	-36.3 dB
Null fill	5% (-26.02 dB)	
Isolation between ports	< -25 dB	
Input power with EDIN connectors	500 W	
Input power with NE connectors	300 W	
Lightning protection	Direct Ground	
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)	
Mechanical Characteristics		
Dimensions Length x Width x Depth	1804 x 285 x 132 mm	71.0 x 11.2 x 5.2 in
Depth with z-brackets	172 mm	6.8 in
Weight without mounting brackets	7.9 kg	17 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.51 m² Side: 0.24 m²	Front: 5.5 ft² Side: 2.6 ft²
Wind load @ 161 km/hr (100 mph)	Front: 759 N Side: 391 N	Front: 169 lbf Side: 89 lbf

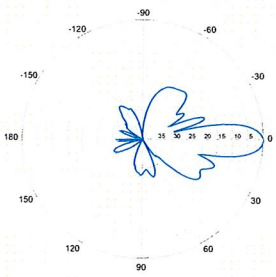
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



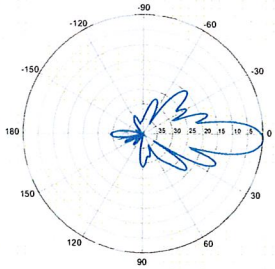
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

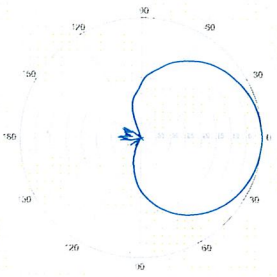


0° | Vertical | 750 MHz

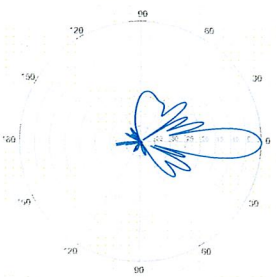
BXA-70063-6CF-EDIN-2



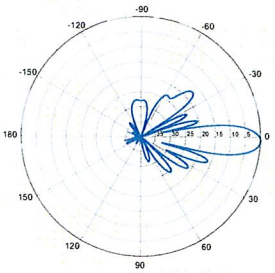
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz

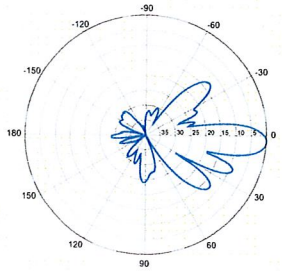


2° | Vertical | 850 MHz

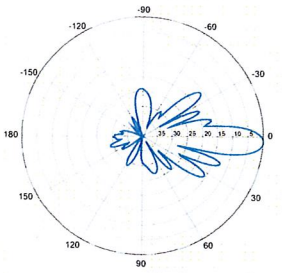
BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

BXA-70063-6CF-EDIN-3

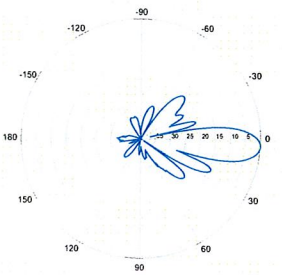


3° | Vertical | 750 MHz

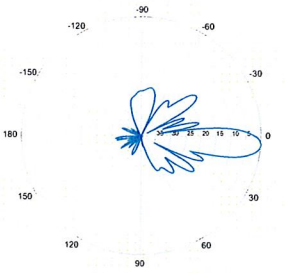


3° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-4

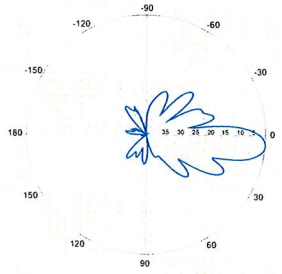


4° | Vertical | 750 MHz

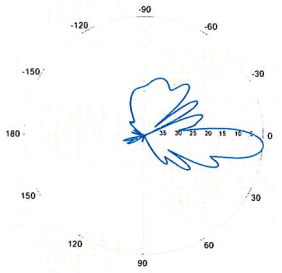


4° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-5

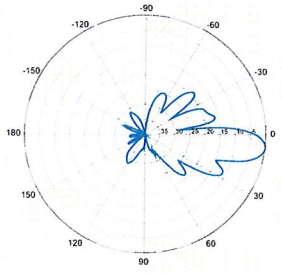


5° | Vertical | 750 MHz

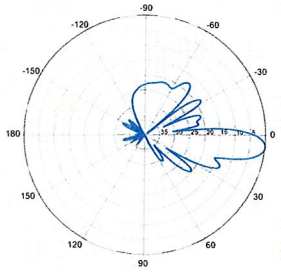


5° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-6

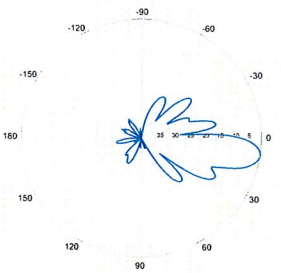


6° | Vertical | 750 MHz

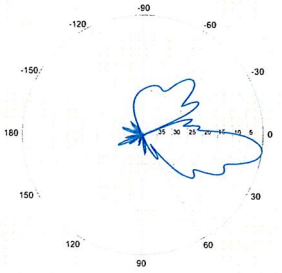


6° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-8

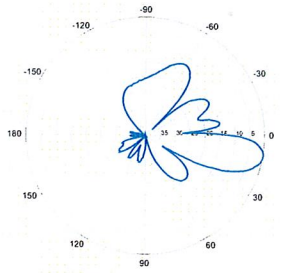


8° | Vertical | 750 MHz

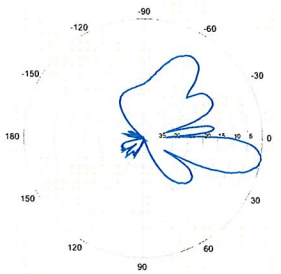


8° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-10



10° | Vertical | 750 MHz



10° | Vertical | 850 MHz

	General	Power	Density					
Site Name: East Hartland								
Tower Height: Verizon @ 170ft								
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE	Total
*T-Mobile	8	151	150	0.0193	1945	1.0000	1.93%	
*Town of Hartland	2	85	190	0.0017	154	0.2000	0.85%	
*AT&T	2	427	160	0.0120	1930	1.0000	1.20%	
*AT&T	4	296	160	0.0166	880	0.5867	2.83%	
*AT&T	1	500	160	0.0070	880	0.5867	1.20%	
Verizon PCS	**11**	**233**	**170**	**0.0319**	**1970**	**1.0000**	**3.19%**	
Verizon Cellular	**9**	**246**	**170**	**0.0275**	**869**	**0.5793**	**4.76%**	
Verizon AWS	**1**	**665**	**170**	**0.0083**	**2145**	**1.0000**	**0.83%**	
Verizon 700	**1**	**810**	**170**	**0.0101**	**698**	**0.4653**	**2.17%**	
								18.95%
* Source: Siting Council								

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

180-ft Existing Valmont Lattice Tower

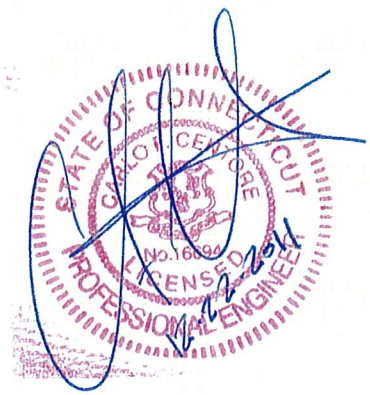
Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: East Hartland

22 Welsh Road
East Hartland, CT

Centek Project No. 12001.C08

Date: December 20, 2011



Prepared for:

Verizon Wireless
99 East River Road, 9th Floor
East Hartford, CT 06108

63-2 North Branford Road, Branford, CT 06405 203.488.0580 Fax 203.488.8587 www.CentekEng.com

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna upgrade proposed by Verizon Wireless on the existing lattice (tower) located in East Hartland, CT.

The host tower is a 180-ft three-legged, tapered steel self-support lattice tower, type U20.0x180', originally designed and manufactured by Valmont Structures; eng file no: A121935 dated April 12, 2006. The tower geometry, structure member sizes and foundation system information were taken from the aforementioned Valmont Structures design documents. Antenna and appurtenance information were obtained from a previous structural report prepared by Centek (formally Natcomm) job no.; 08161.CO1 dated November 11, 2008, visual verification from grade by Centek personnel on December 14, 2011 and a Verizon RF data sheet.

The tower is made up of nine (9) steel sections consisting of A572-50 solid round legs. Diagonal lateral support bracing consists of A36 steel angle construction. The vertical tower sections are connected by bolted flange plates while the solid legs and bracing are connected by bolted and welded gusset connections. The tower face width is 4.00-ft at the top and 20.00-ft at the bottom.

Verizon proposes the removal of six (6) panel antennas and the installation of six (6) panel antennas mounted to the existing three (3) 12-ft T-Frames. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing, proposed and future loads considered in this analysis consist of the following:

- TOWN (EXISTING):
  Antennas: Three (3) 20-ft Omni-directional whip antennas and one (1) 20-ft 4 bay dipole antenna mounted on a 6 arm halo mount with an elevation of 180-ft above grade.
  Coax Cables: One (1) 1-5/8" ∅ and three (3) 7/8" ∅ coax cable running on a leg of the existing tower.
- AT&T (EXISTING):
  Antennas: Six (6) Powerwave 7770 panel antennas, six (6) Powerwave LGP21401 TMA's and six (6) Powerwave LGP21901 Diplexers mounted on three (3) existing 12-ft T-Frames with a RAD center elevation of 160-ft above grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg of the existing tower.
- T-MOBILE (EXISTING):
  Antennas: Three (3) RFS APX16DWV-16DWV-S-E-ACU panel antennas and six (6) TMA's mounted on three (3) existing 12-ft T-Frames with a RAD center elevation of 150-ft above grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on a leg of the existing tower.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled RISATower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower shaft, and the model assumes that the shaft members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for 80 mph basic wind speed (fastest mile) with no ice and 75% reduction of wind force with ½ inch accumulative ice to determine stresses in members as per guidelines of TIA/EIA-222-F-96 entitled "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA/EIA-222-F, gravity loads of the tower structure and its components, and the application of ½" radial ice tower structure and its components.

Basic Wind Speed:	Hartford; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Hartland; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed controls.	
Load Cases:	Load Case 1; 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design of monopole towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 69 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 69 mph wind speed velocity represents 75% of the wind pressure generated by the 80 mph wind speed. This load case typically controls the design of lattice towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 (FS)[1]	Proposed Loading (FS)[1]	Result
Reinforced Concrete Mat and Piers (3)	OTM[2]	2.0	2.1	**PASS**

Note 1: FS denotes Factor of Safety.
Note 2: OTM denotes Overturning Moment

- The anchor bolts and base plate were found to be within allowable limits.

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Tension	42.6%	**PASS**

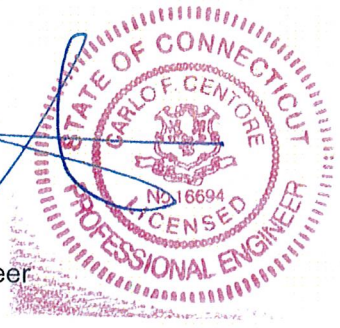
Conclusion

This analysis shows that the subject tower **is adequate** to support the proposed modified antenna configuration.

The analysis is based, in part, on the information provided to this office by Verizon Wireless. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

Respectfully Submitted by:



Carlo F. Centore, PE
Principal ~ Structural Engineer

Prepared by:

Timothy J. Lynn, EIT
Structural Engineer

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

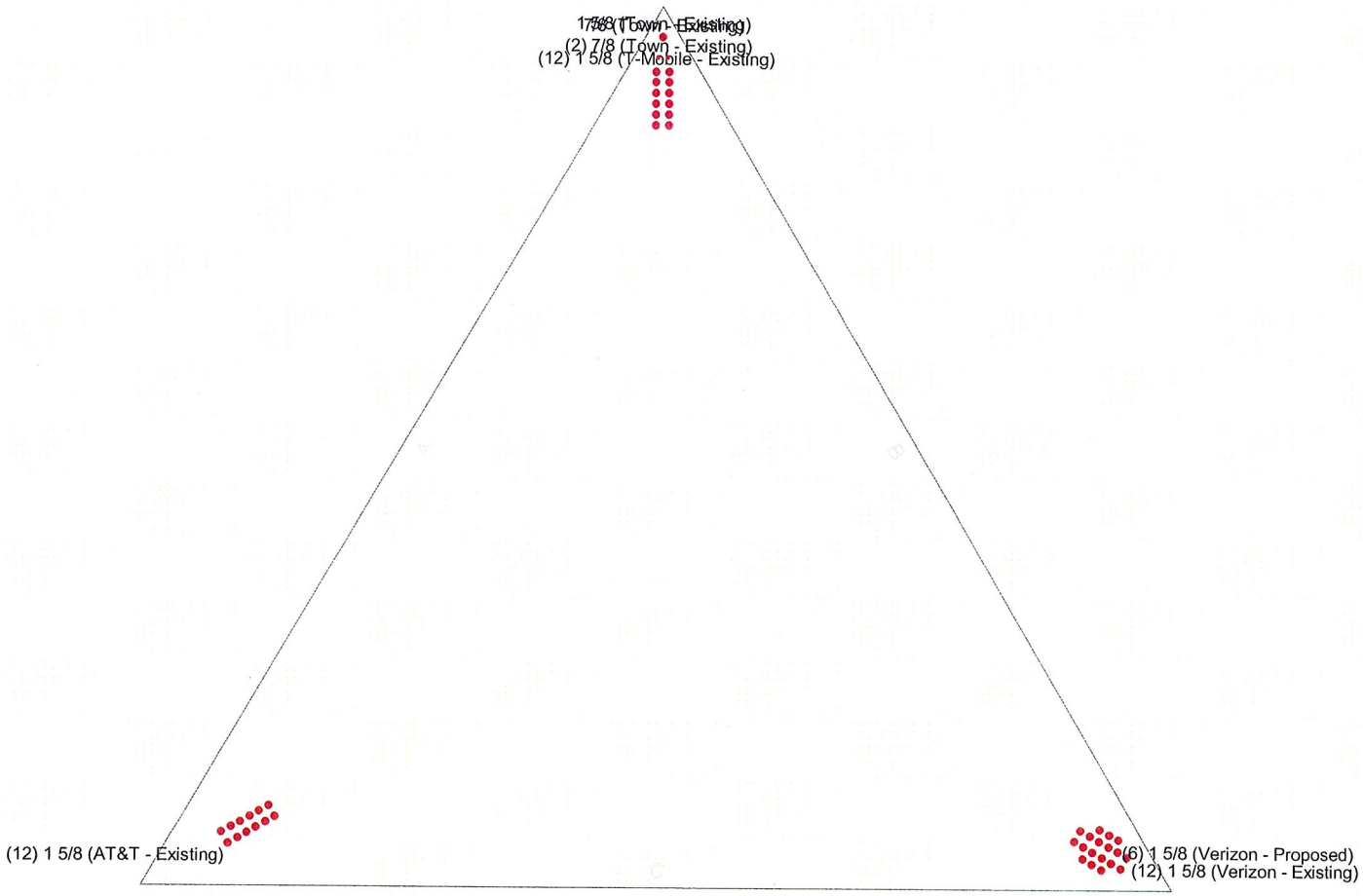
RISATower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, RISATower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

RISATower Features:

- RISATower can analyze and design 3- and 4-sided guyed towers, 3- and 4-sided self-supporting towers and either round or tapered ground mounted poles with or without guys.
- The program analyzes towers using the TIA-222-G (2005) standard or any of the previous TIA/EIA standards back to RS-222 (1959). Steel design is checked using the AISC ASD 9th Edition or the AISC LRFD specifications.
- Linear and non-linear (P-delta) analyses can be used in determining displacements and forces in the structure. Wind pressures and forces are automatically calculated.
- Extensive graphics plots include material take-off, shear-moment, leg compression, displacement, twist, feed line, guy anchor and stress plots.
- RISATower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.

Feedline Plan

Round Flat App In Face App Out Face Truss-Leg



Centek Engineering Inc.
63-2 North Branford Rd.
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587

Job: ***12001.CO8 - East Hartland***		
Project: ***180-ft Valmont Lattice Tower - 22 Welsh Rd., East Hartland, CT***		
Client: Verizon Wireless	Drawn by: TJL	App'd:
Code: TIA/EIA-222-F	Date: 12/20/11	Scale: NTS
Path: J:\Jobs\1200100.WI\CO8 - East Hartland\Calcs\ERI Files\180' Lattice Tower - East Hartland.er		Dwg No. E-7

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 180.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 4.00 ft at the top and 20.00 ft at the base.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

Basic wind speed of 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs	Distribute Leg Loads As Uniform	Treat Feedline Bundles As Cylinder
Consider Moments - Horizontals	Assume Legs Pinned	Use ASCE 10 X-Brace Ly Rules
Consider Moments - Diagonals	√ Assume Rigid Index Plate	√ Calculate Redundant Bracing Forces
Use Moment Magnification	√ Use Clear Spans For Wind Area	Ignore Redundant Members in FEA
√ Use Code Stress Ratios	√ Use Clear Spans For KL/r	√ SR Leg Bolts Resist Compression
√ Use Code Safety Factors - Guys	Retension Guys To Initial Tension	√ All Leg Panels Have Same Allowable
Escalate Ice	Bypass Mast Stability Checks	Offset Girt At Foundation
Always Use Max Kz	Use Azimuth Dish Coefficients	√ Consider Feedline Torque
Use Special Wind Profile	√ Project Wind Area of Appurt.	Include Angle Block Shear Check
√ Include Bolts In Member Capacity	Autocalc Torque Arm Areas	Poles
Leg Bolts Are At Top Of Section	SR Members Have Cut Ends	Include Shear-Torsion Interaction
√ Secondary Horizontal Braces Leg	√ Sort Capacity Reports By Component	Always Use Sub-Critical Flow
Use Diamond Inner Bracing (4 Sided)	Triangulate Diamond Inner Bracing	Use Top Mounted Sockets
Add IBC .6D+W Combination		

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T7	60.00-40.00	10.00	X Brace	No	No	0.0000	0.0000
T8	40.00-20.00	10.00	X Brace	No	No	0.0000	0.0000
T9	20.00-0.00	10.00	X Brace	No	No	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 180.00-160.00	Solid Round	1 1/2	A572-50 (50 ksi)	Solid Round	3/4	A572-50 (50 ksi)
T2 160.00-140.00	Truss Leg	Pirod 105216	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T3 140.00-120.00	Truss Leg	Pirod 105216	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T4 120.00-100.00	Truss Leg	Pirod 105217	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 100.00-80.00	Truss Leg	Pirod 105218	A572-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T6 80.00-60.00	Truss Leg	Pirod 105218	A572-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T7 60.00-40.00	Truss Leg	Pirod 105219	A572-50 (50 ksi)	Single Angle	L3x3x5/16	A36 (36 ksi)
T8 40.00-20.00	Truss Leg	Pirod 105219	A572-50 (50 ksi)	Single Angle	L3x3x5/16	A36 (36 ksi)
T9 20.00-0.00	Truss Leg	Pirod 105220	A572-50 (50 ksi)	Single Angle	L3 1/2x3 1/2x5/16	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 180.00-160.00	Solid Round	7/8	A572-50 (50 ksi)	Solid Round	7/8	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft²	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
T1 180.00-160.00	0.00	0.0000	A36 (36 ksi)	1	1	1.02	36.0000	36.0000
T2 160.00-140.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000

T2 160.00-140.00	1	0.5	0.85	1	0.5	0.85
T3 140.00-120.00	1	0.5	0.85	1	0.5	0.85
T4 120.00-100.00	1	0.5	0.85	1	0.5	0.85
T5 100.00-80.00	1	0.5	0.85	1	0.5	0.85
T6 80.00-60.00	1	0.5	0.85	1	0.5	0.85
T7 60.00-40.00	1	0.5	0.85	1	0.5	0.85
T8 40.00-20.00	1	0.5	0.85	1	0.5	0.85
T9 20.00-0.00	1	0.5	0.85	1	0.85	0.85

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 180.00-160.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T2 160.00-140.00	0.0000	1	0.0000	1	0.0000	1	ðƨƨ 1	1	0.0000	1	0.0000	1	0.0000	1
T3 140.00-120.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T4 120.00-100.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T5 100.00-80.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T6 80.00-60.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T7 60.00-40.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T8 40.00-20.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T9 20.00-0.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		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.
T1 180.00-160.00	Flange	1.0000 A325N	6	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 160.00-140.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 140.00-120.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 120.00-100.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

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
		B	56.500	0.000	0.000	0.000	0.37
		C	49.500	0.000	0.000	0.000	0.25
T4	120.00-100.00	A	46.600	0.000	0.000	0.000	0.30
		B	56.500	0.000	0.000	0.000	0.37
		C	49.500	0.000	0.000	0.000	0.25
T5	100.00-80.00	A	46.600	0.000	0.000	0.000	0.30
		B	56.500	0.000	0.000	0.000	0.37
		C	49.500	0.000	0.000	0.000	0.25
T6	80.00-60.00	A	46.600	0.000	0.000	0.000	0.30
		B	56.500	0.000	0.000	0.000	0.37
		C	49.500	0.000	0.000	0.000	0.25
T7	60.00-40.00	A	46.600	0.000	0.000	0.000	0.30
		B	56.500	0.000	0.000	0.000	0.37
		C	49.500	0.000	0.000	0.000	0.25
T8	40.00-20.00	A	46.600	0.000	0.000	0.000	0.30
		B	56.500	0.000	0.000	0.000	0.37
		C	49.500	0.000	0.000	0.000	0.25
T9	20.00-0.00	A	39.610	0.000	0.000	0.000	0.26
		B	48.025	0.000	0.000	0.000	0.32
		C	42.075	0.000	0.000	0.000	0.21

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	180.00-160.00	A	0.500	12.000	0.000	0.000	0.000	0.14
		B		16.967	14.467	0.000	0.000	0.48
		C		4.967	14.467	0.000	0.000	0.00
T2	160.00-140.00	A	0.500	19.450	31.000	0.000	0.000	0.47
		B		24.417	39.267	0.000	0.000	0.97
		C		14.900	49.600	0.000	0.000	0.65
T3	140.00-120.00	A	0.500	21.933	41.333	0.000	0.000	0.79
		B		26.900	49.600	0.000	0.000	0.97
		C		14.900	49.600	0.000	0.000	0.65
T4	120.00-100.00	A	0.500	21.933	41.333	0.000	0.000	0.79
		B		26.900	49.600	0.000	0.000	0.97
		C		14.900	49.600	0.000	0.000	0.65
T5	100.00-80.00	A	0.500	21.933	41.333	0.000	0.000	0.79
		B		26.900	49.600	0.000	0.000	0.97
		C		14.900	49.600	0.000	0.000	0.65
T6	80.00-60.00	A	0.500	21.933	41.333	0.000	0.000	0.79
		B		26.900	49.600	0.000	0.000	0.97
		C		14.900	49.600	0.000	0.000	0.65
T7	60.00-40.00	A	0.500	21.933	41.333	0.000	0.000	0.79
		B		26.900	49.600	0.000	0.000	0.97
		C		14.900	49.600	0.000	0.000	0.65
T8	40.00-20.00	A	0.500	21.933	41.333	0.000	0.000	0.79
		B		26.900	49.600	0.000	0.000	0.97
		C		14.900	49.600	0.000	0.000	0.65
T9	20.00-0.00	A	0.500	18.643	35.133	0.000	0.000	0.67
		B		22.865	42.160	0.000	0.000	0.82
		C		12.665	42.160	0.000	0.000	0.55

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00						
LPA-80080/6CF	B	From Leg	3.00	0.0000	170.00	No Ice	4.33	9.09	0.02
(Verizon - Existing)			6.00			1/2" Ice	4.76	9.64	0.07
			0.00						
LPA-80080/6CF	C	From Leg	3.00	0.0000	170.00	No Ice	4.33	9.09	0.02
(Verizon - Existing)			-6.00			1/2" Ice	4.76	9.64	0.07
			0.00						
BXA-171085-12BF	C	From Leg	3.00	0.0000	170.00	No Ice	4.73	3.57	0.01
(Verizon - Proposed)			-4.00			1/2" Ice	5.18	4.01	0.04
			0.00						
BXA-70063/6CF	C	From Leg	3.00	0.0000	170.00	No Ice	7.73	4.16	0.02
(Verizon - Proposed)			0.00			1/2" Ice	8.27	4.60	0.06
			0.00						
LPA-80080/6CF	C	From Leg	3.00	0.0000	170.00	No Ice	4.33	9.09	0.02
(Verizon - Existing)			6.00			1/2" Ice	4.76	9.64	0.07
			0.00						
PiROD 12' Lightweight	A	From Leg	1.50	0.0000	170.00	No Ice	10.20	10.20	0.25
T-Frame			0.00			1/2" Ice	16.20	16.20	0.35
(Verizon - Existing)			0.00						
PiROD 12' Lightweight	B	From Leg	1.50	0.0000	170.00	No Ice	10.20	10.20	0.25
T-Frame			0.00			1/2" Ice	16.20	16.20	0.35
(Verizon - Existing)			0.00						
PiROD 12' Lightweight	C	From Leg	1.50	0.0000	170.00	No Ice	10.20	10.20	0.25
T-Frame			0.00			1/2" Ice	16.20	16.20	0.35
(Verizon - Existing)			0.00						
(2) 7770.00	A	From Leg	3.00	0.0000	160.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	B	From Leg	3.00	0.0000	160.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	C	From Leg	3.00	0.0000	160.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) LGP21401 TMA	A	From Leg	3.00	0.0000	160.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00			1/2" Ice	1.09	0.48	0.02
			0.00						
(2) LGP21401 TMA	B	From Leg	3.00	0.0000	160.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00			1/2" Ice	1.09	0.48	0.02
			0.00						
(2) LGP21401 TMA	C	From Leg	3.00	0.0000	160.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00			1/2" Ice	1.09	0.48	0.02
			0.00						
(2) LGP21901 Diplexer	A	From Leg	3.00	0.0000	160.00	No Ice	0.23	0.12	0.01
(AT&T - Existing)			0.00			1/2" Ice	0.30	0.17	0.01
			0.00						
(2) LGP21901 Diplexer	B	From Leg	3.00	0.0000	160.00	No Ice	0.23	0.12	0.01
(AT&T - Existing)			0.00			1/2" Ice	0.30	0.17	0.01
			0.00						
(2) LGP21901 Diplexer	C	From Leg	3.00	0.0000	160.00	No Ice	0.23	0.12	0.01
(AT&T - Existing)			0.00			1/2" Ice	0.30	0.17	0.01
			0.00						
PiROD 12' Lightweight	A	From Leg	1.50	0.0000	160.00	No Ice	10.20	10.20	0.25
T-Frame			0.00			1/2" Ice	16.20	16.20	0.35
(AT&T - Existing)			0.00						
PiROD 12' Lightweight	B	From Leg	1.50	0.0000	160.00	No Ice	10.20	10.20	0.25
T-Frame			0.00			1/2" Ice	16.20	16.20	0.35

Truss-Leg Properties

Section Designation	Area	Area Ice	Self Weight	Ice Weight	Equiv. Diameter	Equiv. Diameter Ice	Leg Area
	in^2	in^2	K	K	in	in	in^2
Pirod 105216	2169.0308	3427.8066	0.47	0.42	7.5314	11.9021	3.6816
Pirod 105216	2169.0308	3427.8066	0.47	0.42	7.5314	11.9021	3.6816
Pirod 105217	2296.2363	3598.8066	0.59	0.43	7.9730	12.4959	5.3014
Pirod 105218	2425.3141	3778.2146	0.72	0.45	8.4212	13.1188	7.2158
Pirod 105218	2425.3141	3778.2146	0.72	0.45	8.4212	13.1188	7.2158
Pirod 105219	2597.9095	4038.9458	1.09	0.47	9.0205	14.0241	9.4248
Pirod 105219	2597.9095	4038.9458	1.09	0.47	9.0205	14.0241	9.4248
Pirod 105220	2735.0688	4240.4956	1.26	0.49	9.4968	14.7239	11.9282

Tower Pressures - No Ice

$G_H = 1.121$

Section Elevation	z	K_Z	q_z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
T1 180.00-160.00	170.00	1.597	26	82.500	A	0.000	17.072	5.000	29.29	0.000	0.000
					B	0.000	31.922		15.66	0.000	0.000
					C	0.000	24.922		20.06	0.000	0.000
T2 160.00-140.00	150.00	1.541	25	122.111	A	7.894	61.846	25.146	36.06	0.000	0.000
					B	7.894	71.746		31.58	0.000	0.000
					C	7.894	74.646		30.47	0.000	0.000
T3 140.00-120.00	130.00	1.48	24	162.111	A	8.723	71.746	25.146	31.25	0.000	0.000
					B	8.723	81.646		27.83	0.000	0.000
					C	8.723	74.646		30.16	0.000	0.000
T4 120.00-100.00	110.00	1.411	23	202.528	A	9.970	73.221	26.621	32.00	0.000	0.000
					B	9.970	83.121		28.60	0.000	0.000
					C	9.970	76.121		30.92	0.000	0.000
T5 100.00-80.00	90.00	1.332	22	242.945	A	13.520	74.718	28.118	31.87	0.000	0.000
					B	13.520	84.618		28.65	0.000	0.000
					C	13.520	77.618		30.85	0.000	0.000
T6 80.00-60.00	70.00	1.24	20	282.945	A	15.144	74.718	28.118	31.29	0.000	0.000
					B	15.144	84.618		28.18	0.000	0.000
					C	15.144	77.618		30.31	0.000	0.000
T7 60.00-40.00	50.00	1.126	18	323.362	A	16.830	76.718	30.118	32.20	0.000	0.000
					B	16.830	86.618		29.11	0.000	0.000
					C	16.830	79.618		31.23	0.000	0.000
T8 40.00-20.00	30.00	1	16	363.362	A	18.566	76.718	30.118	31.61	0.000	0.000
					B	18.566	86.618		28.63	0.000	0.000
					C	18.566	79.618		30.68	0.000	0.000
T9 20.00-0.00	10.00	1	16	403.780	A	23.735	71.319	31.709	33.36	0.000	0.000
					B	23.735	79.734		30.65	0.000	0.000
					C	23.735	73.784		32.52	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.121$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
					B	16.830	86.618		29.11	0.000	0.000
					C	16.830	79.618		31.23	0.000	0.000
T8 40.00-20.00	30.00	1	6	363.362	A	18.566	76.718	30.118	31.61	0.000	0.000
					B	18.566	86.618		28.63	0.000	0.000
					C	18.566	79.618		30.68	0.000	0.000
T9 20.00-0.00	10.00	1	6	403.780	A	23.735	71.319	31.709	33.36	0.000	0.000
					B	23.735	79.734		30.65	0.000	0.000
					C	23.735	73.784		32.52	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.24	0.76	A	0.207	2.573	0.592	1	1	10.104	1.27	63.26	B
180.00-160.00			B	0.387	2.09	0.646	1	1	20.633			
			C	0.302	2.29	0.617	1	1	15.365			
T2	0.80	1.85	A	0.571	1.825	0.736	1	1	53.434	3.41	170.55	C
160.00-140.00			B	0.652	1.781	0.787	1	1	64.353			
			C	0.676	1.777	0.803	1	1	67.836			
T3	0.93	1.89	A	0.496	1.905	0.696	1	1	58.634	3.40	170.16	B
140.00-120.00			B	0.557	1.837	0.728	1	1	68.201			
			C	0.514	1.882	0.705	1	1	61.339			
T4	0.93	2.28	A	0.411	2.043	0.656	1	1	58.007	3.36	168.15	B
120.00-100.00			B	0.46	1.958	0.678	1	1	66.306			
			C	0.425	2.016	0.662	1	1	60.374			
T5	0.93	2.87	A	0.363	2.141	0.637	1	1	61.135	3.46	173.01	B
100.00-80.00			B	0.404	2.056	0.653	1	1	68.794			
			C	0.375	2.115	0.642	1	1	63.332			
T6	0.93	2.94	A	0.318	2.25	0.621	1	1	61.577	3.39	169.45	B
80.00-60.00			B	0.353	2.166	0.633	1	1	68.741			
			C	0.328	2.225	0.625	1	1	63.641			
T7	0.93	4.64	A	0.289	2.325	0.613	1	1	63.834	3.28	164.12	B
60.00-40.00			B	0.32	2.244	0.622	1	1	70.724			
			C	0.298	2.301	0.615	1	1	65.825			
T8	0.93	4.77	A	0.262	2.401	0.605	1	1	64.986	3.06	152.90	B
40.00-20.00			B	0.289	2.324	0.613	1	1	71.641			
			C	0.27	2.378	0.607	1	1	66.914			
T9 20.00-0.00	0.79	5.72	A	0.235	2.482	0.598	1	1	66.402	3.19	159.59	B
			B	0.256	2.419	0.603	1	1	71.853			
			C	0.242	2.463	0.6	1	1	67.986			
Sum Weight:	7.39	27.72						OTM	2375.51 kip-ft	27.82		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.24	0.76	A	0.207	2.573	0.592	0.825	1	10.104	1.27	63.26	B
180.00-160.00			B	0.387	2.09	0.646	0.825	1	20.633			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
40.00-20.00			B	0.289	2.324	0.613	0.8	1	67.927			
			C	0.27	2.378	0.607	0.8	1	63.200			
T9 20.00-0.00	0.79	5.72	A	0.235	2.482	0.598	0.8	1	61.655	2.98	149.05	B
			B	0.256	2.419	0.603	0.8	1	67.106			
			C	0.242	2.463	0.6	0.8	1	63.239			
Sum Weight:	7.39	27.72						OTM	2303.79 kip-ft	26.75		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.24	0.76	A	0.207	2.573	0.592	0.85	1	10.104	1.27	63.26	B
180.00-160.00			B	0.387	2.09	0.646	0.85	1	20.633			
			C	0.302	2.29	0.617	0.85	1	15.365			
T2	0.80	1.85	A	0.571	1.825	0.736	0.85	1	52.250	3.35	167.57	C
160.00-140.00			B	0.652	1.781	0.787	0.85	1	63.169			
			C	0.676	1.777	0.803	0.85	1	66.652			
T3	0.93	1.89	A	0.496	1.905	0.696	0.85	1	57.325	3.34	166.89	B
140.00-120.00			B	0.557	1.837	0.728	0.85	1	66.892			
			C	0.514	1.882	0.705	0.85	1	60.031			
T4	0.93	2.28	A	0.411	2.043	0.656	0.85	1	56.511	3.29	164.36	B
120.00-100.00			B	0.46	1.958	0.678	0.85	1	64.810			
			C	0.425	2.016	0.662	0.85	1	58.879			
T5	0.93	2.87	A	0.363	2.141	0.637	0.85	1	59.107	3.36	167.91	B
100.00-80.00			B	0.404	2.056	0.653	0.85	1	66.766			
			C	0.375	2.115	0.642	0.85	1	61.304			
T6	0.93	2.94	A	0.318	2.25	0.621	0.85	1	59.305	3.28	163.85	B
80.00-60.00			B	0.353	2.166	0.633	0.85	1	66.469			
			C	0.328	2.225	0.625	0.85	1	61.369			
T7	0.93	4.64	A	0.289	2.325	0.613	0.85	1	61.310	3.17	158.26	B
60.00-40.00			B	0.32	2.244	0.622	0.85	1	68.199			
			C	0.298	2.301	0.615	0.85	1	63.300			
T8	0.93	4.77	A	0.262	2.401	0.605	0.85	1	62.201	2.94	146.96	B
40.00-20.00			B	0.289	2.324	0.613	0.85	1	68.856			
			C	0.27	2.378	0.607	0.85	1	64.129			
T9 20.00-0.00	0.79	5.72	A	0.235	2.482	0.598	0.85	1	62.842	3.03	151.68	B
			B	0.256	2.419	0.603	0.85	1	68.293			
			C	0.242	2.463	0.6	0.85	1	64.426			
Sum Weight:	7.39	27.72						OTM	2321.72 kip-ft	27.01		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.63	1.02	A	0.381	2.103	0.644	1	1	20.646	1.69	84.30	B

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T8	2.40	6.83	A	0.369	2.128	0.64	0.825	1	97.353	3.07	153.38	B
40.00-20.00			B	0.406	2.053	0.654	0.825	1	108.495			
			C	0.373	2.12	0.641	0.825	1	99.761			
T9 20.00-0.00	2.04	7.98	A	0.329	2.221	0.625	0.825	1	95.201	3.10	154.99	B
			B	0.357	2.156	0.635	0.825	1	104.403			
			C	0.332	2.215	0.626	0.825	1	97.320			
Sum Weight:	19.13	42.83						OTM	2717.79 kip-ft	30.27		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.63	1.02	A	0.381	2.103	0.644	0.8	1	20.646	1.57	78.58	B
180.00-160.00			B	0.612	1.797	0.761	0.8	1	39.746			
			C	0.469	1.943	0.682	0.8	1	28.648			
T2	2.08	3.41	A	0.818	1.83	0.911	0.8	1	87.924	4.37	218.68	B
160.00-140.00			B	0.925	1.961	1	0.8	1	105.042			
			C	0.931	1.972	1	0.8	1	103.792			
T3	2.40	3.48	A	0.703	1.776	0.822	0.8	1	93.634	4.00	199.81	B
140.00-120.00			B	0.784	1.805	0.884	0.8	1	108.632			
			C	0.711	1.777	0.828	0.8	1	94.779			
T4	2.40	3.95	A	0.583	1.816	0.743	0.8	1	91.306	3.62	181.03	B
120.00-100.00			B	0.647	1.782	0.784	0.8	1	104.561			
			C	0.589	1.812	0.747	0.8	1	92.912			
T5	2.40	4.69	A	0.511	1.886	0.703	0.8	1	93.289	3.55	177.26	B
100.00-80.00			B	0.565	1.829	0.733	0.8	1	105.631			
			C	0.516	1.88	0.706	0.8	1	95.123			
T6	2.40	4.81	A	0.447	1.978	0.672	0.8	1	92.746	3.40	170.07	B
80.00-60.00			B	0.494	1.908	0.694	0.8	1	104.387			
			C	0.451	1.971	0.674	0.8	1	94.760			
T7	2.40	6.65	A	0.408	2.049	0.655	0.8	1	95.226	3.26	163.20	B
60.00-40.00			B	0.448	1.976	0.673	0.8	1	106.502			
			C	0.412	2.042	0.656	0.8	1	97.341			
T8	2.40	6.83	A	0.369	2.128	0.64	0.8	1	95.856	3.02	150.98	B
40.00-20.00			B	0.406	2.053	0.654	0.8	1	106.791			
			C	0.373	2.12	0.641	0.8	1	98.057			
T9 20.00-0.00	2.04	7.98	A	0.329	2.221	0.625	0.8	1	93.730	3.05	152.54	B
			B	0.357	2.156	0.635	0.8	1	102.755			
			C	0.332	2.215	0.626	0.8	1	95.673			
Sum Weight:	19.13	42.83						OTM	2682.41 kip-ft	29.84		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
			C	0.298	2.301	0.615	1	1	65.825			
T8	0.93	4.77	A	0.262	2.401	0.605	1	1	64.986	1.19	59.73	B
40.00-20.00			B	0.289	2.324	0.613	1	1	71.641			
			C	0.27	2.378	0.607	1	1	66.914			
T9 20.00-0.00	0.79	5.72	A	0.235	2.482	0.598	1	1	66.402	1.25	62.34	B
			B	0.256	2.419	0.603	1	1	71.853			
			C	0.242	2.463	0.6	1	1	67.986			
Sum Weight:	7.39	27.72						OTM	927.93 kip-ft	10.87		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.24	0.76	A	0.207	2.573	0.592	0.825	1	10.104	0.49	24.71	B
180.00-160.00			B	0.387	2.09	0.646	0.825	1	20.633			
			C	0.302	2.29	0.617	0.825	1	15.365			
T2	0.80	1.85	A	0.571	1.825	0.736	0.825	1	52.053	1.31	65.27	C
160.00-140.00			B	0.652	1.781	0.787	0.825	1	62.972			
			C	0.676	1.777	0.803	0.825	1	66.455			
T3	0.93	1.89	A	0.496	1.905	0.696	0.825	1	57.107	1.30	64.98	B
140.00-120.00			B	0.557	1.837	0.728	0.825	1	66.674			
			C	0.514	1.882	0.705	0.825	1	59.813			
T4	0.93	2.28	A	0.411	2.043	0.656	0.825	1	56.262	1.28	63.96	B
120.00-100.00			B	0.46	1.958	0.678	0.825	1	64.561			
			C	0.425	2.016	0.662	0.825	1	58.629			
T5	0.93	2.87	A	0.363	2.141	0.637	0.825	1	58.770	1.31	65.26	B
100.00-80.00			B	0.404	2.056	0.653	0.825	1	66.428			
			C	0.375	2.115	0.642	0.825	1	60.966			
T6	0.93	2.94	A	0.318	2.25	0.621	0.825	1	58.927	1.27	63.64	B
80.00-60.00			B	0.353	2.166	0.633	0.825	1	66.091			
			C	0.328	2.225	0.625	0.825	1	60.991			
T7	0.93	4.64	A	0.289	2.325	0.613	0.825	1	60.889	1.23	61.44	B
60.00-40.00			B	0.32	2.244	0.622	0.825	1	67.778			
			C	0.298	2.301	0.615	0.825	1	62.880			
T8	0.93	4.77	A	0.262	2.401	0.605	0.825	1	61.737	1.14	57.02	B
40.00-20.00			B	0.289	2.324	0.613	0.825	1	68.391			
			C	0.27	2.378	0.607	0.825	1	63.665			
T9 20.00-0.00	0.79	5.72	A	0.235	2.482	0.598	0.825	1	62.248	1.17	58.74	B
			B	0.256	2.419	0.603	0.825	1	67.699			
			C	0.242	2.463	0.6	0.825	1	63.833			
Sum Weight:	7.39	27.72						OTM	903.42 kip-ft	10.50		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
			C	0.298	2.301	0.615	0.85	1	63.300			
T8	0.93	4.77	A	0.262	2.401	0.605	0.85	1	62.201	1.15	57.40	B
40.00-20.00			B	0.289	2.324	0.613	0.85	1	68.856			
			C	0.27	2.378	0.607	0.85	1	64.129			
T9 20.00-0.00	0.79	5.72	A	0.235	2.482	0.598	0.85	1	62.842	1.19	59.25	B
			B	0.256	2.419	0.603	0.85	1	68.293			
			C	0.242	2.463	0.6	0.85	1	64.426			
Sum Weight:	7.39	27.72						OTM	906.92 kip-ft	10.55		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	19.63					
Bracing Weight	8.09					
Total Member Self-Weight	27.72			0.47	-5.87	
Total Weight	41.00			0.47	-5.87	
Wind 0 deg - No Ice		0.00	-36.57	-3825.92	-5.87	5.34
Wind 30 deg - No Ice		17.88	-30.97	-3266.70	-1892.17	4.03
Wind 45 deg - No Ice		25.19	-25.19	-2660.83	-2667.17	3.01
Wind 60 deg - No Ice		30.74	-17.75	-1876.87	-3257.51	1.80
Wind 90 deg - No Ice		35.76	0.00	0.47	-3778.48	-0.88
Wind 120 deg - No Ice		31.67	18.29	1913.67	-3319.62	-3.47
Wind 135 deg - No Ice		25.19	25.19	2661.77	-2667.17	-4.24
Wind 150 deg - No Ice		17.88	30.97	3267.64	-1892.17	-4.91
Wind 180 deg - No Ice		0.00	35.49	3755.15	-5.87	-5.10
Wind 210 deg - No Ice		-17.88	30.97	3267.64	1880.43	-4.03
Wind 225 deg - No Ice		-25.19	25.19	2661.77	2655.43	-3.01
Wind 240 deg - No Ice		-31.67	18.29	1913.67	3307.88	-1.86
Wind 270 deg - No Ice		-35.76	0.00	0.47	3766.74	0.88
Wind 300 deg - No Ice		-30.74	-17.75	-1876.87	3245.78	3.30
Wind 315 deg - No Ice		-25.19	-25.19	-2660.83	2655.43	4.24
Wind 330 deg - No Ice		-17.88	-30.97	-3266.70	1880.43	4.91
Member Ice	15.12					
Total Weight Ice	70.81			0.78	-15.25	
Wind 0 deg - Ice		0.00	-41.75	-4377.35	-15.25	3.61
Wind 30 deg - Ice		19.58	-33.91	-3599.17	-2093.68	1.22
Wind 45 deg - Ice		27.39	-27.39	-2913.55	-2929.58	0.02
Wind 60 deg - Ice		33.18	-19.15	-2042.27	-3553.92	-1.13
Wind 90 deg - Ice		39.15	0.00	0.78	-4172.11	-3.25
Wind 120 deg - Ice		36.15	20.87	2189.85	-3806.82	-4.89
Wind 135 deg - Ice		27.39	27.39	2915.11	-2929.58	-4.54
Wind 150 deg - Ice		19.58	33.91	3600.73	-2093.68	-4.46
Wind 180 deg - Ice		0.00	38.31	4086.89	-15.25	-3.17
Wind 210 deg - Ice		-19.58	33.91	3600.73	2063.19	-1.22
Wind 225 deg - Ice		-27.39	27.39	2915.11	2899.08	-0.02
Wind 240 deg - Ice		-36.15	20.87	2189.85	3776.33	1.29
Wind 270 deg - Ice		-39.15	0.00	0.78	4141.62	3.25
Wind 300 deg - Ice		-33.18	-19.15	-2042.27	3523.43	4.30
Wind 315 deg - Ice		-27.39	-27.39	-2913.55	2899.08	4.54
Wind 330 deg - Ice		-19.58	-33.91	-3599.17	2063.19	4.46
Total Weight	41.00			0.47	-5.87	
Wind 0 deg - Service		0.00	-14.29	-1494.55	0.26	2.09

Comb. No.	Description
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	180 - 160	Leg	Max Tension	10	22.61	-0.00	0.27
			Max. Compression	24	-27.16	-1.11	-0.62
			Max. Mx	24	-27.16	-1.11	-0.62
			Max. My	19	-26.88	-0.01	1.27
			Max. Vy	24	2.75	-1.11	-0.62
			Max. Vx	19	-3.14	-0.01	1.27
		Diagonal	Max Tension	23	2.60	0.00	0.00
			Max. Compression	31	-2.64	0.00	0.00
			Max. Mx	24	2.30	-0.00	0.00
			Max. My	14	-2.23	-0.00	-0.00
			Max. Vy	24	0.00	-0.00	0.00
			Max. Vx	14	0.00	-0.00	-0.00
		Top Girt	Max Tension	7	0.18	0.00	0.00
			Max. Compression	27	-0.23	0.00	0.00
			Max. Mx	18	-0.01	0.01	0.00
			Max. My	6	0.04	0.00	0.00
			Max. Vy	18	0.01	0.00	0.00
			Max. Vx	6	-0.00	0.00	0.00
		Bottom Girt	Max Tension	10	0.23	0.00	0.00
			Max. Compression	7	-0.23	0.00	0.00
			Max. Mx	18	0.01	0.01	0.00
			Max. My	4	-0.05	0.00	-0.00
			Max. Vy	18	0.01	0.00	0.00
			Max. Vx	4	0.00	0.00	0.00
T2	160 - 140	Leg	Max Tension	27	45.11	-2.24	0.01
			Max. Compression	24	-55.25	3.32	0.00
			Max. Mx	24	-55.25	3.32	0.00
			Max. My	26	-3.05	-0.20	-3.02
			Max. Vy	32	-0.78	-2.22	0.01
			Max. Vx	28	0.83	-0.19	3.00
		Diagonal	Max Tension	31	6.39	0.00	0.00
			Max. Compression	31	-6.55	0.00	0.00
			Max. Mx	24	5.25	0.06	-0.00
			Max. My	23	-5.26	-0.02	-0.02
			Max. Vy	24	-0.02	0.06	-0.00
			Max. Vx	23	0.00	0.00	0.00
T3	140 - 120	Leg	Max Tension	27	77.57	-3.24	0.02
			Max. Compression	24	-93.59	3.61	0.01
			Max. Mx	24	-93.59	3.61	0.01

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	32	0.88	-9.00	-0.02
			Max. Vx	23	0.20	2.06	3.98
		Diagonal	Max Tension	34	7.52	0.00	0.00
			Max. Compression	34	-7.00	0.00	0.00
			Max. Mx	24	6.52	0.14	0.01
			Max. My	32	-5.88	0.07	-0.01
			Max. Vy	22	0.05	0.13	0.01
			Max. Vx	32	0.00	0.00	0.00
T9	20 - 0	Leg	Max Tension	22	207.08	4.63	-0.01
			Max. Compression	24	-275.02	-0.00	0.00
			Max. Mx	24	-257.45	11.83	-0.01
			Max. My	23	-25.32	8.09	6.13
			Max. Vy	32	-1.48	-9.00	-0.02
			Max. Vx	23	0.71	8.09	6.13
		Diagonal	Max Tension	33	10.89	0.00	0.00
			Max. Compression	34	-9.07	0.00	0.00
			Max. Mx	22	2.77	0.21	0.02
			Max. My	32	-8.22	0.14	-0.02
			Max. Vy	22	0.07	0.21	0.02
			Max. Vx	32	0.00	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	30	277.43	18.88	-10.93
	Max. H_x	13	235.26	20.75	-11.92
	Max. H_z	21	-208.65	-23.94	14.28
	Min. Vert	22	-214.77	-24.62	14.26
	Min. H_x	22	-214.77	-24.62	14.26
	Min. H_z	13	235.26	20.75	-11.92
Leg B	Max. Vert	24	278.96	-18.85	-11.06
	Max. H_x	32	-213.23	24.55	14.31
	Max. H_z	33	-207.12	23.85	14.37
	Min. Vert	32	-213.23	24.55	14.31
	Min. H_x	7	235.85	-20.68	-12.06
	Min. H_z	7	235.85	-20.68	-12.06
Leg A	Max. Vert	19	278.13	0.13	21.84
	Max. H_x	31	23.56	1.61	-4.28
	Max. H_z	2	235.51	0.16	23.94
	Min. Vert	27	-214.07	-0.08	-28.44
	Min. H_x	24	-103.72	-1.59	-17.38
	Min. H_z	27	-214.07	-0.08	-28.44

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	41.00	0.00	0.00	0.47	-5.87	-0.00
Dead+Wind 0 deg - No Ice	41.00	0.00	-36.57	-3842.43	-5.90	5.37
Dead+Wind 30 deg - No Ice	41.00	17.88	-30.97	-3280.86	-1900.39	4.07

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
6	35.76	-41.00	0.00	-35.76	41.00	0.00	0.000%
7	31.67	-41.00	18.29	-31.67	41.00	-18.29	0.000%
8	25.19	-41.00	25.19	-25.19	41.00	-25.19	0.000%
9	17.88	-41.00	30.97	-17.88	41.00	-30.97	0.000%
10	0.00	-41.00	35.49	0.00	41.00	-35.49	0.000%
11	-17.88	-41.00	30.97	17.88	41.00	-30.97	0.000%
12	-25.19	-41.00	25.19	25.19	41.00	-25.19	0.000%
13	-31.67	-41.00	18.29	31.67	41.00	-18.29	0.000%
14	-35.76	-41.00	0.00	35.76	41.00	0.00	0.000%
15	-30.74	-41.00	-17.75	30.74	41.00	17.75	0.000%
16	-25.19	-41.00	-25.19	25.19	41.00	25.19	0.000%
17	-17.88	-41.00	-30.97	17.88	41.00	30.97	0.000%
18	0.00	-70.81	0.00	0.00	70.81	0.00	0.000%
19	0.00	-70.81	-41.75	0.00	70.81	41.75	0.000%
20	19.58	-70.81	-33.91	-19.58	70.81	33.91	0.000%
21	27.39	-70.81	-27.39	-27.39	70.81	27.39	0.000%
22	33.18	-70.81	-19.15	-33.18	70.81	19.15	0.000%
23	39.15	-70.81	0.00	-39.15	70.81	0.00	0.000%
24	36.15	-70.81	20.87	-36.15	70.81	-20.87	0.000%
25	27.39	-70.81	27.39	-27.39	70.81	-27.39	0.000%
26	19.58	-70.81	33.91	-19.58	70.81	-33.91	0.000%
27	0.00	-70.81	38.31	0.00	70.81	-38.31	0.000%
28	-19.58	-70.81	33.91	19.58	70.81	-33.91	0.000%
29	-27.39	-70.81	27.39	27.39	70.81	-27.39	0.000%
30	-36.15	-70.81	20.87	36.15	70.81	-20.87	0.000%
31	-39.15	-70.81	0.00	39.15	70.81	0.00	0.000%
32	-33.18	-70.81	-19.15	33.18	70.81	19.15	0.000%
33	-27.39	-70.81	-27.39	27.39	70.81	27.39	0.000%
34	-19.58	-70.81	-33.91	19.58	70.81	33.91	0.000%
35	0.00	-41.00	-14.29	0.00	41.00	14.29	0.000%
36	6.99	-41.00	-12.10	-6.99	41.00	12.10	0.000%
37	9.84	-41.00	-9.84	-9.84	41.00	9.84	0.000%
38	12.01	-41.00	-6.93	-12.01	41.00	6.93	0.000%
39	13.97	-41.00	0.00	-13.97	41.00	0.00	0.000%
40	12.37	-41.00	7.14	-12.37	41.00	-7.14	0.000%
41	9.84	-41.00	9.84	-9.84	41.00	-9.84	0.000%
42	6.99	-41.00	12.10	-6.99	41.00	-12.10	0.000%
43	-0.00	-41.00	13.86	0.00	41.00	-13.86	0.000%
44	-6.99	-41.00	12.10	6.99	41.00	-12.10	0.000%
45	-9.84	-41.00	9.84	9.84	41.00	-9.84	0.000%
46	-12.37	-41.00	7.14	12.37	41.00	-7.14	0.000%
47	-13.97	-41.00	0.00	13.97	41.00	0.00	0.000%
48	-12.01	-41.00	-6.93	12.01	41.00	6.93	0.000%
49	-9.84	-41.00	-9.84	9.84	41.00	9.84	0.000%
50	-6.99	-41.00	-12.10	6.99	41.00	12.10	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	0.00000001
3	Yes	4	0.00000001	0.00000001
4	Yes	4	0.00000001	0.00000001
5	Yes	4	0.00000001	0.00000001
6	Yes	4	0.00000001	0.00000001

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
190.00	20' x 3" Dia Omni	40	6.698	0.3856	0.0143	86592
178.00	6 Arm Halo Mount	40	6.535	0.3819	0.0134	86592
170.00	LPA-80080/6CF	40	5.886	0.3671	0.0110	43296
160.00	(2) 7770.00	40	5.101	0.3471	0.0095	22290
150.00	APX16DWV-16DWV-S-E-ACU	40	4.368	0.3240	0.0083	18756

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	180 - 160	19.327	24	1.0903	0.0365
T2	160 - 140	14.810	24	0.9882	0.0243
T3	140 - 120	10.803	24	0.8491	0.0171
T4	120 - 100	7.548	24	0.6491	0.0136
T5	100 - 80	5.051	24	0.4946	0.0102
T6	80 - 60	3.138	24	0.3765	0.0074
T7	60 - 40	1.720	24	0.2565	0.0048
T8	40 - 20	0.776	24	0.1640	0.0031
T9	20 - 0	0.212	24	0.0718	0.0014

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
190.00	20' x 3" Dia Omni	24	19.327	1.0903	0.0365	33739
178.00	6 Arm Halo Mount	24	18.866	1.0805	0.0343	33739
170.00	LPA-80080/6CF	24	17.033	1.0411	0.0282	16869
160.00	(2) 7770.00	24	14.810	0.9882	0.0243	8659
150.00	APX16DWV-16DWV-S-E-ACU	24	12.722	0.9271	0.0212	7093

Bolt Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T9	20 - 0	Pirod 105220	20.03	10.02	25.2 K=1.00	27.723	11.9282	-275.02	330.69	0.832 ✔

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	F_a ksi	A in^2	Actual V K	Allow. V_a K	Stress Ratio
T2	160 - 140	0.5	1.48	121.0	10.133	0.1963	0.68	2.23	0.307 ✔
T3	140 - 120	0.5	1.48	121.0	10.133	0.1963	0.20	2.23	0.091 ✔
T4	120 - 100	0.5	1.47	120.0	10.279	0.1963	0.16	2.26	0.072 ✔
T5	100 - 80	0.5	1.46	119.0	10.423	0.1963	0.18	2.29	0.077 ✔
T6	80 - 60	0.5	1.46	119.0	10.423	0.1963	0.25	2.29	0.108 ✔
T7	60 - 40	0.625	1.45	94.4	13.671	0.3068	0.23	4.69	0.049 ✔
T8	40 - 20	0.625	1.45	94.4	13.671	0.3068	0.88	4.69	0.187 ✔
T9	20 - 0	0.625	1.43	93.6	13.766	0.3068	1.48	4.73	0.312 ✔

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	180 - 160	3/4	4.65	2.25	129.8 K=0.90	8.865	0.4418	-2.64	3.92	0.675 ✔
T2	160 - 140	L2 1/2x2 1/2x3/16	11.42	5.00	121.3 K=1.00	10.097	0.9020	-6.55	9.11	0.719 ✔
T3	140 - 120	L2 1/2x2 1/2x3/16	12.50	5.65	136.9 K=1.00	7.965	0.9020	-6.14	7.18	0.855 ✔
T4	120 - 100	L2 1/2x2 1/2x3/16	13.80	6.35	153.9 K=1.00	6.306	0.9020	-5.93	5.69	1.042 ✔
T5	100 - 80	L3x3x3/16	15.24	7.10	143.0 K=1.00	7.302	1.0900	-6.03	7.96	0.758 ✔
T6	80 - 60	L3x3x3/16	16.80	7.90	159.1 K=1.00	5.898	1.0900	-6.21	6.43	0.966 ✔
T7	60 - 40	L3x3x5/16	18.45	8.70	177.2 K=1.00	4.756	1.7800	-6.49	8.47	0.767 ✔
T8	40 - 20	L3x3x5/16	19.30	9.14	186.1 K=1.00	4.311	1.7800	-7.00	7.67	0.912 ✔
T9	20 - 0	L3 1/2x3 1/2x5/16	21.03	10.01	174.1	4.928	2.0900	-9.07	10.30	0.880

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	F_a ksi	A in^2	Actual V K	Allow. V_a K	Stress Ratio
T2	160 - 140	0.5	1.48	121.0	10.133	0.1963	0.68	2.23	0.307
T3	140 - 120	0.5	1.48	121.0	10.133	0.1963	0.20	2.23	0.091
T4	120 - 100	0.5	1.47	120.0	10.279	0.1963	0.16	2.26	0.072
T5	100 - 80	0.5	1.46	119.0	10.423	0.1963	0.18	2.29	0.077
T6	80 - 60	0.5	1.46	119.0	10.423	0.1963	0.25	2.29	0.108
T7	60 - 40	0.625	1.45	94.4	13.671	0.3068	0.23	4.69	0.049
T8	40 - 20	0.625	1.45	94.4	13.671	0.3068	0.88	4.69	0.187
T9	20 - 0	0.625	1.43	93.6	13.766	0.3068	1.48	4.73	0.312

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	180 - 160	3/4	4.65	2.25	144.2	30.000	0.4418	2.60	13.25	0.196
T2	160 - 140	L2 1/2x2 1/2x3/16	11.42	5.00	80.1	21.600	0.9020	6.39	19.48	0.328
T3	140 - 120	L2 1/2x2 1/2x3/16	11.93	5.40	86.2	21.600	0.9020	5.97	19.48	0.306
T4	120 - 100	L2 1/2x2 1/2x3/16	13.13	6.04	96.0	21.600	0.9020	5.73	19.48	0.294
T5	100 - 80	L3x3x3/16	14.50	6.75	88.6	21.600	1.0900	5.81	23.54	0.247
T6	80 - 60	L3x3x3/16	16.01	7.52	98.4	21.600	1.0900	5.94	23.54	0.252
T7	60 - 40	L3x3x5/16	18.45	8.70	116.2	21.600	1.7800	6.37	38.45	0.166
T8	40 - 20	L3x3x5/16	20.16	9.56	127.4	21.600	1.7800	7.52	38.45	0.196
T9	20 - 0	L3 1/2x3 1/2x5/16	21.92	10.45	118.6	21.600	2.0900	10.89	45.14	0.241

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
						(T1)		
						Bolt Checks	55.2	Pass
						RATING =	**78.2**	**Pass**

Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.0 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 18$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 3 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 9$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.128 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 35$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 9$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.128 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 35$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =

$$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.785 \cdot in^2$$

Pad Top Reinforcement Bar Area =

$$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.999 \cdot in^2$$

Pad Bottom Reinforcement Bar Area =

$$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.999 \cdot in^2$$

Coefficient of Lateral Soil Pressure =

$$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$$

Load Factor =

$$LF := \begin{cases} 1.333 & \text{if } H_t \le 700 \cdot ft \\ 1.7 & \text{if } H_t \ge 1200 \cdot ft \\ 1.333 + \left(\frac{H_t - 700ft}{1200ft - 700ft} \right) \cdot 0.4 & \text{otherwise} \end{cases} = 1.333$$

Bearing Pressure Caused by Footing:

Total Load = $Load_{tot} := WT_c + WT_{s1} + WT_t = 733 \cdot kip$

Area of the Mat = $A_{mat} := W_f^{\,2} = 812.25$

Section Modulus of Mat = $S := \frac{W_f^{\,3}}{6} = 3858.19 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{Load_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 2.12 \cdot ksf$

$Max\_Pressure\_Check := if\left(P_{max} < q_s, "Okay", "No Good"\right)$

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \frac{Load_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.315 \cdot ksf$

$Min\_Pressure\_Check := if\left[\left(P_{min} \geq 0\right) \cdot \left(P_{min} < q_s\right), "Okay", "No Good"\right]$

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 8.272$

Distance to Kern = $X_k := \frac{W_f}{6} = 4.75$

Since Resultant Force is Not in Kern, Area to which Pressure is Applied Must be Reduced.

Eccentricity = $e := \frac{M_{ot}}{Load_{tot}} = 6.407$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot Load_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 2.186 \cdot ksf$

$q_{adj} := if\left(P_{min} < 0, P_a, P_{max}\right) = 2.186 \cdot ksf$

$Pressure\_Check := if\left(q_{adj} < q_s, "Okay", "No Good"\right)$

Pressure_Check = "Okay"

Concrete Bearing Capacity:

Strength Reduction Factor = $\Phi_c := 0.65$ (ACI-2008 9.3.2.2)

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^{\,2}}{4} = 5.468 \times 10^3 \cdot kips$ (ACI-2008 10.14)

$Bearing\_Check := if\left(P_b > LF \cdot C_t, "Okay", "No Good"\right)$

Bearing_Check = "Okay"

Required Shear Strength = $V_{req} := LF \cdot V_u = 1.2 \times 10^3 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 1621.5 \cdot kip$ (ACI-2008 11.11.2.1)

$Punching\_Shear\_Check := if(V_{req} < V_{Avail}, "Okay", "No Good")$

Punching_Shear_Check = "Okay"

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor = $\phi_m := .90$ (ACI-2008 9.3.2.1)

$$M_{nT} := LF \cdot \left[U_t \cdot \left(W_t \cdot \sin(60 \cdot deg) - \frac{d_p}{2} \right) + S_t \cdot (D_f + L_{pag}) \right] - WT_t \cdot X_{off} = 4406 \cdot ft \cdot k$$

$$M_{nS} := -1 \cdot \left[\frac{1}{2} \cdot \left(\frac{W_f}{2} + \frac{W_t}{3} \cdot \cos(30 \cdot deg) - \frac{d_p}{2} \right)^2 \cdot W_t \cdot \left[\gamma_s \cdot (T_f - T_f) \right] \right]$$

$$M_{nC} := -1 \cdot \left[\frac{1}{2} \cdot \left(\frac{W_f}{2} + \frac{W_t}{3} \cdot \cos(30 \cdot deg) - \frac{d_p}{2} \right)^2 \cdot W_t \cdot \left(\gamma_c \cdot T_f \right) \right]$$

Design Moment = $M_n := \frac{M_{nT} + M_{nS} + M_{nC}}{\phi_m} = 3.489 \times 10^3 \cdot kips \cdot ft$

$$\beta := \begin{cases} 0.85 & \text{if } 2500 \cdot psi \le f_c \le 4000 \cdot psi \\ 0.65 & \text{if } f_c > 8000 \cdot psi \\ \left[0.85 - \left[\frac{\left(\frac{f_c}{psi} - 4000 \right)}{1000} \right] \cdot 0.5 \right] & \text{otherwise} \end{cases} = 0.85$$

(ACI-200810.2.7.3)

$b_{eff} := W_t \cdot \cos(30 \cdot deg) + d_p = 267.846 \cdot in$

$d := T_f - Cvr_{pad} - d_{bbot} = 28.872 \cdot in$

$A_s := \frac{M_n}{(f_y \cdot d)} = 24.166 \cdot in^2$

$a := \frac{A_s \cdot f_y}{\beta \cdot f_c \cdot b_{eff}} = 1.82 \cdot in$

$A_s := \frac{M_n}{f_y \cdot \left(d - \frac{a}{2} \right)} = 24.952 \cdot in^2$

$\rho := \frac{A_s}{b_{eff} \, d} = 0.00323$

Steel Reinforcement in Pier:

Area of Pier =

$$A_p := \frac{\pi \cdot d_p^2}{4} = 2827.43 \cdot in^2$$

$$A_{smin} := 0.01 \cdot 0.05 \cdot A_p = 1.41 \cdot in^2 \qquad \text{(ACI-2008 10.8.4 \& 10.9.1)}$$

$$A_{sprov} := NB_{pier} \cdot A_{bpier} = 14.14 \cdot in^2$$

$$Steel\_Area\_Check := if\left(A_{sprov} > A_{smin}, "Okay", "No Good"\right)$$

Steel_Area_Check = "Okay"

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 9.472 \cdot in$$

Diameter of Reinforcement Cage =

$$Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 54 \cdot in$$

Maximum Moment in Pier =

$$M_p := \left[S_t \cdot \left(L_p + \frac{A_{BP}}{2}\right)\right] \cdot LF = 2855.3 \cdot in \cdot kips$$

Pier Check evaluated from outside program and results are listed below;

$$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) := \left(d_p \cdot 12 \;\; NB_{pier} \;\; BS_{pier} \;\; \frac{C_t \cdot 1.333}{kips} \;\; \frac{M_p}{in \cdot kips}\right)$$

$$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) = (60 \;\; 18 \;\; 8 \;\; 371.9 \;\; 2855.3)$$

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) := (0 \;\; 0 \;\; 0 \;\; 0)$$

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) := \phi P'_n\left(D, N, n, P_u, M_{xu}\right)^T$$

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) = (3992.2 \;\; 30650.2 \;\; -28.7 \;\; 0)$$

$$Axial\_Load\_Check := if\left(\phi P_n \geq P_u, "Okay", "No Good"\right)$$

Axial_Load_Check = "Okay"

$$Bending\_Check := if\left(\phi M_{xn} \geq M_{xu}, "Okay", "No Good"\right)$$

Bending_Check = "Okay"

Tie Size and Spacing in Column:

Minimum Tie Size = $Tie_{min} := if(BS_{pier} \le 10, 3, 4) = 3$

Used #3 Ties

Seismic Factor = $z := if(Z \le 2, 1, 0.5) = 1$ (ACI-2008 21.10.5)

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 16 \cdot in$

$s_{lim2} := \frac{48 \cdot d_{Tie}}{8} \cdot z = 18 \cdot in$

$s_{lim3} := D_f \cdot z = 72 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing = $s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) = 16 \cdot in$

Number of Ties Required = $n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 3.438$

Check Anchor Steel Embedment:

Depth Available = $D_{ab} := L_{st} - A_{BP} = 5 \cdot ft$

Length of Anchor Bolt = $L_{anchor} := \frac{(0.11 \cdot f_{ya}) \cdot in}{\sqrt{f_c \cdot psi}} = 11.621 \cdot ft$

$Depth\_Check := if(D_{ab} \ge L_{anchor}, "Okay", "No Good")$

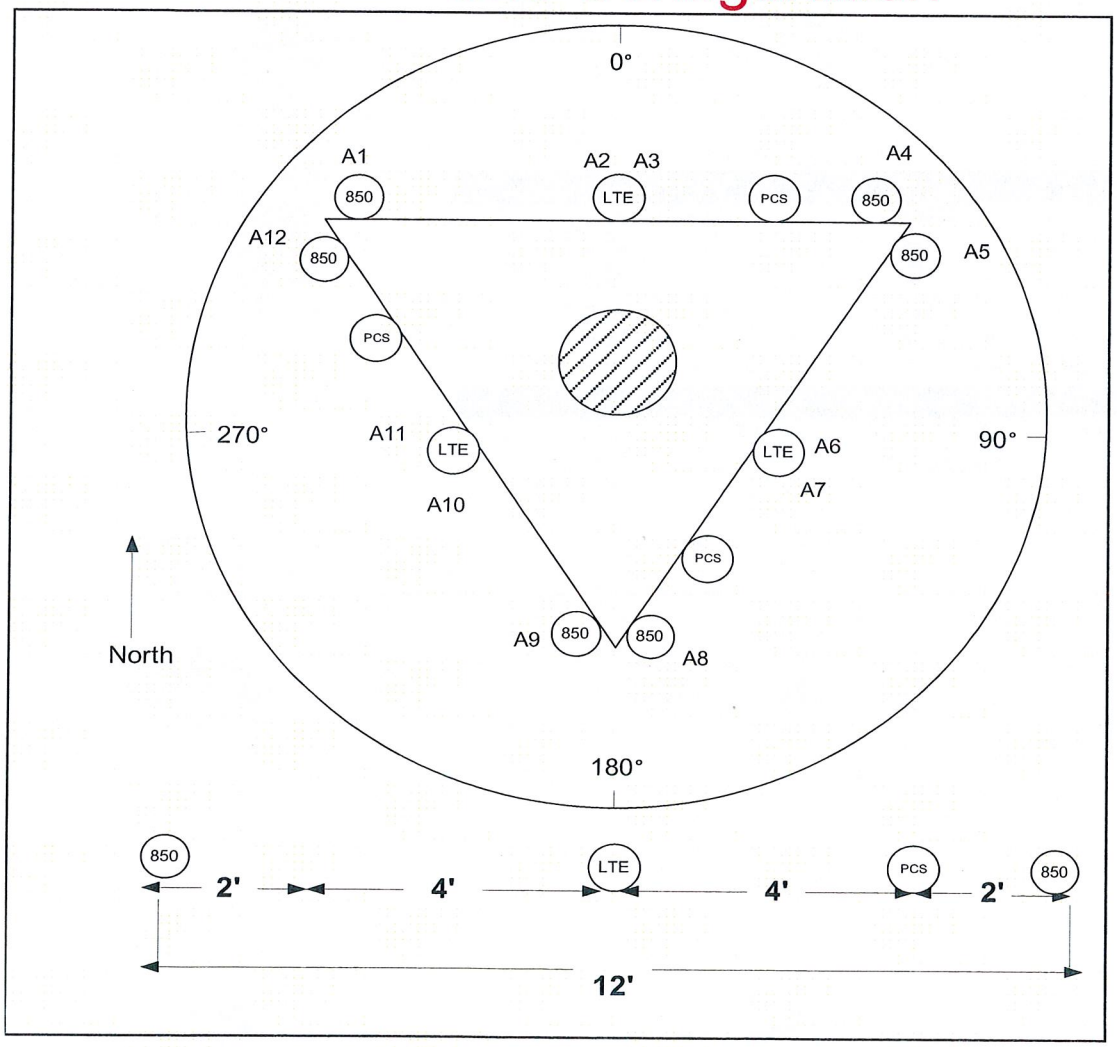
Depth_Check = "No Good"

Note: Anchor plate is provided

ALPHA				BETA				GAMMA			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1	800	Tx1/Rx0	RED	A7	800	Tx2/Rx0	BLUE	A13	800	Tx3/Rx0	GREEN
A2	1900	Tx1/Rx0	RED/ WHITE	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/ ORANGE	A9	700	Tx2/Rx0	BLUE/ ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE
A4	700	Tx4/Rx1	RED/RED/ ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A5	1900	Tx4/Rx1	RED/RED/ WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By: Mark Brauer	Steve Weatherbee	MB	9/1/2011

Site Configuration



Vertically Polarized, Log Periodic 80° / 14 dBd

LPA-80080/6CF ___

When ordering replace "___" with connector type.

Mechanical specifications

Length	1800 mm	70.9 in
Width	140 mm	5.5 in
Depth	335 mm	13.2 in
Depth with z-bracket	375 mm	14.8 in
[4] Weight	9.5 kg	21.0 lbs
Wind Area		
Fore/Aft	0.25 m^2	2.7 ft^2
Side	0.60 m^2	6.5 ft^2
Rated Wind Velocity (Safety factor 2.0)	>295 km/hr	>183 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	415 N	93.3 lbs
Side	870 N	195.6 lbs

Antenna consisting of aluminum alloy with brass feedlines covered by a UV safe fiberglass radome.

Mounting and Downtilting

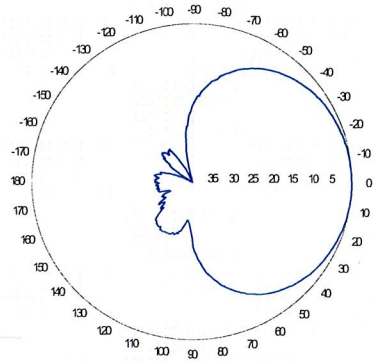
Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in). If the lock-down brace is used, the maximum diameter is Ø88.9 mm (3.5 in)

Mounting Bracket & Downtilt Bracket Kit #21699999

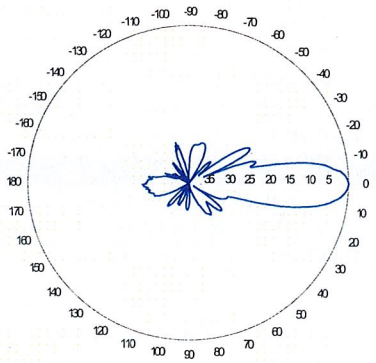
Electrical specifications

Frequency Range	806-960 MHz
Impedance	50Ω
[3] Connector(s)	NE or E-DIN 1 port / center
[1] VSWR	≤ 1.4:1
Polarization	Vertical
[1] Gain	14 dBd
[2] Power Rating	500 W
[1] Half Power Angle	
H-Plane	80°
E-Plane	10°
[1] Electrical Downtilt	0°
[1] Null Fill	10%
Lightning Protection	Direct Ground

Radiation pattern[1]



Horizontal

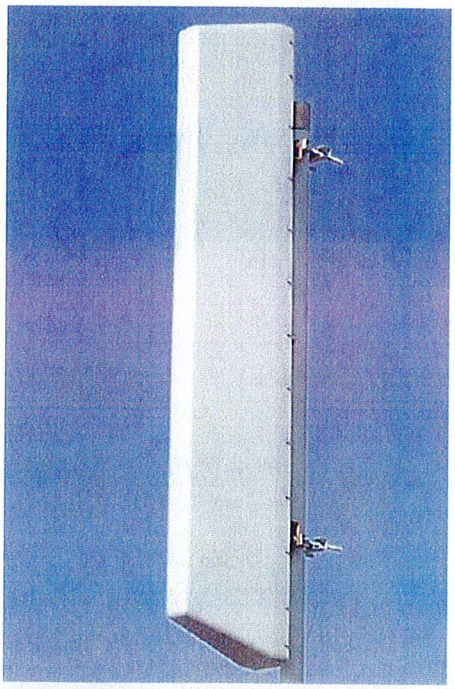


Vertical

Featuring upper side lobe suppression.

Radiation patterns for all antennas are measured with the antenna mounted on a fiberglass pole.

Mounting on a metal pole will typically improve the Front-to-Back ratio.



Amphenol Antel's Exclusive 3T (True Transmission Line Technology) Antenna Design:

- True log-periodic design allows for superior front-to-side characteristics to minimize sector overlap.
- Unique feedline design eliminates the need for conventional solder joints in the signal path.
- A non-collinear system with access to every radiating element for broad band-width and superior performance.
- Air as insulation for virtually no internal signal loss.

This Amphenol Antel antenna is under a five-year limited warranty for repair or replacement.

Antenna available with center-fed connector only.

1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) The antenna weight listed above does not include the bracket weight.

Improvements to mechanical and/or electrical performance of the antenna may be made without notice.

CF Denotes a Center-Fed Connector.

806-960 MHz

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Amphenol Antel, Inc. The Antenna Technology Company

Revision Date: 7/5/07