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Also admitted in Massachusetts

November 21, 2013

Melanie A. Bachman
Acting Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Antenna Swap**
2 Allen Raymond Lane (formerly Sunny Lane), Westport, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the top of the existing 130-foot tower at the above-referenced address. The tower and underlying property are owned Cellco. The Council approved Cellco's construction and use of this tower in Docket No. 188 in 1998. Cellco now intends to replace six (6) of its existing antennas with three (3) model BXA-171085-8BCF PCS antennas and three (3) model BXA-171085-8BF AWS antennas, all at the same level on the tower. Cellco also intends to install six (6) coaxial cable diplexers and six (6) additional cables, attached to the outside of the tower. Included in Attachment 1 are specifications for Cellco's replacement antennas and cable diplexers.

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 James Marpe, Westport's First Selectman.

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 and cable diplexers will be located at the same 130-foot level on the tower.

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

3. The proposed modifications will not increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.

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

5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.

6. The tower and its foundation can support Cellco's proposed modifications. (*See* Structural Analysis Report included in Attachment 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:
James Marpe, Westport First Selectman
Sandy M. Carter

ATTACHMENT 1

BXA-171085-8BF-EDIN-X

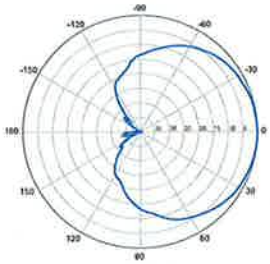
Replace "X" with desired electrical downtilt

X-Pol | FET Panel | 85° | 16.4 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	7°	7°	7°
Gain	13.5 dBd / 15.6 dBi	13.9 dBd / 16.0 dBi	14.3 dBd / 16.4 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	> 25 dB		
IM3 (2x20W 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	1225 x 154 x 105 mm	48.2 x 6.1 x 4.1 in	
Depth with t-brackets	133 mm	5.2 in	
Weight without mounting brackets	4.2 kg	9.2 lbs	
Survival wind speed	>201 km/hr	>125 mph	
Wind area	Front: 0.19 m² Side: 0.14 m²	Front: 2.0 ft² Side: 1.5 ft²	
Wind load @ 161 km/hr (100 mph)	Front: 281 N Side: 223 N	Front: 63 lbf Side: 50 lbf	

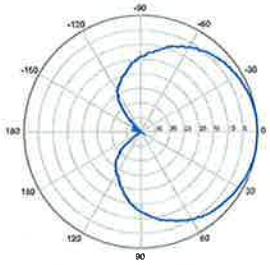
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171085-8BF-EDIN-X-FP		

BXA-171085-8BF-EDIN-X



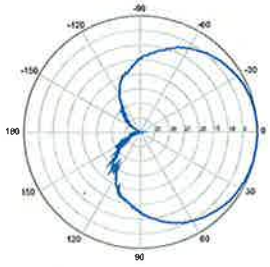
Horizontal | 1710-1880 MHz

BXA-171085-8BF-EDIN-X



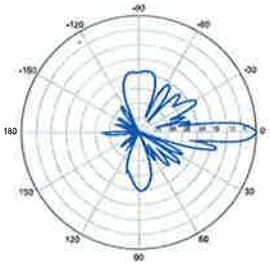
Horizontal | 1850-1990 MHz

BXA-171085-8BF-EDIN-X



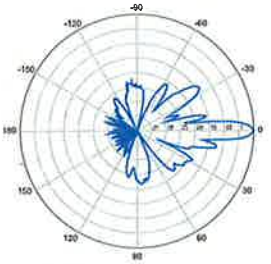
Horizontal | 1920-2170 MHz

BXA-171085-8BF-EDIN-0



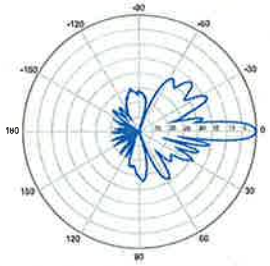
0° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-0

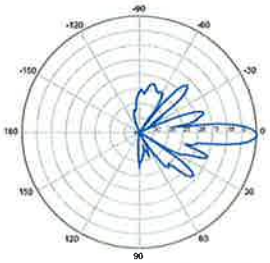


0° | Vertical | 1920-2170 MHz

BXA-171085-8BF-EDIN-X

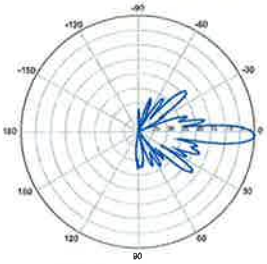
X-Pol | FET Panel | 85° | 16.4 dBi

BXA-171085-8BF-EDIN-2



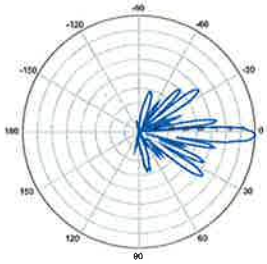
2° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-2



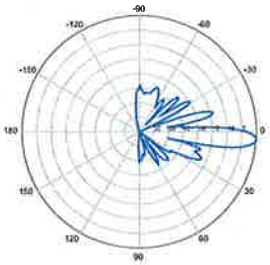
2° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-2



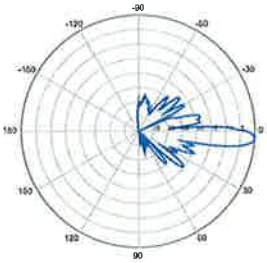
2° | Vertical | 1920-2170 MHz

BXA-171085-8BF-EDIN-4



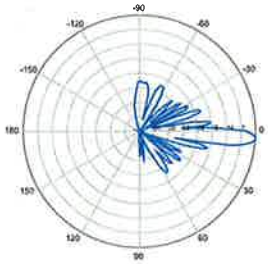
4° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-4



4° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-4



4° | Vertical | 1920-2170 MHz

Product Data Sheet FD9R6004/2C-3L

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

Product Description

The ShareLite FD9R6004 Series of diplexers are designed to enable feeder sharing between systems in the 698-960 MHz range and in the 1710-2200 MHz range. The diplexer is equipped with in-line connector placement so it can be installed in the BTS cabinet or at the tower top. This is especially valuable in crowded sites or when the feeders are not easily accessible. Due to its wideband design, the FD9R6004 Series can accommodate many combining solutions between 698-960 MHz and 1710-2200 MHz systems such as LTE 700 MHz, Cellular 800 MHz with PCS, GSM900 with GSM1800, or GSM900 with UMTS. This diplexer features a highly selective filter. It provides a high level of isolation between ports, while keeping the insertion loss on both paths at an extremely low level. The FD9R6004 diplexers are available with various DC pass options, helpful in configurations with or without the Tower Mount Amplifiers installed.

Features/Benefits

- **LTE ready design**
- **Extremely Low Insertion Loss**
- **High level of Rejection between bands – Protection against interferences**
- **Extremely High Power Handling Capability**
- **Integrated DC block/bypass versions available**
- **Very compact & small size design – Easy installation and reduced tower load**
- **In-line long-neck connectors for easy connection & waterproofing**
- **Exceptional reliability & environmental protection (IP 67)**
- **Equipped with 1 * Breathable Vent – Prevent any humidity inside the product**
- **Mounting hardware for Wall and Pole mount provided (P/N SEM2-1A)**
- **Grounding already provided through the mounting bracket**
- **Kit available for easy dual mount**

Technical Specifications

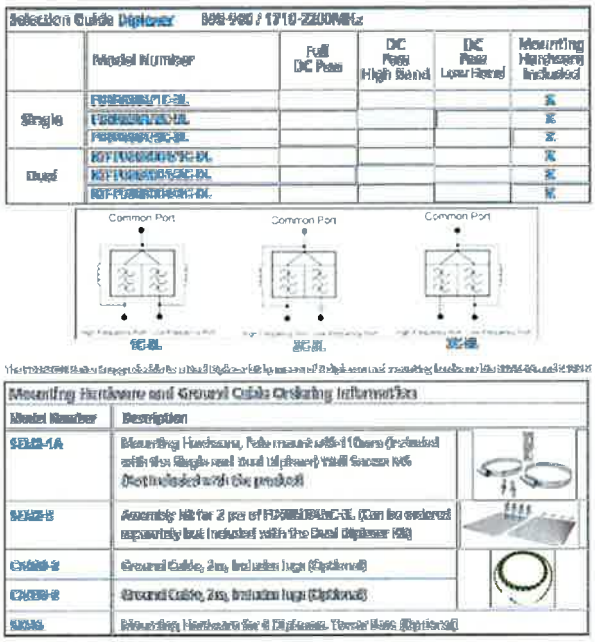
Product Type	Diplexer/Cross Band Coupler
Application	LTE700, GSM900, UMTS, GSM1800, Cellular 800, PCS
Frequency Range 1, MHz	698-960
Frequency Range 2, MHz	1710-2200
Configuration	Sharelite Single diplexer, outdoor, DC pass in the 1710-2170MHz path, with mounting hardware SEM2-1A
Mounting	Wall Mounting: With 4 screws (maximum 6mm diameter); Pole Mounting: With included clamp set 40-110mm (1.57-4.33)
Return Loss All Ports Min/Typ, dB	19/23
Power Handling Continuous, Max, W	1250 at common port; 750 in low frequency path & 500 in high frequency path
Power Handling Peak, Max, W	15000 in low frequency path & 8000 in high frequency path
Impedance, Ohms	50
Insertion Loss, Path 1, dB	0.07 typ.
Insertion Loss, Path 2, dB	0.13 typ.
Rejection Between Bands Min/Typ, dB	58/64@698-960MHz; 57/70@1710-2200MHz
IMP Level at the COM Port, Typ, dBm	-112 @ 2x43
DC Pass in Low Frequency Path	No
DC Pass in High Frequency Path	Yes
Temperature Range, °C (°F)	-40 to +60 (-40 to +140)
Environmental	ETSI 300-019-2-4 Class 4.1E
Ingress Protection	IP 67
Lightning Protection	EN/IEC61000-4-5 Level 4
Connectors	In-line long-neck 7-16-Female
Weight, kg (lb)	1.2 (2.6)
Shipping Weight, kg (lb)	3.2 (7) for 2 * single units in 1 * box, 9.8 (21.6) for 6 * units = 3 * Boxes in 1 * overwrap
Dimensions, H x W x D, mm (in)	147 x 164 x 37 (5.8 x 6.5 x 1.5)
Shipping Dimensions, H x W x D, mm (in)	254 x 406 x 82 (10 x 16 x 3.2) for 2 * Single Units in 1 * box, 280 x 406 x 241 (11 x 16 x 9.5) for 6 * units = 3 * Boxes in 1 * overwrap
Volume, L	0.43
Housing	Aluminum

Notes

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

Other Documentation

FD9R6004/2C-3L Installation Instructions: Wideband_Diplexer_Installation_Rev5.pdf



Selection Guide Diplexer 698-960 / 1710-2200MHz

	Model Number	Full DC Pass	DC Pass High Band	DC Pass Low Band	Mounting Hardware Included
Single	[illegible]				X
	[illegible]				X
	[illegible]				X
Dual	[illegible]				X
	[illegible]				X
	[illegible]				X

1C-3L 2C-3L 3C-3L

[illegible]

Mounting Hardware and Ground Cable Ordering Information

Model Number	Description	
[illegible]	Mounting Hardware, Pole mount ø65-110mm (Included with the Single and Dual Diplexer) Wall Screws M6 (Not included with the product)	
[illegible]	Assembly kit for 2 pcs of [illegible] (Can be ordered separately but included with the Dual Diplexer Kit)	
[illegible]	Ground Cable, 2m, Inclusive lugs (Optional)	
[illegible]	Ground Cable, 2m, Inclusive lugs (Optional)	
[illegible]	Mounting Hardware for 4 Diplexers. Tower Mast (Optional)	

ATTACHMENT 2

	General	Power	Density					
Site Name: Cranbury (Westport)								
Tower Height: Verizon @ 130ft								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*T-Mobile LTE	2	24	110	0.0014	2100	1.0000	0.14%	
*T-Mobile GSM/UMTS	2	12	110	0.0007	1950	1.0000	0.07%	
*T-Mobile UMTS	2	12	110	0.0007	2100	1.0000	0.07%	
*Clearwire	2	153	120	0.0076	2496	1.0000	0.76%	
*Clearwire	1	211	120	0.0053	11 GHz	1.0000	0.53%	
*Nextel	12	100	144	0.0208	851	0.5673	3.67%	
*Sprint CDMA/LTE	2	778	120	0.0389	1900	1.0000	3.89%	
*Sprint CDMA/LTE	1	438	120	0.0109	850	0.5667	1.93%	
*AT&T GSM	3	427	102	0.0443	1900	1.0000	4.43%	
*AT&T GSM	7	296	102	0.0716	880	0.5867	12.21%	
*AT&T UMTS	1	500	102	0.0173	880	0.5867	2.95%	
*AT&T UMTS	1	500	102	0.0173	1900	1.0000	1.73%	
*AT&T LTE	1	500	102	0.0173	740	0.4933	3.50%	
Verizon PCS	**15**	**236**	**130**	**0.0753**	**1970**	**1.0000**	**7.53%**	
Verizon Cellular	**9**	**399**	**130**	**0.0764**	**869**	**0.5793**	**13.19%**	
Verizon AWS	**1**	**1750**	**130**	**0.0372**	**2145**	**1.0000**	**3.72%**	
Verizon 700	**1**	**641**	**130**	**0.0136**	**698**	**0.4653**	**2.93%**	
								63.24%
* Source: Siting Council								

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

130-ft Existing EEI Monopole

Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Cranbury

2 Sunny Lane
Westport, CT

Centek Project No. 13001.051

~~Date: September 23, 2013~~
Rev 1: September 26, 2013

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

Table of Contents

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 on the existing monopole (tower), owned and operated by Verizon Wireless, located in Westport, CT.

The host tower is a 130-ft tall, three-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI job no; 10847-E01), signed and sealed June 6, 2002. The manufacturer's drawings and calculations were unavailable for use in this report. The tower geometry, structure member sizes and foundation system information were obtained from a previous structural analysis report prepared by Centek Engineering, Inc., job no; 12097, marked Revision #1, dated September 13, 2012. Antenna and appurtenance information were obtained from the aforementioned structural report and an RF data sheet provided by Verizon Wireless.

The tower consists of three (3) tapered steel vertical sections conforming to ASTM A572-65. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 28.18-in at the top and 62.0-in at the base.

Verizon proposes the removal of six (6) existing panel antennas and the installation of six (6) panel antennas mounted to the existing Verizon antenna platform. 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:

- NEXTEL (Existing):
  Antennas: Three (3) 12-ft Omni-directional whip antennas mounted on the existing Verizon Wireless low profile platform with an elevation of 130-ft above the existing tower base plate.
  Coax Cables: Three (3) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- SPRINT/CLEARWIRE (Existing):
  Antennas: Three (3) Kathrein 840-10054 panel antennas w/ Samsung Remote Radio Heads U-RAS , one (1) Andrew VHLP800-11-DW1 microwave dish, six (6) RFS APXVSPP18-C-A20 panel antennas, three (3) ALU 1900 MHz RRH's and three (3) ALU 800 MHz RRH's mounted on an existing low profile platform with a RAD center elevation of 120-ft above the existing tower base plate.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables, two (2) 2" ∅ flex conduits (with three (3) fiber and three (3) dc control cables running in each one), one (1) 1/2" ∅ coax cable and three (3) 1-1/4" ∅ Hybriflex cables running on the interior of the existing tower.

- T-MOBILE (Existing/Reserved):
  Antennas: Six (6) RR90-17-02DP panel antennas, six (6) Ericsson AIR21-B2A/B4P panel antennas, three (3) RFS ATMP1412D-1A20 TMA's and one (1) GPS mounted on an existing low profile platform with a RAD center elevation of 110-ft above the existing tower base plate.
  Coax Cables: Six (6) 1-5/8" ∅, six (6) 7/8" ∅, one (1) 1/2" ∅ coax cables and one (1) 1-5/8" ∅ hybrid cable running on the inside of the existing tower.
- AT&T (Existing):
  Antennas: Three (3) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted to one (1) universal ring mount with a RAD center elevation of 104-ft above grade level.
  Coax Cables: One (1) fiber cable and two (2) dc control cables running within the interior of the existing tower.
- AT&T (Existing):
  Antennas: Six (6) Powerwave 7770 panel antennas, three (3) Powerwave P65-16-XLH-RR panel antennas, twelve (12) Powerwave LGP21401 TMA's and one (1) GPS mounted on an existing low profile platform with a RAD center elevation of 100-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables, one (1) 1/2" ∅ coax cable and three (3) 3/8 ∅ RET cables running on the inside of the existing tower.
- VACANT (Existing):
  Antennas: One (1) low profile platform with an elevation of 89-ft above the existing tower base plate.
- UNKNOWN (Existing):
  GPS Antennas: Five (5) GPS antennas and mounted on five GPS stand-off mounts with RAD center elevations of 70-ft and 72-ft above grade level.
  Coax Cables: Five (5) 1/2" ∅ coax cables running within the interior of the existing tower.
- AT&T (Existing):
  LTE GPS Antenna: One (1) LTE GPS antenna and mounted on one (1) SitePro1 2-ft GPS stand-off mount (P/N #CHGPS) with a RAD center elevation of 60-ft above grade level.
  Coax Cables: One (1) 1/2" ∅ coax cable running within the interior of the existing tower.
- VERIZON (Existing to Remain):
  Antennas: Two (2) Antel LPA-80080/6CF, four (4) Decibel DB846F65ZAXY and three (3) Powerwave P65-16-XL-2 panel antennas mounted on an existing low profile platform with a RAD center elevation of 130-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running within the interior of the existing tower.
- VERIZON (Existing to Remove):
  Antennas: Six (6) Antel LPA-185080/8CF panel antennas mounted on an existing low profile platform with a RAD center elevation of 130-ft above the existing tower base plate.

- **VERIZON (PROPOSED):**
  Antennas: Six (6) Antel BXA171085-8BF panel antennas and six (6) RFS FD9R6004/2C-3L Diplexer's mounted on an existing low profile platform with a RAD center elevation of 130-ft above the existing tower base plate.
  Coax Cables: Six (6) 1-5/8" Ø coax cables running on the exterior of the existing tower

Primary Assumptions Used in the Analysis

- The tower structure's theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents or reinforcement drawings.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All existing coax cables to be installed as indicated in this report.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled tnxTower. 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 the controlling basic wind speed (fastest mile) with no ice and a 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).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix K of the CSBC[1] and the wind speed data available in the TIA/EIA-222-F-96 Standard. The higher of the two wind speeds is utilized in preparation on the tower analysis.

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 on the tower structure and its components.

Basic Wind Speed:	Fairfield; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Westport; v = 110 mph (3 second gust) equivalent to v = 90 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	Appendix K wind speed controls.	
Load Cases:	Load Case 1; 90 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 78 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 78 mph wind speed velocity represents 75% of the wind pressure generated by the 90 mph wind speed.	*[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*

[1] The 2005 Connecticut State Building Code as amended by the 2009 CT State Supplement. (CSBC)

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software tnxTower. Allowable stresses were determined based on Table 5 of the TIA/EIA code with a 1/3 increase per Section 3.1.1.1 of the same code.

- Calculated stresses were found to be within allowable limits. In Load Case 1, per tnxTower "Section Capacity Table", this tower was found to be at **62.3%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L3)	0.00'-42.01'	62.3%	**PASS**

Foundation and Anchors

The existing foundation consists of an 8.0-ft ∅ x 2.5-ft long reinforced concrete pier on a 29.5-ft square x 3.0-ft thick reinforce concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned structural report prepared by Centek. The base of the tower is connected to the foundation by means of (20) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 6-ft into the concrete foundation structure.

Review of the foundation and anchor design consisted of verification of applied loads obtained from the tower design calculations and code checks of allowable stresses:

- The tower base reactions developed from the governing Load Case 1 were used in the verification of the foundation and its anchors:

Location	Vector	Proposed Reactions
Base	Shear	36 kips
	Compression	46 kips
	Moment	3448 kip-ft

- 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 Pad and Pier	OTM[2]	2.0	2.66	**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	Combined Axial & Bending	61.0%	**PASS**
Base Plate	Bending	79.6%	**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

STATE OF CONNECTICUT
CARLO F. CENTORE
No. 15624
LICENSED
PROFESSIONAL ENGINEER

Prepared by:

Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

All engineering services are performed on the basis that the information used is current and correct. This information may consist of, but is not necessarily limited to:

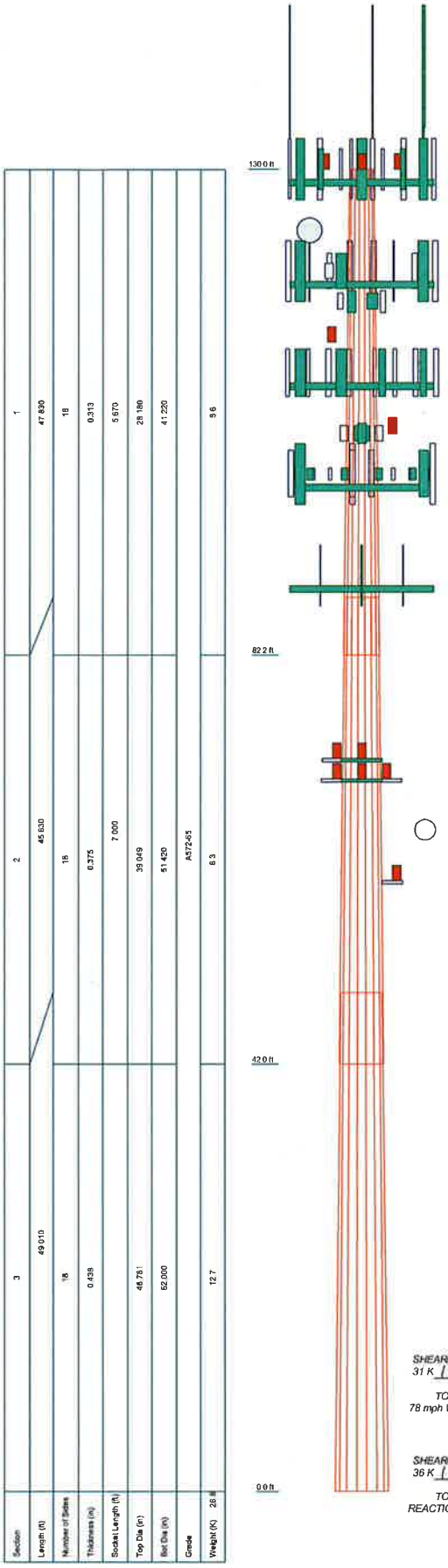
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of CENTEK engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provide to CENTEK engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the "as new" condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. CENTEK engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

General Description of Structural Analysis Program

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

tnxTower Features:

- tnxTower 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.
- tnxTower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.



Section	1	2	3
Length (ft)	47.830	45.630	49.013
Number of Sides	18	18	18
Thickness (in)	0.313	0.375	0.438
Socket Length (ft)	5.670	7.000	
Top Dia (in)	28.180	39.049	48.761
Bot Dia (in)	41.220	51.420	62.000
Grade		A572-65	
Weight (K)	9.6	8.3	12.7

AXIAL 57 K
SHEAR 31 K
MOMENT 2954 kip-ft
TORQUE 3 kip-ft
78 mph WIND - 0.500 in ICE

AXIAL 46 K
SHEAR 36 K
MOMENT 3448 kip-ft
TORQUE 3 kip-ft
REACTIONS - 90 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
12' x 3" Dia Omni (Nextel - Existing)	140	A2R21 (T-Mobile - Reserved)	110
12' x 3" Dia Omni (Nextel - Existing)	140	A2R21 (T-Mobile - Reserved)	110
12' x 3" Dia Omni (Nextel - Existing)	140	A2R21 (T-Mobile - Reserved)	110
8'x2 1/2" Pipe Mount (Nextel - Existing)	134	A2R21 (T-Mobile - Reserved)	110
6'x2 1/2" Pipe Mount (Nextel - Existing)	134	A2R21 (T-Mobile - Reserved)	110
8'x2 1/2" Pipe Mount (Nextel - Existing)	134	RR90-17-02DP (T-Mobile - Existing)	110
LPA-80080-6CF (Verizon - Existing)	130	RR90-17-02DP (T-Mobile - Existing)	110
P65-16-XL 2 (Verizon - Existing)	130	RR90-17-02DP (T-Mobile - Existing)	110
LPA-80080-6CF (Verizon - Existing)	130	RR90-17-02DP (T-Mobile - Existing)	110
DB846F65ZAXY (Verizon - Existing)	130	RR90-17-02DP (T-Mobile - Existing)	110
P65-16-XL 2 (Verizon - Existing)	130	ATMAP1412D-1A20 (T-Mobile - Existing)	110
DB846F65ZAXY (Verizon - Existing)	130	RR90-17-02DP (T-Mobile - Existing)	110
DB846F65ZAXY (Verizon - Existing)	130	ATMAP1412D-1A20 (T-Mobile - Existing)	110
P65-16-XL 2 (Verizon - Existing)	130	ATMAP1412D-1A20 (T-Mobile - Existing)	110
DB846F65ZAXY (Verizon - Existing)	130	EEI Low Profile Platform (T-Mobile - Existing)	109
(2) FD6R6004/2C-3L Diplexer (Verizon - proposed)	130	GPS (AT&T - Existing)	104
(2) FD6R6004/2C-3L Diplexer (Verizon - proposed)	130	RRUS-11 (AT&T - Existing)	104
(2) FD6R6004/2C-3L Diplexer (Verizon - proposed)	130	RRUS-11 (AT&T - Existing)	104
8XA-171065-8BF (Verizon - proposed)	130	RRUS-11 (AT&T - Existing)	104
8XA-171065-8BF (Verizon - proposed)	130	DC6-48-60-18-8F Surge Arrestor (AT&T - Existing)	104
8XA-171065-8BF (Verizon - proposed)	130	Valmont Uni-Tri Bracket (AT&T - Existing)	102.5
8XA-171065-8BF (Verizon - proposed)	130	P65-16-XLH RR (AT&T - Existing)	100
8XA-171065-8BF (Verizon - proposed)	130	P65-16-XLH RR (AT&T - Existing)	100
8XA-171065-8BF (Verizon - proposed)	130	P65-16-XLH RR (AT&T - Existing)	100
EEI Low Profile Platform (Verizon - Existing)	129	7770.00 (AT&T - Existing)	100
VHLP800-11-DW1 (Clearwire - Existing)	124	7770.00 (AT&T - Existing)	100
640-10054 (Clearwire - Existing)	120	7770.00 (AT&T - Existing)	100
640-10054 (Clearwire - Existing)	120	7770.00 (AT&T - Existing)	100
640-10054 (Clearwire - Existing)	120	7770.00 (AT&T - Existing)	100
RRH (Clearwire - Existing)	120	(4) LGP21401 TMA (AT&T - Existing)	100
RRH (Clearwire - Existing)	120	7770.00 (AT&T - Existing)	100
RRH (Clearwire - Existing)	120	(4) LGP21401 TMA (AT&T - Existing)	100
6'x3" Pipe Mount (Clearwire - Existing)	120	(4) LGP21401 TMA (AT&T - Existing)	100
6'x3" Pipe Mount (Clearwire - Existing)	120	EEI Low Profile Platform (AT&T - Existing)	99
Filler Box (Clearwire - Existing)	120	(3) 6'x3" Pipe Mount (Vacant)	90
APXV9PP18-C-A20 (Sprint - Existing)	120	(3) 6'x3" Pipe Mount (Vacant)	90
APXV9PP18-C-A20 (Sprint - Existing)	120	(3) 6'x3" Pipe Mount (Vacant)	90
APXV9PP18-C-A20 (Sprint - Existing)	120	EEI Low Profile Platform (Vacant)	89
APXV9PP18-C-A20 (Sprint - Existing)	120	3' GPS Stand-off Mount	72
APXV9PP18-C-A20 (Sprint - Existing)	120	3' GPS Stand-off Mount	72
APXV9PP18-C-A20 (Sprint - Existing)	120	GPS	72
EEI Low Profile Platform (Sprint - Existing)	119	GPS	72
FD-RRH 2x50 800 (Sprint - Existing)	117	3' GPS Stand-off Mount	70
FD-RRH 4x40 1900 (Sprint - Existing)	117	Valmont B2069 3' GPS Mount	70
FD-RRH 4x40 1900 (Sprint - Existing)	117	GPS	70
Valmont Uni-Tri Bracket (Sprint - Existing)	117	GPS	70
FD-RRH 4x40 1900 (Sprint - Existing)	117	GPS	70
FD-RRH 2x50 800 (Sprint - Existing)	117	3' GPS Stand-off Mount	70
FD-RRH 2x50 800 (Sprint - Existing)	117	3' GPS Stand-off Mount (AT&T - Existing)	60
GPS (T-Mobile - Existing)	113	GPS (AT&T - Existing)	60
A2R21 (T-Mobile - Reserved)	110		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Fairfield County, Connecticut.
2. Tower designed for a 90 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 78 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. Weld together tower sections have flange connections.
6. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
7. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
8. Welds are fabricated with ER-70S-6 electrodes.
9. TOWER RATING: 62.3%

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

Job:	13001.051 - Cranbury
Project:	130-ft EEI Monopole - 2 Sunny Lane Westport, CT
Client: Verizon Wireless	Drawn by: TJL / App'd
Code: TIA/EIA-222-F	Date: 09/26/13 / Scale: NTS
Path:	Dwg No. E-1

tnxTower	Job	Page
	13001.051 - Cranbury	1 of 23
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project 130-ft EEI Monopole - 2 Sunny Lane Westport, CT	Date 13:06:36 09/26/13
	Client Verizon Wireless	Designed by TJL

Tower Input Data

There is a pole section.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

Tower is located in Fairfield County, Connecticut.
Basic wind speed of 90 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 78 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 pole 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				

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	130.000-82.170	47.830	5.670	18	28.180	41.220	0.313	1.250	A572-65 (65 ksi)
L2	82.170-42.010	45.830	7.000	18	39.049	51.420	0.375	1.500	A572-65 (65 ksi)
L3	42.010-0.000	49.010		18	48.781	62.000	0.438	1.750	A572-65

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
									(65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	28.615	27.641	2711.992	9.893	14.315	189.445	5427.553	13.823	4.410	14.111
	41.856	40.575	8578.339	14.522	20.940	409.668	17167.966	20.291	6.705	21.455
L2	41.206	46.032	8698.389	13.729	19.837	438.494	17408.223	23.020	6.213	16.567
	52.213	60.756	20000.243	18.121	26.121	765.666	40026.802	30.384	8.390	22.373
L3	51.450	67.130	19820.893	17.162	24.780	799.859	39667.867	33.572	7.815	17.864
	62.956	85.487	40932.774	21.855	31.496	1299.618	81919.408	42.752	10.142	23.182

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 130.000-82.170				1	1	1		
L2 82.170-42.010				1	1	1		
L3 42.010-0.000				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
1 5/8 (Nextel - Existing)	C	No	Inside Pole	130.000 - 3.000	3	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (Verizon - Existing)	C	No	Inside Pole	130.000 - 3.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (Sprint - Existing)	C	No	Inside Pole	120.000 - 3.000	6	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
2" dia Flex Conuit (Clearwire - Existing)	A	No	Inside Pole	120.000 - 3.000	2	No Ice	0.000	0.005
						1/2" Ice	0.000	0.005
1/2 (Clearwire - Existing)	A	No	Inside Pole	120.000 - 3.000	1	No Ice	0.000	0.000
						1/2" Ice	0.000	0.000
7/8 (T-Mobile - Existing)	C	No	Inside Pole	110.000 - 3.000	6	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1/2 (T-Mobile - Existing)	C	No	Inside Pole	110.000 - 3.000	1	No Ice	0.000	0.000
						1/2" Ice	0.000	0.000
1 5/8 (AT&T - Existing)	C	No	Inside Pole	100.000 - 3.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1/2 (AT&T - Existing)	C	No	Inside Pole	100.000 - 3.000	1	No Ice	0.000	0.000
						1/2" Ice	0.000	0.000
1/2 (GPS)	C	No	Inside Pole	72.000 - 3.000	2	No Ice	0.000	0.000
						1/2" Ice	0.000	0.000
1/2	C	No	Inside Pole	70.000 - 3.000	3	No Ice	0.000	0.000

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
(GPS)						1/2" Ice	0.000	0.000
RG6-Fiber	C	No	Inside Pole	130.000 - 3.000	1	No Ice	0.000	0.001
(AT&T - Existing)						1/2" Ice	0.000	0.001
#8 AWG Copper WIre	C	No	Inside Pole	130.000 - 3.000	2	No Ice	0.000	0.000
(AT&T - Existing)						1/2" Ice	0.000	0.000
0.3" dia RET	C	No	Inside Pole	100.000 - 0.000	3	No Ice	0.000	0.000
(AT&T - Existing)						1/2" Ice	0.000	0.000
1/2	C	No	Inside Pole	60.000 - 3.000	1	No Ice	0.000	0.000
(AT&T - Existing)						1/2" Ice	0.000	0.000
1 5/8	C	No	Inside Pole	110.000 - 3.000	6	No Ice	0.000	0.001
(T-Mobile - Existing)						1/2" Ice	0.000	0.001
1 5/8	C	No	Inside Pole	110.000 - 3.000	1	No Ice	0.000	0.001
(T-Mobile - Reserved)						1/2" Ice	0.000	0.001
HYBRIFLEX 1-1/4"	C	No	Inside Pole	120.000 - 3.000	3	No Ice	0.000	0.001
(Sprint - Proposed)						1/2" Ice	0.000	0.001
1 5/8	C	No	CaAa (Out Of Face)	130.000 - 3.000	1	No Ice	0.198	0.001
(Verizon - Proposed)						1/2" Ice	0.298	0.003
1 5/8	C	No	CaAa (Out Of Face)	130.000 - 3.000	5	No Ice	0.000	0.001
(Verizon - Proposed)						1/2" Ice	0.000	0.003

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	130.000-82.170	A	0.000	0.000	0.000	0.000	0.388
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	9.470	2.008
L2	82.170-42.010	A	0.000	0.000	0.000	0.000	0.412
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	7.952	2.313
L3	42.010-0.000	A	0.000	0.000	0.000	0.000	0.400
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	7.724	2.266

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	130.000-82.170	A	0.500	0.000	0.000	0.000	0.000	0.388
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	14.253	2.441
L2	82.170-42.010	A	0.500	0.000	0.000	0.000	0.000	0.412
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	11.968	2.677
L3	42.010-0.000	A	0.500	0.000	0.000	0.000	0.000	0.400
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	11.625	2.619

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
12' x 3" Dia Omni (Nextel - Existing)	A	From Face	3.500 -6.000 0.000	0.000	140.000	No Ice 1/2" Ice	3.600 4.833	3.600 4.833	0.035 0.061
12' x 3" Dia Omni (Nextel - Existing)	B	From Face	3.500 -6.000 0.000	0.000	140.000	No Ice 1/2" Ice	3.600 4.833	3.600 4.833	0.035 0.061
12' x 3" Dia Omni (Nextel - Existing)	C	From Face	3.500 -6.000 0.000	0.000	140.000	No Ice 1/2" Ice	3.600 4.833	3.600 4.833	0.035 0.061
8'x2 1/2" Pipe Mount (Nextel - Existing)	A	From Face	3.500 -6.000 0.000	0.000	134.000	No Ice 1/2" Ice	2.300 3.132	2.300 3.132	0.041 0.057
8'x2 1/2" Pipe Mount (Nextel - Existing)	B	From Face	3.500 -6.000 0.000	0.000	134.000	No Ice 1/2" Ice	2.300 3.132	2.300 3.132	0.041 0.057
8'x2 1/2" Pipe Mount (Nextel - Existing)	C	From Face	3.500 -6.000 0.000	0.000	134.000	No Ice 1/2" Ice	2.300 3.132	2.300 3.132	0.041 0.057
EEI Low Profile Platform (Verizon - Existing)	C	None		0.000	129.000	No Ice 1/2" Ice	22.500 28.200	22.500 28.200	1.500 2.250
LPA-80080/6CF (Verizon - Existing)	A	From Face	3.500 -6.000 0.000	0.000	130.000	No Ice 1/2" Ice	4.326 4.764	9.088 9.637	0.021 0.069
P65-16-XL-2 (Verizon - Existing)	A	From Face	3.500 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	8.400 8.949	4.117 4.558	0.020 0.065
LPA-80080-6CF (Verizon - Existing)	A	From Face	3.500 6.000 0.000	0.000	130.000	No Ice 1/2" Ice	4.326 4.764	9.088 9.637	0.021 0.069
DB846F65ZAXY (Verizon - Existing)	B	From Face	3.500 -6.000 0.000	0.000	130.000	No Ice 1/2" Ice	7.033 7.536	6.158 6.619	0.021 0.070
P65-16-XL-2 (Verizon - Existing)	B	From Face	3.500 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	8.400 8.949	4.117 4.558	0.020 0.065
DB846F65ZAXY (Verizon - Existing)	B	From Face	3.500 6.000 0.000	0.000	130.000	No Ice 1/2" Ice	7.033 7.536	6.158 6.619	0.021 0.070
DB846F65ZAXY (Verizon - Existing)	C	From Face	3.500 -6.000 0.000	0.000	130.000	No Ice 1/2" Ice	7.033 7.536	6.158 6.619	0.021 0.070
P65-16-XL-2 (Verizon - Existing)	C	From Face	3.500 0.000 0.000	0.000	130.000	No Ice 1/2" Ice	8.400 8.949	4.117 4.558	0.020 0.065
DB846F65ZAXY (Verizon - Existing)	C	From Face	3.500 6.000 0.000	0.000	130.000	No Ice 1/2" Ice	7.033 7.536	6.158 6.619	0.021 0.070
EEI Low Profile Platform (Sprint - Existing)	C	None		0.000	119.000	No Ice 1/2" Ice	22.500 28.200	22.500 28.200	1.500 2.250
APXVSPP18-C-A20 (Sprint - Existing)	A	From Face	3.500 6.000 0.000	0.000	120.000	No Ice 1/2" Ice	8.260 8.807	5.283 5.736	0.057 0.107
APXVSPP18-C-A20 (Sprint - Existing)	A	From Face	3.500 -6.000 0.000	0.000	120.000	No Ice 1/2" Ice	8.260 8.807	5.283 5.736	0.057 0.107
APXVSPP18-C-A20	B	From Face	3.500	0.000	120.000	No Ice	8.260	5.283	0.057

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
(Sprint - Existing)			6.000			1/2" Ice	8.807	5.736	0.107
			0.000						
APXVSPP18-C-A20	B	From Face	3.500	0.000	120.000	No Ice	8.260	5.283	0.057
(Sprint - Existing)			-6.000			1/2" Ice	8.807	5.736	0.107
			0.000						
APXVSPP18-C-A20	C	From Face	3.500	0.000	120.000	No Ice	8.260	5.283	0.057
(Sprint - Existing)			6.000			1/2" Ice	8.807	5.736	0.107
			0.000						
APXVSPP18-C-A20	C	From Face	3.500	0.000	120.000	No Ice	8.260	5.283	0.057
(Sprint - Existing)			-6.000			1/2" Ice	8.807	5.736	0.107
			0.000						
FD-RRH 2x50 800	A	From Face	0.500	0.000	117.000	No Ice	2.401	2.254	0.064
(Sprint - Existing)			-1.000			1/2" Ice	2.613	2.460	0.086
			0.000						
FD-RRH 2x50 800	B	From Face	0.500	0.000	117.000	No Ice	2.401	2.254	0.064
(Sprint - Existing)			-1.000			1/2" Ice	2.613	2.460	0.086
			0.000						
FD-RRH 2x50 800	C	From Face	0.500	0.000	117.000	No Ice	2.401	2.254	0.064
(Sprint - Existing)			-1.000			1/2" Ice	2.613	2.460	0.086
			0.000						
FD-RRH 4x40 1900	A	From Face	0.500	0.000	117.000	No Ice	2.609	2.709	0.060
(Sprint - Existing)			1.000			1/2" Ice	2.845	2.948	0.083
			0.000						
FD-RRH 4x40 1900	B	From Face	0.500	0.000	117.000	No Ice	2.609	2.709	0.060
(Sprint - Existing)			1.000			1/2" Ice	2.845	2.948	0.083
			0.000						
FD-RRH 4x40 1900	C	From Face	0.500	0.000	117.000	No Ice	2.609	2.709	0.060
(Sprint - Existing)			1.000			1/2" Ice	2.845	2.948	0.083
			0.000						
Valmont Uni-Tri Bracket	C	None		0.000	117.000	No Ice	1.750	1.750	0.290
(Sprint - Existing)						1/2" Ice	1.940	1.940	0.306
840-10054	A	From Face	3.500	0.000	120.000	No Ice	5.186	1.361	0.000
(Clearwire - Existing)			2.000			1/2" Ice	5.545	1.620	0.024
			0.000						
840-10054	B	From Face	3.500	0.000	120.000	No Ice	5.186	1.361	0.000
(Clearwire - Existing)			2.000			1/2" Ice	5.545	1.620	0.024
			0.000						
840-10054	C	From Face	3.500	0.000	120.000	No Ice	5.186	1.361	0.000
(Clearwire - Existing)			2.000			1/2" Ice	5.545	1.620	0.024
			0.000						
RRH	A	From Face	3.000	0.000	120.000	No Ice	1.804	0.778	0.033
(Clearwire - Existing)			0.000			1/2" Ice	2.000	0.920	0.045
			0.000						
RRH	B	From Face	3.000	0.000	120.000	No Ice	1.804	0.778	0.033
(Clearwire - Existing)			0.000			1/2" Ice	2.000	0.920	0.045
			0.000						
RRH	C	From Face	3.000	0.000	120.000	No Ice	1.804	0.778	0.033
(Clearwire - Existing)			0.000			1/2" Ice	2.000	0.920	0.045
			0.000						
6'x3" Pipe Mount	A	From Face	3.500	0.000	120.000	No Ice	1.767	1.767	0.035
(Clearwire - Existing)			-2.000			1/2" Ice	2.129	2.129	0.048
			0.000						
6'x3" Pipe Mount	B	From Face	3.500	0.000	120.000	No Ice	1.767	1.767	0.035
(Clearwire - Existing)			-2.000			1/2" Ice	2.129	2.129	0.048
			0.000						
Filter Box	A	From Face	3.500	0.000	120.000	No Ice	3.500	1.400	0.040
(Clearwire - Existing)			2.000			1/2" Ice	3.751	1.573	0.063

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Offsets: Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
				0.000						
EEI Low Profile Platform	C	None			0.000	109.000	No Ice	22.500	22.500	1.500
(T-Mobile - Existing)							1/2" Ice	28.200	28.200	2.250
RR90-17-02DP	A	From Face	3.500	0.000	0.000	110.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			-2.000				1/2" Ice	4.775	2.312	0.040
			0.000							
RR90-17-02DP	A	From Face	3.500	0.000	0.000	110.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			-6.000				1/2" Ice	4.775	2.312	0.040
			0.000							
RR90-17-02DP	B	From Face	3.500	0.000	0.000	110.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			-2.000				1/2" Ice	4.775	2.312	0.040
			0.000							
RR90-17-02DP	B	From Face	3.500	0.000	0.000	110.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			-6.000				1/2" Ice	4.775	2.312	0.040
			0.000							
RR90-17-02DP	C	From Face	3.500	0.000	0.000	110.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			-2.000				1/2" Ice	4.775	2.312	0.040
			0.000							
RR90-17-02DP	C	From Face	3.500	0.000	0.000	110.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			-6.000				1/2" Ice	4.775	2.312	0.040
			0.000							
ATMAP1412D-1A20	A	From Face	3.500	0.000	0.000	110.000	No Ice	1.167	0.467	0.013
(T-Mobile - Existing)			2.000				1/2" Ice	1.314	0.575	0.021
			0.000							
ATMAP1412D-1A20	B	From Face	3.500	0.000	0.000	110.000	No Ice	1.167	0.467	0.013
(T-Mobile - Existing)			2.000				1/2" Ice	1.314	0.575	0.021
			0.000							
ATMAP1412D-1A20	C	From Face	3.500	0.000	0.000	110.000	No Ice	1.167	0.467	0.013
(T-Mobile - Existing)			2.000				1/2" Ice	1.314	0.575	0.021
			0.000							
GPS	A	From Face	2.000	0.000	0.000	113.000	No Ice	1.000	1.000	0.010
(T-Mobile - Existing)			0.000				1/2" Ice	1.500	1.500	0.015
			0.000							
AIR21	A	From Face	3.500	0.000	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Reserved)			6.000				1/2" Ice	6.978	4.775	0.125
			0.000							
AIR21	A	From Face	3.500	0.000	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Reserved)			2.000				1/2" Ice	6.978	4.775	0.125
			0.000							
AIR21	B	From Face	3.500	0.000	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Reserved)			6.000				1/2" Ice	6.978	4.775	0.125
			0.000							
AIR21	B	From Face	3.500	0.000	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Reserved)			2.000				1/2" Ice	6.978	4.775	0.125
			0.000							
AIR21	C	From Face	3.500	0.000	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Reserved)			6.000				1/2" Ice	6.978	4.775	0.125
			0.000							
AIR21	C	From Face	3.500	0.000	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Reserved)			2.000				1/2" Ice	6.978	4.775	0.125
			0.000							
EEI Low Profile Platform	C	None			0.000	99.000	No Ice	22.500	22.500	1.500
(AT&T - Existing)							1/2" Ice	28.200	28.200	2.250
7770.00	A	From Face	3.000	0.000	0.000	100.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			-6.000				1/2" Ice	6.314	3.273	0.068
			0.000							
7770.00	A	From Face	3.000	0.000	0.000	100.000	No Ice	5.882	2.928	0.035

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
(AT&T - Existing)			6.000 0.000			1/2" Ice	6.314	3.273	0.068
7770.00	B	From Face	3.000	0.000	100.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			-6.000 0.000			1/2" Ice	6.314	3.273	0.068
7770.00	B	From Face	3.000	0.000	100.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			6.000 0.000			1/2" Ice	6.314	3.273	0.068
7770.00	C	From Face	3.000	0.000	100.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			-6.000 0.000			1/2" Ice	6.314	3.273	0.068
7770.00	C	From Face	3.000	0.000	100.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			6.000 0.000			1/2" Ice	6.314	3.273	0.068
(4) LGP21401 TMA	A	From Face	3.000	0.000	100.000	No Ice	0.953	0.367	0.018
(AT&T - Existing)			0.000 0.000			1/2" Ice	1.093	0.480	0.023
(4) LGP21401 TMA	B	From Face	3.000	0.000	100.000	No Ice	0.953	0.367	0.018
(AT&T - Existing)			0.000 0.000			1/2" Ice	1.093	0.480	0.023
(4) LGP21401 TMA	C	From Face	3.000	0.000	100.000	No Ice	0.953	0.367	0.018
(AT&T - Existing)			0.000 0.000			1/2" Ice	1.093	0.480	0.023
GPS	B	From Face	2.000	0.000	104.000	No Ice	1.000	1.000	0.010
(AT&T - Existing)			0.000 0.000			1/2" Ice	1.500	1.500	0.015
P65-16-XLH-RR	A	From Face	3.000	0.000	100.000	No Ice	8.400	4.700	0.060
(AT&T - Existing)			6.000 0.000			1/2" Ice	8.949	5.147	0.107
P65-16-XLH-RR	B	From Face	3.000	0.000	100.000	No Ice	8.400	4.700	0.060
(AT&T - Existing)			6.000 0.000			1/2" Ice	8.949	5.147	0.107
P65-16-XLH-RR	C	From Face	3.000	0.000	100.000	No Ice	8.400	4.700	0.060
(AT&T - Existing)			6.000 0.000			1/2" Ice	8.949	5.147	0.107
RRUS-11	A	From Face	0.500	0.000	104.000	No Ice	2.994	1.246	0.050
(AT&T - Existing)			0.000 0.000			1/2" Ice	3.226	1.412	0.070
RRUS-11	B	From Face	0.500	0.000	104.000	No Ice	2.994	1.246	0.050
(AT&T - Existing)			0.000 0.000			1/2" Ice	3.226	1.412	0.070
RRUS-11	C	From Face	0.500	0.000	104.000	No Ice	2.994	1.246	0.050
(AT&T - Existing)			0.000 0.000			1/2" Ice	3.226	1.412	0.070
DC6-48-60-18-8F Surge	C	From Face	0.500	0.000	104.000	No Ice	2.228	2.228	0.020
Arrestor			0.000			1/2" Ice	2.447	2.447	0.039
(AT&T - Existing)			0.000						
Valmont Uni-Tri Bracket	C	None		0.000	102.500	No Ice	1.750	1.750	0.290
(AT&T - Existing)						1/2" Ice	1.940	1.940	0.306
EEI Low Profile Platform	C	None		0.000	89.000	No Ice	22.500	22.500	1.500
(Vacant)						1/2" Ice	28.200	28.200	2.250
(3) 6'x3" Pipe Mount	A	From Face	3.000	0.000	90.000	No Ice	1.767	1.767	0.035
(Vacant)			0.000 0.000			1/2" Ice	2.129	2.129	0.048
(3) 6'x3" Pipe Mount	B	From Face	3.000	0.000	90.000	No Ice	1.767	1.767	0.035
(Vacant)			0.000 0.000			1/2" Ice	2.129	2.129	0.048

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
(3) 6'x3" Pipe Mount	C	From Face	3.000	0.000	90.000	No Ice	1.767	1.767	0.035
(Vacant)			0.000			1/2" Ice	2.129	2.129	0.048
			0.000						
GPS	A	From Face	1.000	0.000	70.000	No Ice	1.000	1.000	0.010
			0.000			1/2" Ice	1.500	1.500	0.015
			0.000						
GPS	B	From Face	1.000	0.000	70.000	No Ice	1.000	1.000	0.010
			0.000			1/2" Ice	1.500	1.500	0.015
			0.000						
GPS	C	From Face	1.000	0.000	70.000	No Ice	1.000	1.000	0.010
			0.000			1/2" Ice	1.500	1.500	0.015
			0.000						
GPS	A	From Face	1.000	0.000	72.000	No Ice	1.000	1.000	0.010
			0.000			1/2" Ice	1.500	1.500	0.015
			0.000						
GPS	C	From Face	1.000	0.000	72.000	No Ice	1.000	1.000	0.010
			0.000			1/2" Ice	1.500	1.500	0.015
			0.000						
3' GPS Stand-off Mount	A	From Face	1.500	0.000	70.000	No Ice	2.450	2.450	0.051
			0.000			1/2" Ice	3.980	3.980	0.075
			0.000						
3' GPS Stand-off Mount	B	From Face	1.500	0.000	70.000	No Ice	2.450	2.450	0.051
			0.000			1/2" Ice	3.980	3.980	0.075
			0.000						
Valmont B2069 2' GPS	C	From Face	1.000	0.000	70.000	No Ice	0.780	0.680	0.025
Mount			0.000			1/2" Ice	1.100	1.100	0.033
			0.000						
3' GPS Stand-off Mount	A	From Face	1.500	0.000	72.000	No Ice	2.450	2.450	0.051
			0.000			1/2" Ice	3.980	3.980	0.075
			0.000						
3' GPS Stand-off Mount	C	From Face	1.500	0.000	72.000	No Ice	2.450	2.450	0.051
			0.000			1/2" Ice	3.980	3.980	0.075
			0.000						
GPS	B	From Face	2.000	0.000	60.000	No Ice	1.000	1.000	0.010
(AT&T - Existing)			0.000			1/2" Ice	1.500	1.500	0.015
			0.000						
3' GPS Stand-off Mount	B	From Face	1.500	0.000	60.000	No Ice	2.450	2.450	0.051
(AT&T - Existing)			0.000			1/2" Ice	3.980	3.980	0.075
			0.000						
(2) FD9R6004/2C-3L	A	From Face	3.000	0.000	130.000	No Ice	0.367	0.085	0.003
Diplexer			0.000			1/2" Ice	0.451	0.136	0.005
(Verizon - proposed)			0.000						
(2) FD9R6004/2C-3L	B	From Face	3.000	0.000	130.000	No Ice	0.367	0.085	0.003
Diplexer			0.000			1/2" Ice	0.451	0.136	0.005
(Verizon - proposed)			0.000						
(2) FD9R6004/2C-3L	C	From Face	3.000	0.000	130.000	No Ice	0.367	0.085	0.003
Diplexer			0.000			1/2" Ice	0.451	0.136	0.005
(Verizon - proposed)			0.000						
BXA-171085-8BF	A	From Face	3.500	0.000	130.000	No Ice	2.941	2.156	0.011
(Verizon - proposed)			4.000			1/2" Ice	3.255	2.458	0.029
			0.000						
BXA-171085-8BF	B	From Face	3.500	0.000	130.000	No Ice	2.941	2.156	0.011
(Verizon - proposed)			4.000			1/2" Ice	3.255	2.458	0.029
			0.000						
BXA-171085-8BF	C	From Face	3.500	0.000	130.000	No Ice	2.941	2.156	0.011
(Verizon - proposed)			4.000			1/2" Ice	3.255	2.458	0.029
			0.000						

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
BXA-171085-8BF (Verizon - proposed)	A	From Face	3.500 -4.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.941 3.255	2.156 2.458	0.011 0.029
BXA-171085-8BF (Verizon - proposed)	B	From Face	3.500 -4.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.941 3.255	2.156 2.458	0.011 0.029
BXA-171085-8BF (Verizon - proposed)	C	From Face	3.500 -4.000 0.000	0.000	130.000	No Ice 1/2" Ice	2.941 3.255	2.156 2.458	0.011 0.029

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
VHLP800-11-DW1 (Clearwire - Existing)	A	Paraboloid w/Radome	From Face	3.500 -2.000 0.000	Worst		124.000	2.500	No Ice 1/2" Ice	4.910 5.240	0.049 0.076

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg % %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	104.971	1.392	0.029	138.308	A	0.000	138.308	138.308	100.00	0.000	0.000
130.000-82.17					B	0.000	138.308		100.00	0.000	0.000
0					C	0.000	138.308		100.00	0.000	9.470
L2	61.769	1.196	0.025	153.946	A	0.000	153.946	153.946	100.00	0.000	0.000
82.170-42.010					B	0.000	153.946		100.00	0.000	0.000
					C	0.000	153.946		100.00	0.000	7.952
L3	20.301	1	0.021	197.217	A	0.000	197.217	197.217	100.00	0.000	0.000
42.010-0.000					B	0.000	197.217		100.00	0.000	0.000
					C	0.000	197.217		100.00	0.000	7.724

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	t_Z in	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
L1	104.971	1.392	0.022	0.500	142.294	A	0.000	142.294	142.294	100.00	0.000	0.000
130.000-82.170						B	0.000	142.294		100.00	0.000	0.000
						C	0.000	142.294		100.00	0.000	14.253
L2	61.769	1.196	0.019	0.500	157.293	A	0.000	157.293	157.293	100.00	0.000	0.000
82.170-42.010						B	0.000	157.293		100.00	0.000	0.000
						C	0.000	157.293		100.00	0.000	11.968
L3 42.010-0.000	20.301	1	0.016	0.500	200.718	A	0.000	200.718	200.718	100.00	0.000	0.000
						B	0.000	200.718		100.00	0.000	0.000
						C	0.000	200.718		100.00	0.000	11.625

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	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
L1	104.971	1.392	0.009	138.308	A	0.000	138.308	138.308	100.00	0.000	0.000
130.000-82.17					B	0.000	138.308		100.00	0.000	0.000
0					C	0.000	138.308		100.00	0.000	9.470
L2	61.769	1.196	0.008	153.946	A	0.000	153.946	153.946	100.00	0.000	0.000
82.170-42.010					B	0.000	153.946		100.00	0.000	0.000
					C	0.000	153.946		100.00	0.000	7.952
L3	20.301	1	0.006	197.217	A	0.000	197.217	197.217	100.00	0.000	0.000
42.010-0.000					B	0.000	197.217		100.00	0.000	0.000
					C	0.000	197.217		100.00	0.000	7.724

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 klf	Ctrl. Face
L1	2.395	5.551	A	1	0.65	1	1	1	138.308	4.835	0.101	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.725	8.327	A	1	0.65	1	1	1	153.946	4.506	0.112	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.666	12.726	A	1	0.65	1	1	1	197.217	4.763	0.113	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.786	26.604						OTM	882.586 kip-ft	14.104		

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 klf	Ctrl. Face
L1	2.395	5.551	A	1	0.65	1	1	1	138.308	4.835	0.101	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.725	8.327	A	1	0.65	1	1	1	153.946	4.506	0.112	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.666	12.726	A	1	0.65	1	1	1	197.217	4.763	0.113	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.786	26.604						OTM	882.586 kip-ft	14.104		

Tower Forces - No 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 ft²	F K	w klf	Ctrl. Face
L1	2.395	5.551	A	1	0.65	1	1	1	138.308	4.835	0.101	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.725	8.327	A	1	0.65	1	1	1	153.946	4.506	0.112	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.666	12.726	A	1	0.65	1	1	1	197.217	4.763	0.113	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.786	26.604						OTM	882.586 kip-ft	14.104		

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 klf	Ctrl. Face
L1	2.395	5.551	A	1	0.65	1	1	1	138.308	4.835	0.101	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.725	8.327	A	1	0.65	1	1	1	153.946	4.506	0.112	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.666	12.726	A	1	0.65	1	1	1	197.217	4.763	0.113	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.786	26.604						OTM	882.586 kip-ft	14.104		

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 ft^2	F K	w klf	Ctrl. Face
L1	2.829	6.590	A	1	0.65	1	1	1	142.294	3.896	0.081	C
130.000-82.17			B	1	0.65	1	1	1	142.294			
0			C	1	0.65	1	1	1	142.294			
L2	3.088	9.479	A	1	0.65	1	1	1	157.293	3.573	0.089	C
82.170-42.010			B	1	0.65	1	1	1	157.293			
			C	1	0.65	1	1	1	157.293			
L3	3.019	14.200	A	1	0.65	1	1	1	200.718	3.735	0.089	C
42.010-0.000			B	1	0.65	1	1	1	200.718			
			C	1	0.65	1	1	1	200.718			
Sum Weight:	8.936	30.269						OTM	705.448 kip-ft	11.203		

Tower Forces - With 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 ft^2	F K	w klf	Ctrl. Face
L1	2.829	6.590	A	1	0.65	1	1	1	142.294	3.896	0.081	C
130.000-82.17			B	1	0.65	1	1	1	142.294			
0			C	1	0.65	1	1	1	142.294			
L2	3.088	9.479	A	1	0.65	1	1	1	157.293	3.573	0.089	C
82.170-42.010			B	1	0.65	1	1	1	157.293			
			C	1	0.65	1	1	1	157.293			
L3	3.019	14.200	A	1	0.65	1	1	1	200.718	3.735	0.089	C
42.010-0.000			B	1	0.65	1	1	1	200.718			
			C	1	0.65	1	1	1	200.718			
Sum Weight:	8.936	30.269						OTM	705.448 kip-ft	11.203		

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 klf	Ctrl. Face
L1	2.829	6.590	A	1	0.65	1	1	1	142.294	3.896	0.081	C
130.000-82.17			B	1	0.65	1	1	1	142.294			
0			C	1	0.65	1	1	1	142.294			
L2	3.088	9.479	A	1	0.65	1	1	1	157.293	3.573	0.089	C
82.170-42.010			B	1	0.65	1	1	1	157.293			
			C	1	0.65	1	1	1	157.293			
L3	3.019	14.200	A	1	0.65	1	1	1	200.718	3.735	0.089	C
42.010-0.000			B	1	0.65	1	1	1	200.718			
			C	1	0.65	1	1	1	200.718			
Sum Weight:	8.936	30.269						OTM	705.448 kip-ft	11.203		

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 klf	Ctrl. Face
L1	2.829	6.590	A	1	0.65	1	1	1	142.294	3.896	0.081	C
130.000-82.17			B	1	0.65	1	1	1	142.294			
0			C	1	0.65	1	1	1	142.294			
L2	3.088	9.479	A	1	0.65	1	1	1	157.293	3.573	0.089	C
82.170-42.010			B	1	0.65	1	1	1	157.293			
			C	1	0.65	1	1	1	157.293			
L3	3.019	14.200	A	1	0.65	1	1	1	200.718	3.735	0.089	C
42.010-0.000			B	1	0.65	1	1	1	200.718			
			C	1	0.65	1	1	1	200.718			
Sum Weight:	8.936	30.269						OTM	705.448 kip-ft	11.203		

Tower Forces - Service - 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 ft^2	F K	w klf	Ctrl. Face
L1	2.395	5.551	A	1	0.65	1	1	1	138.308	1.492	0.031	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.725	8.327	A	1	0.65	1	1	1	153.946	1.391	0.035	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.666	12.726	A	1	0.65	1	1	1	197.217	1.470	0.035	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.786	26.604						OTM	272.403 kip-ft	4.353		

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 ft^2	F K	w klf	Ctrl. Face
L1	2.395	5.551	A	1	0.65	1	1	1	138.308	1.492	0.031	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.725	8.327	A	1	0.65	1	1	1	153.946	1.391	0.035	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.666	12.726	A	1	0.65	1	1	1	197.217	1.470	0.035	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.786	26.604						OTM	272.403	4.353		

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 klf	Ctrl. Face
									kip-ft			

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 ft^2	F K	w klf	Ctrl. Face
L1	2.395	5.551	A	1	0.65	1	1	1	138.308	1.492	0.031	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.725	8.327	A	1	0.65	1	1	1	153.946	1.391	0.035	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.666	12.726	A	1	0.65	1	1	1	197.217	1.470	0.035	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.786	26.604						OTM	272.403 kip-ft	4.353		

Tower Forces - Service - 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 klf	Ctrl. Face
L1	2.395	5.551	A	1	0.65	1	1	1	138.308	1.492	0.031	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.725	8.327	A	1	0.65	1	1	1	153.946	1.391	0.035	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.666	12.726	A	1	0.65	1	1	1	197.217	1.470	0.035	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.786	26.604						OTM	272.403 kip-ft	4.353		

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	26.604					
Bracing Weight	0.000					
Total Member Self-Weight	26.604			-0.467	0.429	

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
Total Weight	46.036			-0.467	0.429	
Wind 0 deg - No Ice		0.207	-36.145	-3373.029	-26.944	-2.600
Wind 30 deg - No Ice		18.130	-31.406	-2934.878	-1693.602	-3.251
Wind 45 deg - No Ice		25.533	-25.705	-2404.585	-2381.123	-3.252
Wind 60 deg - No Ice		31.195	-18.252	-1710.454	-2906.345	-3.031
Wind 90 deg - No Ice		35.901	-0.207	-27.840	-3340.221	-1.998
Wind 120 deg - No Ice		30.988	17.893	1662.108	-2878.972	-0.430
Wind 135 deg - No Ice		25.240	25.412	2364.939	-2342.411	0.426
Wind 150 deg - No Ice		17.771	31.199	2906.571	-1646.190	1.253
Wind 180 deg - No Ice		-0.207	36.145	3372.096	27.803	2.600
Wind 210 deg - No Ice		-18.130	31.406	2933.945	1694.461	3.251
Wind 225 deg - No Ice		-25.533	25.705	2403.651	2381.982	3.252
Wind 240 deg - No Ice		-31.195	18.252	1709.520	2907.204	3.031
Wind 270 deg - No Ice		-35.901	0.207	26.906	3341.080	1.998
Wind 300 deg - No Ice		-30.988	-17.893	-1663.042	2879.831	0.430
Wind 315 deg - No Ice		-25.240	-25.412	-2365.873	2343.270	-0.426
Wind 330 deg - No Ice		-17.771	-31.199	-2907.505	1647.049	-1.253
Member Ice	3.665					
Total Weight Ice	57.099			-0.680	0.652	
Wind 0 deg - Ice		0.159	-30.495	-2872.381	-20.393	-2.067
Wind 30 deg - Ice		15.294	-26.489	-2498.168	-1441.273	-2.691
Wind 45 deg - Ice		21.546	-21.676	-2046.160	-2027.644	-2.735
Wind 60 deg - Ice		26.330	-15.385	-1454.756	-2475.790	-2.593
Wind 90 deg - Ice		30.312	-0.159	-21.726	-2846.747	-1.801
Wind 120 deg - Ice		26.171	15.110	1416.944	-2454.745	-0.526
Wind 135 deg - Ice		21.321	21.451	2015.037	-1997.882	0.188
Wind 150 deg - Ice		15.018	26.330	2475.762	-1404.822	0.890
Wind 180 deg - Ice		-0.159	30.495	2871.020	21.698	2.067
Wind 210 deg - Ice		-15.294	26.489	2496.808	1442.578	2.691
Wind 225 deg - Ice		-21.546	21.676	2044.800	2028.949	2.735
Wind 240 deg - Ice		-26.330	15.385	1453.396	2477.095	2.593
Wind 270 deg - Ice		-30.312	0.159	20.365	2848.052	1.801
Wind 300 deg - Ice		-26.171	-15.110	-1418.305	2456.050	0.526
Wind 315 deg - Ice		-21.321	-21.451	-2016.398	1999.186	-0.188
Wind 330 deg - Ice		-15.018	-26.330	-2477.123	1406.126	-0.890
Total Weight	46.036			-0.467	0.429	
Wind 0 deg - Service		0.064	-11.156	-1041.381	-8.019	-0.803
Wind 30 deg - Service		5.596	-9.693	-906.149	-522.420	-1.003
Wind 45 deg - Service		7.880	-7.934	-742.478	-734.618	-1.004
Wind 60 deg - Service		9.628	-5.633	-528.241	-896.723	-0.935
Wind 90 deg - Service		11.081	-0.064	-8.915	-1030.636	-0.617
Wind 120 deg - Service		9.564	5.523	512.674	-888.275	-0.133
Wind 135 deg - Service		7.790	7.843	729.597	-722.670	0.131
Wind 150 deg - Service		5.485	9.629	896.767	-507.786	0.387
Wind 180 deg - Service		-0.064	11.156	1040.448	8.878	0.803
Wind 210 deg - Service		-5.596	9.693	905.216	523.279	1.003
Wind 225 deg - Service		-7.880	7.934	741.545	735.476	1.004
Wind 240 deg - Service		-9.628	5.633	527.307	897.582	0.935
Wind 270 deg - Service		-11.081	0.064	7.982	1031.494	0.617
Wind 300 deg - Service		-9.564	-5.523	-513.607	889.134	0.133
Wind 315 deg - Service		-7.790	-7.843	-730.530	723.528	-0.131
Wind 330 deg - Service		-5.485	-9.629	-897.701	508.645	-0.387

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
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
L1	130 - 82.17	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-25.568	0.676	0.509
			Max. Mx	14	-17.264	659.289	-9.020

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	2	-17.244	-8.951	669.989
			Max. Vy	14	-25.822	659.289	-9.020
			Max. Vx	2	-26.068	-8.951	669.989
			Max. Torque	11			-3.310
L2	82.17 - 42.01	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-37.701	0.652	0.680
			Max. Mx	14	-28.131	1761.892	-17.164
			Max. My	2	-28.120	-17.203	1782.359
			Max. Vy	14	-30.896	1761.892	-17.164
			Max. Vx	2	-31.145	-17.203	1782.359
			Max. Torque	11			-3.489
L3	42.01 - 0	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-57.099	0.652	0.680
			Max. Mx	14	-46.020	3399.511	-27.457
			Max. My	2	-46.019	-27.495	3432.084
			Max. Vy	14	-35.923	3399.511	-27.457
			Max. Vx	2	-36.166	-27.495	3432.084
			Max. Torque	12			-3.232

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	57.099	30.312	-0.159
	Max. H_x	14	46.036	35.901	-0.207
	Max. H_z	2	46.036	-0.207	36.145
	Max. M_x	2	3432.084	-0.207	36.145
	Max. M_z	6	3398.625	-35.901	0.207
	Max. Torsion	3	3.227	-18.130	31.406
	Min. Vert	1	46.036	0.000	0.000
	Min. H_x	6	46.036	-35.901	0.207
	Min. H_z	10	46.036	0.207	-36.145
	Min. M_x	10	-3431.125	0.207	-36.145
	Min. M_z	14	-3399.511	35.901	-0.207
	Min. Torsion	12	-3.231	25.533	-25.705

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	46.036	0.000	0.000	-0.467	0.429	0.000
Dead+Wind 0 deg - No Ice	46.036	0.207	-36.145	-3432.084	-27.496	-2.583
Dead+Wind 30 deg - No Ice	46.036	18.130	-31.406	-2986.289	-1723.267	-3.227
Dead+Wind 45 deg - No Ice	46.036	25.533	-25.705	-2446.732	-2422.791	-3.226
Dead+Wind 60 deg - No Ice	46.036	31.195	-18.252	-1740.470	-2957.182	-3.006
Dead+Wind 90 deg - No Ice	46.036	35.901	-0.207	-28.412	-3398.625	-1.983
Dead+Wind 120 deg - No Ice	46.036	30.988	17.893	1691.151	-2929.280	-0.432
Dead+Wind 135 deg - No Ice	46.036	25.240	25.412	2406.304	-2383.316	0.416
Dead+Wind 150 deg - No Ice	46.036	17.771	31.199	2957.432	-1674.901	1.236
Dead+Wind 180 deg - No Ice	46.036	-0.207	36.145	3431.125	28.373	2.575
Dead+Wind 210 deg - No Ice	46.036	-18.130	31.406	2985.334	1724.144	3.227

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 225 deg - No Ice	46.036	-25.533	25.705	2445.780	2423.670	3.231
Dead+Wind 240 deg - No Ice	46.036	-31.195	18.252	1739.518	2958.063	3.014
Dead+Wind 270 deg - No Ice	46.036	-35.901	0.207	27.458	3399.511	1.991
Dead+Wind 300 deg - No Ice	46.036	-30.988	-17.893	-1692.110	2930.167	0.432
Dead+Wind 315 deg - No Ice	46.036	-25.240	-25.412	-2407.265	2384.200	-0.421
Dead+Wind 330 deg - No Ice	46.036	-17.771	-31.199	-2958.394	1675.783	-1.244
Dead+Ice+Temp	57.099	0.000	0.000	-0.680	0.652	0.000
Dead+Wind 0 deg+Ice+Temp	57.099	0.159	-30.495	-2941.646	-20.964	-2.047
Dead+Wind 30 deg+Ice+Temp	57.099	15.294	-26.489	-2558.447	-1476.035	-2.665
Dead+Wind 45 deg+Ice+Temp	57.099	21.546	-21.676	-2095.561	-2076.507	-2.709
Dead+Wind 60 deg+Ice+Temp	57.099	26.330	-15.385	-1489.916	-2535.427	-2.569
Dead+Wind 90 deg+Ice+Temp	57.099	30.312	-0.159	-22.347	-2915.280	-1.787
Dead+Wind 120 deg+Ice+Temp	57.099	26.171	15.110	1451.032	-2513.802	-0.528
Dead+Wind 135 deg+Ice+Temp	57.099	21.321	21.451	2063.562	-2045.917	0.178
Dead+Wind 150 deg+Ice+Temp	57.099	15.018	26.330	2535.412	-1438.558	0.872
Dead+Wind 180 deg+Ice+Temp	57.099	-0.159	30.495	2940.232	22.321	2.041
Dead+Wind 210 deg+Ice+Temp	57.099	-15.294	26.489	2557.037	1477.391	2.665
Dead+Wind 225 deg+Ice+Temp	57.099	-21.546	21.676	2094.153	2077.866	2.713
Dead+Wind 240 deg+Ice+Temp	57.099	-26.330	15.385	1488.509	2536.787	2.576
Dead+Wind 270 deg+Ice+Temp	57.099	-30.312	0.159	20.938	2916.646	1.793
Dead+Wind 300 deg+Ice+Temp	57.099	-26.171	-15.110	-1452.446	2515.168	0.528
Dead+Wind 315 deg+Ice+Temp	57.099	-21.321	-21.451	-2064.978	2047.281	-0.181
Dead+Wind 330 deg+Ice+Temp	57.099	-15.018	-26.330	-2536.829	1439.920	-0.878
Dead+Wind 0 deg - Service	46.036	0.064	-11.156	-1059.950	-8.181	-0.798
Dead+Wind 30 deg - Service	46.036	5.596	-9.693	-922.320	-531.733	-0.998
Dead+Wind 45 deg - Service	46.036	7.880	-7.934	-755.737	-747.703	-0.999
Dead+Wind 60 deg - Service	46.036	9.628	-5.633	-537.685	-912.688	-0.931
Dead+Wind 90 deg - Service	46.036	11.081	-0.064	-9.106	-1048.971	-0.614
Dead+Wind 120 deg - Service	46.036	9.564	5.523	521.784	-904.063	-0.133
Dead+Wind 135 deg - Service	46.036	7.790	7.843	742.579	-735.505	0.129
Dead+Wind 150 deg - Service	46.036	5.485	9.629	912.734	-516.793	0.383
Dead+Wind 180 deg - Service	46.036	-0.064	11.156	1058.988	9.069	0.798
Dead+Wind 210 deg - Service	46.036	-5.596	9.693	921.359	532.621	0.998
Dead+Wind 225 deg - Service	46.036	-7.880	7.934	754.776	748.591	0.999
Dead+Wind 240 deg - Service	46.036	-9.628	5.633	536.724	913.576	0.932
Dead+Wind 270 deg - Service	46.036	-11.081	0.064	8.145	1049.860	0.615
Dead+Wind 300 deg - Service	46.036	-9.564	-5.523	-522.746	904.952	0.133
Dead+Wind 315 deg - Service	46.036	-7.790	-7.843	-743.540	736.394	-0.130
Dead+Wind 330 deg - Service	46.036	-5.485	-9.629	-913.696	517.682	-0.384

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.000	-46.036	0.000	0.000	46.036	0.000	0.000%
2	0.207	-46.036	-36.145	-0.207	46.036	36.145	0.000%
3	18.130	-46.036	-31.406	-18.130	46.036	31.406	0.000%
4	25.533	-46.036	-25.705	-25.533	46.036	25.705	0.000%
5	31.195	-46.036	-18.252	-31.195	46.036	18.252	0.000%
6	35.901	-46.036	-0.207	-35.901	46.036	0.207	0.000%
7	30.988	-46.036	17.893	-30.988	46.036	-17.893	0.000%
8	25.240	-46.036	25.412	-25.240	46.036	-25.412	0.000%
9	17.771	-46.036	31.199	-17.771	46.036	-31.199	0.000%
10	-0.207	-46.036	36.145	0.207	46.036	-36.145	0.000%
11	-18.130	-46.036	31.406	18.130	46.036	-31.406	0.000%
12	-25.533	-46.036	25.705	25.533	46.036	-25.705	0.000%
13	-31.195	-46.036	18.252	31.195	46.036	-18.252	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
14	-35.901	-46.036	0.207	35.901	46.036	-0.207	0.000%
15	-30.988	-46.036	-17.893	30.988	46.036	17.893	0.000%
16	-25.240	-46.036	-25.412	25.240	46.036	25.412	0.000%
17	-17.771	-46.036	-31.199	17.771	46.036	31.199	0.000%
18	0.000	-57.099	0.000	0.000	57.099	0.000	0.000%
19	0.159	-57.099	-30.495	-0.159	57.099	30.495	0.000%
20	15.294	-57.099	-26.489	-15.294	57.099	26.489	0.000%
21	21.546	-57.099	-21.676	-21.546	57.099	21.676	0.000%
22	26.330	-57.099	-15.385	-26.330	57.099	15.385	0.000%
23	30.312	-57.099	-0.159	-30.312	57.099	0.159	0.000%
24	26.171	-57.099	15.110	-26.171	57.099	-15.110	0.000%
25	21.321	-57.099	21.451	-21.321	57.099	-21.451	0.000%
26	15.018	-57.099	26.330	-15.018	57.099	-26.330	0.000%
27	-0.159	-57.099	30.495	0.159	57.099	-30.495	0.000%
28	-15.294	-57.099	26.489	15.294	57.099	-26.489	0.000%
29	-21.546	-57.099	21.676	21.546	57.099	-21.676	0.000%
30	-26.330	-57.099	15.385	26.330	57.099	-15.385	0.000%
31	-30.312	-57.099	0.159	30.312	57.099	-0.159	0.000%
32	-26.171	-57.099	-15.110	26.171	57.099	15.110	0.000%
33	-21.321	-57.099	-21.451	21.321	57.099	21.451	0.000%
34	-15.018	-57.099	-26.330	15.018	57.099	26.330	0.000%
35	0.064	-46.036	-11.156	-0.064	46.036	11.156	0.000%
36	5.596	-46.036	-9.693	-5.596	46.036	9.693	0.000%
37	7.880	-46.036	-7.934	-7.880	46.036	7.934	0.000%
38	9.628	-46.036	-5.633	-9.628	46.036	5.633	0.000%
39	11.081	-46.036	-0.064	-11.081	46.036	0.064	0.000%
40	9.564	-46.036	5.523	-9.564	46.036	-5.523	0.000%
41	7.790	-46.036	7.843	-7.790	46.036	-7.843	0.000%
42	5.485	-46.036	9.629	-5.485	46.036	-9.629	0.000%
43	-0.064	-46.036	11.156	0.064	46.036	-11.156	0.000%
44	-5.596	-46.036	9.693	5.596	46.036	-9.693	0.000%
45	-7.880	-46.036	7.934	7.880	46.036	-7.934	0.000%
46	-9.628	-46.036	5.633	9.628	46.036	-5.633	0.000%
47	-11.081	-46.036	0.064	11.081	46.036	-0.064	0.000%
48	-9.564	-46.036	-5.523	9.564	46.036	5.523	0.000%
49	-7.790	-46.036	-7.843	7.790	46.036	7.843	0.000%
50	-5.485	-46.036	-9.629	5.485	46.036	9.629	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	0.00010820
3	Yes	4	0.00000001	0.00075677
4	Yes	4	0.00000001	0.00094290
5	Yes	4	0.00000001	0.00088739
6	Yes	4	0.00000001	0.00010358
7	Yes	4	0.00000001	0.00076675
8	Yes	4	0.00000001	0.00088754
9	Yes	4	0.00000001	0.00074583
10	Yes	4	0.00000001	0.00014115
11	Yes	4	0.00000001	0.00090204
12	Yes	4	0.00000001	0.00094674
13	Yes	4	0.00000001	0.00076096
14	Yes	4	0.00000001	0.00007189

15	Yes	4	0.00000001	0.00078060
16	Yes	4	0.00000001	0.00089018
17	Yes	4	0.00000001	0.00081210
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00002951
20	Yes	5	0.00000001	0.00005006
21	Yes	5	0.00000001	0.00005647
22	Yes	5	0.00000001	0.00005241
23	Yes	4	0.00000001	0.00099513
24	Yes	5	0.00000001	0.00004927
25	Yes	5	0.00000001	0.00005458
26	Yes	5	0.00000001	0.00004903
27	Yes	5	0.00000001	0.00002963
28	Yes	5	0.00000001	0.00005268
29	Yes	5	0.00000001	0.00005655
30	Yes	5	0.00000001	0.00005009
31	Yes	4	0.00000001	0.00099251
32	Yes	5	0.00000001	0.00004971
33	Yes	5	0.00000001	0.00005472
34	Yes	5	0.00000001	0.00005018
35	Yes	4	0.00000001	0.00001929
36	Yes	4	0.00000001	0.00003904
37	Yes	4	0.00000001	0.00005213
38	Yes	4	0.00000001	0.00005203
39	Yes	4	0.00000001	0.00001618
40	Yes	4	0.00000001	0.00003935
41	Yes	4	0.00000001	0.00004599
42	Yes	4	0.00000001	0.00003747
43	Yes	4	0.00000001	0.00002043
44	Yes	4	0.00000001	0.00005381
45	Yes	4	0.00000001	0.00005253
46	Yes	4	0.00000001	0.00003908
47	Yes	4	0.00000001	0.00001521
48	Yes	4	0.00000001	0.00004093
49	Yes	4	0.00000001	0.00004638
50	Yes	4	0.00000001	0.00004462

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 82.17	12.884	36	0.824	0.005
L2	87.84 - 42.01	6.121	36	0.653	0.002
L3	49.01 - 0	1.911	36	0.354	0.001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
140.000	12' x 3" Dia Omni	36	12.884	0.824	0.005	70612
134.000	8'x2 1/2" Pipe Mount	36	12.884	0.824	0.005	70612
130.000	LPA-80080/6CF	36	12.884	0.824	0.005	70612
129.000	EEI Low Profile Platform	36	12.714	0.821	0.004	70612
124.000	VHLP800-11-DW1	36	11.863	0.806	0.004	58843

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
120.000	APXVSPP18-C-A20	36	11.185	0.793	0.004	35306
119.000	EEI Low Profile Platform	36	11.016	0.790	0.004	32096
117.000	FD-RRH 2x50 800	36	10.680	0.783	0.004	27158
113.000	GPS	36	10.014	0.769	0.003	20768
110.000	RR90-17-02DP	36	9.520	0.759	0.003	17653
109.000	EEI Low Profile Platform	36	9.356	0.755	0.003	16812
104.000	GPS	36	8.551	0.735	0.003	13579
102.500	Valmont Uni-Tri Bracket	36	8.314	0.728	0.002	12838
100.000	7770.00	36	7.923	0.717	0.002	11768
99.000	EEI Low Profile Platform	36	7.768	0.712	0.002	11388
90.000	(3) 6'x3" Pipe Mount	36	6.427	0.665	0.002	8844
89.000	EEI Low Profile Platform	36	6.285	0.659	0.002	8653
72.000	GPS	36	4.090	0.541	0.001	7115
70.000	GPS	36	3.862	0.525	0.001	6983
60.000	GPS	36	2.829	0.444	0.001	6388

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 82.17	41.701	3	2.668	0.015
L2	87.84 - 42.01	19.817	3	2.113	0.005
L3	49.01 - 0	6.188	3	1.148	0.002

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
140.000	12' x 3" Dia Omni	3	41.701	2.668	0.015	21912
134.000	8'x2 1/2" Pipe Mount	3	41.701	2.668	0.015	21912
130.000	LPA-80080/6CF	3	41.701	2.668	0.015	21912
129.000	EEI Low Profile Platform	3	41.149	2.658	0.014	21912
124.000	VHLP800-11-DW1	3	38.395	2.609	0.013	18260
120.000	APXVSPP18-C-A20	3	36.203	2.568	0.012	10956
119.000	EEI Low Profile Platform	3	35.657	2.557	0.012	9959
117.000	FD-RRH 2x50 800	3	34.570	2.536	0.011	8427
113.000	GPS	3	32.413	2.491	0.010	6444
110.000	RR90-17-02DP	3	30.815	2.456	0.010	5477
109.000	EEI Low Profile Platform	3	30.286	2.444	0.009	5216
104.000	GPS	3	27.680	2.379	0.008	4212
102.500	Valmont Uni-Tri Bracket	3	26.912	2.358	0.008	3982
100.000	7770.00	3	25.647	2.322	0.007	3650
99.000	EEI Low Profile Platform	3	25.146	2.307	0.007	3532
90.000	(3) 6'x3" Pipe Mount	3	20.808	2.154	0.006	2742
89.000	EEI Low Profile Platform	3	20.346	2.135	0.005	2683
72.000	GPS	3	13.241	1.751	0.003	2203
70.000	GPS	3	12.504	1.700	0.003	2161
60.000	GPS	3	9.160	1.438	0.002	1976

Compression Checks

Pole 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 $\frac{P}{P_a}$
L1	130 - 82.17 (1)	TP41.22x28.18x0.313	47.830	0.000	0.0	39.000	39.042	-17.235	1522.630	0.011
L2	82.17 - 42.01 (2)	TP51.42x39.049x0.375	45.830	0.000	0.0	39.000	58.507	-28.114	2281.790	0.012
L3	42.01 - 0 (3)	TP62x48.781x0.438	49.010	0.000	0.0	39.000	85.487	-46.019	3334.000	0.014

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	130 - 82.17 (1)	TP41.22x28.18x0.313	675.108	21.365	39.000	0.548	0.000	0.000	39.000	0.000
L2	82.17 - 42.01 (2)	TP51.42x39.049x0.375	1792.225	30.298	39.000	0.777	0.000	0.000	39.000	0.000
L3	42.01 - 0 (3)	TP62x48.781x0.438	3447.833	31.836	39.000	0.816	0.000	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	130 - 82.17 (1)	TP41.22x28.18x0.313	26.192	0.671	26.000	0.052	3.118	0.048	26.000	0.002
L2	82.17 - 42.01 (2)	TP51.42x39.049x0.375	31.267	0.534	26.000	0.041	3.228	0.027	26.000	0.001
L3	42.01 - 0 (3)	TP62x48.781x0.438	36.285	0.424	26.000	0.033	3.227	0.015	26.000	0.001

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	130 - 82.17 (1)	0.011	0.548	0.000	0.052	0.002	0.560 ✔	1.333	H1-3+VT ✔
L2	82.17 - 42.01 (2)	0.012	0.777	0.000	0.041	0.001	0.790 ✔	1.333	H1-3+VT ✔
L3	42.01 - 0 (3)	0.014	0.816	0.000	0.033	0.001	0.830 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	130 - 82.17	Pole	TP41.22x28.18x0.313	1	-17.235	2029.666	42.0	Pass
L2	82.17 - 42.01	Pole	TP51.42x39.049x0.375	2	-28.114	3041.626	59.2	Pass
L3	42.01 - 0	Pole	TP62x48.781x0.438	3	-46.019	4444.222	62.3	Pass
							Summary	
						Pole (L3)	62.3	Pass
						RATING =	**62.3**	**Pass**

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Subject:		Anchor Bolt and Baseplate Analysis
Location:		130-ft EEI Monopole Westport, CT
Rev. 1: 9/26/13		Prepared by: J.R.M. Checked by: C.F.C. Job No. 13001.051

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 3448·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 36·kips	(Input From RisaTower)
Axial Force =	Axial := 46·kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 20	(User Input)
Diameter of Bolt Circle =	D_{bc} := 71.00·in	(User Input)
Bolt "Column" Distance =	l := 3.25·in	(User Input)
Bolt Ultimate Strenght =	F_u := 100·ksi	(User Input)
Bolt Yeild Strenght =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 Mod 60

Plate Yield Strength =	Fy_{bp} := 60·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 2.0·in	(User Input)
Base Plate Diameter =	D_{bp} := 77.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 62.00·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 35.5\,in$

Distance to Bolts = $i := 1..N$

$$d_i := \left| \begin{array}{l} \theta \leftarrow 2\cdot\pi\cdot\left(\frac{i}{N}\right) \\ d \leftarrow R_{bc}\cdot\sin(\theta) \end{array} \right.$$

$d_1 = 10.97\,in$
$d_2 = 20.87\,in$
$d_3 = 28.72\,in$
$d_4 = 33.76\,in$
$d_5 = 35.50\,in$
$d_6 = 33.76\,in$
$d_7 = 28.72\,in$
$d_8 = 20.87\,in$
$d_9 = 10.97\,in$
$d_{10} = 0.00\,in$
$d_{11} = -10.97\,in$
etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 31\,in$

Moment Arms of Bolts about Neutral Axis = $MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$

$MA_1 = 0.00\,in$
$MA_2 = 0.00\,in$
$MA_3 = 0.00\,in$
$MA_4 = 2.76\,in$
$MA_5 = 4.50\,in$
$MA_6 = 2.76\,in$
$MA_7 = 0.00\,in$
$MA_8 = 0.00\,in$
$MA_9 = 0.00\,in$
$MA_{10} = 0.00\,in$
$MA_{11} = 0.00\,in$
etc

Effective Width of Baseplate for Bending = $B_{eff} := .8\cdot 2\cdot\sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 36.53\,in$

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Subject:	Anchor Bolt and Baseplate Analysis
Location:	130-ft EEI Monopole Westport, CT
Rev. 1: 9/26/13	Prepared by: J.R.M. Checked by: C.F.C. Job No. 13001.051

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 1.26 \times 10^4 \cdot in^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot in^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 = 3.248 \cdot in^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 2.033 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.508 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.826 \cdot in^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 114.3 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 174.9 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net} := 1.333 \cdot \left(0.60 \cdot A_n \cdot F_y\right) = 194.8 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 58.6 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

Condition1 = $Condition1 := if\left(\frac{T_{Max}}{T_{ALL.Net}} \le 1.00, "OK", "Overstressed"\right)$

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.487 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 7.1 \cdot ksi$

Allowable Bending Stress = $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 60 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

Per ASCE Manual 72: "If the clearance between the base plate and concrete does not exceed two times the bolt diameter a bending stress analysis of the bolts is NOT normally required.

$$l := \begin{cases} l & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 0 \cdot in$$

$$f_{bx} := \begin{cases} f_{bx} & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 0 \cdot ksi$$

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 118.9 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 36.6 \cdot ksi$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{F_y}} = 87.364$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^2}\right] \cdot F_y}{\dfrac{5}{3} + \dfrac{3\left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^3}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} = 45 \cdot ksi$$

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 60 \cdot ksi$$

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 61 \cdot \%$$

Condition 2 =

$$Condition2 := if\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$$

Condition2 = "OK"

Base Plate Analysis:

Force from Bolts = $C_i := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$

$C_1 = 38.3 \cdot kips$ $C_7 = 96.6 \cdot kips$

$C_2 = 70.8 \cdot kips$ $C_8 = 70.8 \cdot kips$

$C_3 = 96.6 \cdot kips$ $C_9 = 38.3 \cdot kips$

$C_4 = 113.1 \cdot kips$ $C_{10} = 2.3 \cdot kips$

$C_5 = 118.9 \cdot kips$ $C_{11} = -33.7 \cdot kips$

$C_6 = 113.1 \cdot kips$ etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 47.6 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 59.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 79.6 \cdot \%$

Condition3 = $Condition3 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$

Condition3 = "Ok"

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Subject:	FOUNDATION ANALYSIS	
Location:	130-ft EEI Monopole Westport, CT	
Rev. 1: 9/26/13	Prepared by: J.R.M. Checked by: C.F.C. Job No. 13001.051	

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 3448 \cdot ft \cdot kips$	(User Input from RISATower)	
Shear Force =	$Shear := 36 \cdot kip$	(User Input from RISATower)	
Axial Force =	$Axial := 46 \cdot kip$	(User Input from RISATower)	
Tower Height =	$H_t := 130 \cdot ft$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 5.5 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 2.5 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 1.0 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 8 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 3 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 29.5 \cdot ft$	(User Input)	

Anchor Bolt Data:

Length of Anchor Bolts =	$L_{st} := 72.0 \cdot in$	(User Input)	
Projection of Anchor Bolts Above Pier =	$A_{BP} := 12.0 \cdot in$	(User Input)	
Anchor Bolt Diameter =	$d_{anchor} := 2.25 \cdot in$	(User Input)	
Base Plate Bolt Circle =	$MP := 72.76 \cdot in$	(User Input)	

Material Properties:

Concrete Compressive Strength =	$f_c := 4000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Anchor Bolt Yield Strength =	$f_{ya} := 75000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 30 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 3000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 100 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 0 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.000 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 44$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(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 =	$BS_{top} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.000 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 28$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.000 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 44$	(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 =

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

Pad Bottom Reinforcement Bar Area =

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

Coefficient of Lateral Soil Pressure =

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

Load Factor =

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

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Location:	130-ft EEI Monopole Westport, CT
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Stability of Footing:

Adjusted Concrete Unit Weight =

$\gamma_c := if\left(Bouyancy = 1, \gamma_{conc} - 62.4pcf, \gamma_{conc}\right) = 150\cdot pcf$

Adjusted Soil Unit Weight =

$\gamma_s := if\left(Bouyancy = 1, \gamma_{soil} - 62.4pcf, \gamma_{soil}\right) = 100\cdot pcf$

Passive Pressure =

$P_{pn} := K_p\cdot\gamma_s\cdot n + c\cdot 2\cdot\sqrt{K_p} = 0\cdot ksf$

$P_{pt} := K_p\cdot\gamma_s\cdot\left(D_f - T_f\right) + c\cdot 2\cdot\sqrt{K_p} = 0.75\cdot ksf$

$P_{top} := if\left[n < \left(D_f - T_f\right), P_{pt}, P_{pn}\right] = 0.75\cdot ksf$

$P_{bot} := K_p\cdot\gamma_s\cdot D_f + c\cdot 2\cdot\sqrt{K_p} = 1.65\cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.2\cdot ksf$

$T_p := if\left[n < \left(D_f - T_f\right), T_f, \left(D_f - n\right)\right] = 3$

$A_p := W_f\cdot T_p = 88.5$

Ultimate Shear =

$S_u := P_{ave}\cdot A_p = 106.2\cdot kip$

Weight of Concrete Pad =

$WT_c := \left[\left(W_f^2\cdot T_f\right) + d_p^2\cdot L_p\right]\cdot\gamma_c = 415.613\cdot kip$

Weight of Soil Above Footing =

$WT_{s1} := \left[\left(W_f^2 - d_p^2\right)\cdot\begin{cases}\left(L_p - L_{pag} - n\right) & \text{if } \left(L_p - L_{pag} - n\right) \geq 0 \\ 0 & \text{if } \left(L_p - L_{pag} - n\right) \leq 0\end{cases}\right]\cdot\gamma_s = 120.94\cdot kip$

Weight of Soil Wedge at Back Face =

$WT_{s2} := \left(\frac{D_f^2\cdot\tan\left(\Phi_s\right)}{2}\cdot W_f\right)\cdot\gamma_s = 25.761\cdot kip$

Weight of Soil Wedge at back face Corners =

$WT_{s3} := 2\cdot\left[\left(D_f\right)^3\cdot\frac{\tan\left(\Phi_s\right)}{3}\right]\cdot\gamma_s = 6.404\cdot kips$

Total Weight =

$WT_{tot} := WT_c + WT_{s1} + Axial = 582.55\cdot kip$

Resisting Moment =

$M_r := \left(WT_{tot}\right)\cdot\frac{W_f}{2} + S_u\cdot\frac{T_f}{3} + \left[\left(WT_{s2} + WT_{s3}\right)\cdot\left(W_f + \frac{D_f\cdot\tan\left(\Phi_s\right)}{3}\right)\right] = 9682\cdot kip\cdot ft$

Overturning Moment =

$M_{ot} := OM + Shear\cdot\left(L_p + T_f\right) = 3646\cdot kip\cdot ft$

Factor of Safety Actual =

$FS := \frac{M_r}{M_{ot}} = 2.66$

Factor of Safety Required =

$FS_{req} := 2$

$OverTurning\_Moment\_Check := if\left(FS \geq FS_{req}, "Okay", "No\ Good"\right)$

$OverTurning\_Moment\_Check = "Okay"$

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Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 131.074 \cdot kips$

$Shear\_Check := if(S_p > Shear, "Okay", "No Good")$

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Area of the Mat = $A_{mat} := W_f^2 = 870.25$

Section Modulus of Mat = $S := \frac{W_f^3}{6} = 4278.73 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{(WT_c + Axial)}{A_{mat}} + \frac{M_{ot}}{S} = 1.383 \cdot ksf$

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

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \frac{(WT_c + Axial)}{A_{mat}} - \frac{M_{ot}}{S} = -0.322 \cdot ksf$

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

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 7.977$

Distance to Kern = $X_k := \frac{W_f}{6} = 4.917$

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

Eccentricity = $e := \frac{M_{ot}}{WT_{tot}} = 6.259$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot (WT_c + Axial)}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.229 \cdot ksf$

$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.229 \cdot ksf$

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

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 = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.6 \times 10^4 \cdot kips$ (ACI-2008 10.14)

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

Bearing_Check = "Okay"

Shear Strength of Concrete:

Beam Shear: (Critical section located at a distance d from the face of Pier) (ACI 11.3.1.1)

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 32 \cdot in$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$

$d_2 := d_1 - d$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$

$V_{req} := LF \cdot \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d$ (ACI-2008 11.2.1.1)

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

Beam_Shear_Check = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.11.1.2)

Critical Perimeter of Punching Shear = $b_o := \left(d_p + d\right) \cdot \pi = 33.5$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 89.4$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 780.9$

Guess Value = $v_u := 1ksf$ (From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

Given $d^2 + d_p \cdot d = \frac{WT_{tot}}{\pi \cdot v_u}$

$v_u := Find(v_u) = 6.5 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 512.8 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 683.6 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 2767.1 \cdot kip$ (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)

$q_b := q_{adj} - d_1 \cdot Slope = 0.71 \cdot ksf$

Maximum Bending at Face of Pier = $M_u := LF \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 2398.8 \cdot kip \cdot ft$

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

(ACI-200810.2.7.3)

$R_n := \frac{M_u}{\phi_m \cdot W_f \cdot d^2} = 88.2 \cdot psi$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) = 0.0015$

$\rho_{min} := \rho = 0.00149$

Required Reinforcement for Temperature and Shrinkage:

$$\rho_{sh} := \begin{cases} .0018 & \text{if } f_y \geq 60000\cdot psi \\ .0020 & \text{otherwise} \end{cases}$$ (ACI -2008 7.12.2.1)

Check Bottom Bars:

$$As := \begin{cases} \rho_{min}\cdot W_f\cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} = 16.88\cdot in^2 \\ \rho_{sh}\cdot W_f\cdot \frac{d}{2} & \text{otherwise} \end{cases}$$

$$As_{prov} := A_{bbot}\cdot NB_{bot} = 34.6\cdot in^2$$

$$Pad\_Reinforcement\_Bot := if\left(As_{prov} > As, "Okay", "No Good"\right)$$

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$$As := \rho_{sh}\cdot\left(W_f\cdot\frac{d}{2}\right) = 10.2\cdot in^2$$

$$As_{prov} := A_{btop}\cdot NB_{top} = 22\cdot in^2$$

$$Pad\_Reinforcement\_Top := if\left(As_{prov} > As, "Okay", "No Good"\right)$$

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2\cdot Cvr_{pad} - NB_{bot}\cdot d_{bbot}}{NB_{bot} - 1} = 7.07\cdot in$$

Spacing or Cover Dimension =

$$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 3\cdot in$$

Transverse Reinforcement Index =

$$k_{tr} := 0$$ (ACI-2008 12.2.3)

$$L_{dbt} := \frac{3\cdot f_y\cdot\alpha_{pad}\cdot\beta_{pad}\cdot\gamma_{pad}\cdot\lambda_{pad}}{40\cdot\sqrt{f_c\cdot psi}\cdot\frac{c + k_{tr}}{d_{bbot}}}\cdot d_{bbot} = 23.7\cdot in$$

Minimum Development Length =

$$L_{dbmin} := 12\cdot in$$ (ACI-2008 12.2.1)

$$L_{dbtCheck} := if\left(L_{dbt} \geq L_{dbmin}, "Use\ L.dbt", "Use\ L.dbmin"\right)$$

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 126\cdot in$$

$$Lpad\_Check := if\left(L_{Pad} > L_{dbt}, "Okay", "No Good"\right)$$

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier =

$$A_p := \frac{\pi \cdot d_p^2}{4} = 7238.23 \cdot in^2$$

$$A_{smin} := 0.01 \cdot 0.05 \cdot A_p = 3.62 \cdot in^2$$ (ACI-2008 10.8.4 & 10.9.1)

$$A_{sprov} := NB_{pier} \cdot A_{bpier} = 34.56 \cdot in^2$$

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

Steel_Area_Check = "Okay"

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 5.854 \cdot in$$

Diameter of Reinforcement Cage =

$$Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 90 \cdot in$$

Maximum Moment in Pier =

$$M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 56881.8 \cdot in \cdot kips$$

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

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

$$(D \ N \ n \ P_u \ M_{xu}) = (96 \ 44 \ 8 \ 61.318 \ 5.688 \times 10^4)$$

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

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

$$(\phi P_n \ \phi M_{xn} \ f_{sp} \ \rho) = (85.672 \ 7.947 \times 10^4 \ -60 \ 4.802 \times 10^{-3})$$

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

Axial_Load_Check = "Okay"

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

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 27 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 33 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 2.927 \cdot in$

Transverse Reinforcement =

$k_{tr} := 0$ (ACI-2008 12.2.3)

$L_{dbt} := \frac{3 \cdot f_y \alpha_{pier} \beta_{pier} \gamma_{pier} \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 24.31 \cdot in$

Minimum Development Length =

$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 13.282 \cdot in$ (ACI 12.2.1)

Pier reinforcement bars are standard 90 degree hooks and therefore developement in the pad is computed as follows:

$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right)$

$L_{tension\_Check} := if\left(L_{pier} + L_{pad} > L_{dbt}, "Okay", "No Good"\right)$

$L_{tension\_Check} = "Okay"$

Compression: (ACI-2008 12.3.2)

$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 18.974 \cdot in$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 18 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 18.974 \cdot in$

$L_{compression\_Check} := if\left(L_{pier} + L_{pad} > L_{dbc}, "Okay", "No Good"\right)$

$L_{compression\_Check} = "Okay"$

Tie Size and Spacing in Column:

Minimum Tie Size =

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

Used #4 Ties

Seismic Factor =

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

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

$s_{lim2} := 48 \cdot d_{Tie} \cdot z = 144 \cdot in$

$s_{lim3} := D_f \cdot z = 66 \cdot in$

$s_{lim4} := 18in$

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 =

$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 2.5$

Check Anchor Steel Embedment:

Depth Available =

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

Length of Anchor Bolt =

$L_{anchor} := \frac{(0.11 \cdot f_{ya}) \cdot in}{\sqrt{f_c \cdot psi}} = 10.87 \cdot ft$

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

Depth_Check = "No Good"

Note: Anchor plate is provided

SITE NAME	CRANBURY CT	ECP - CELL #	5	254
LATITUDE	41-09-46.50 N	LONGITUDE	73-22-23.10 W	
		SAVE BUTTON		
AWS: Swap out PCS antenna for xpol, add AWS antenna, diplex cell/PCS, need 6 cables.		STRUCTURE TYPE	MONOPOLE	

2100 Mhz - LTE ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	2100 TRDU	2100 TRDU	2100 TRDU
ANTENNA TYPE	BXA-171085-8BF-EDIN-0	BXA-171085-8BF-EDIN-0	BXA-171085-8BF-EDIN-0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	60	180	300
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	128	128	128
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			
RRH - QTY/MODEL			
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			

700 Mhz - LTE Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	700 MHz eNodeB + TRDU	700 MHz eNodeB + TRDU	700 MHz eNodeB + TRDU
ANTENNA TYPE	P65-16-XL2_2	P65-16-XL2_2	P65-16-XL2_2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	60	170	300
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	128	128	128
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			
RRH - QTY/MODEL			
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			

700 Mhz - LTE Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	700 MHz eNodeB + TRDU	700 MHz eNodeB + TRDU	700 MHz eNodeB + TRDU
ANTENNA TYPE	P65-16-XL2_2	P65-16-XL2_2	P65-16-XL2_2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	60	170	300
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	128	128	128
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			
RRH - QTY/MODEL			
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0HD	Cellular Modcell 4.0HD	Cellular Modcell 4.0HD
ANTENNA TYPE	LPA-80080/6CF	DB846F65ZAXY	DB846F65ZAXY
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	60	180	300
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	128	128	128
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0HD	Cellular Modcell 4.0HD	Cellular Modcell 4.0HD
ANTENNA TYPE	LPA-80080/6CF	DB846F65ZAXY	DB846F65ZAXY
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	60	180	300
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	128	128	128
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 PCS - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	LPA-185080/8CF 2	LPA-185080/8CF 2	LPA-185080/8CF 2
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	60	180	300
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	128	128	128
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 PCS - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	BXA-171085-8BF-EDIN-0	BXA-171085-8BF-EDIN-0	BXA-171085-8BF-EDIN-0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	60	180	300
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	128	128	128
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE	DIPLEX W/CELL	DIPLEX W/CELL	DIPLEX W/CELL
MCPA BRICKS (QTY)			

NUMBER OF CABLE'S NEEDED						ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES			12	MAINLINE (FT)			
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS			12	TOP JUMPER (FT)			12
Equipment Cable Ordering		MAIN CABLE	12	+	6	TOP JUMPER #	12	+	6
FIBER LINE SIZE	1 5/8"	TOTAL # OF FIBER LINES				FIBER LINE MODEL #			HB158-1-08U8-S8J18
JUMPER SIZE	5/8"	TOTAL # OF TOP JUMPERS				TOP JUMPER MODEL #			HB058-1-08U1-S1J18
Fiber Cable Ordering		FIBER CABLE	0	+		TOP JUMPER #	0	+	

TX / RX FREQUENCIES			TX POWER OUTPUT	
Cellular A-Band	PCS F-Band	700 Mhz C - B	Cellular (Watts)	20
TX - 869-880,890-891.5 MHz	TX - 1970-1975	TX - 746-757	PCS (Watts)	16
RX - 824-835,845-846.5 MHz	RX - 1890-1895	RX - 776-787	LTE (Watts)	40

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/	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/	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
F1-A	1700	Tx/Rx	RED/	F1-B	1700	Tx/Rx	BLUE/BROWN	F1-C	1700	Tx/Rx	GREEN/BROWN
F1-D	1700	Tx/Rx	RED/RED/	F1-E	1700	Tx/Rx	BLUE/BLUE/BR	F1-F	1700	Tx/Rx	GREEN/GREEN/BROWN

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By :Maria Montrose	Robert Hesselbach	MMM	8/8/2013

Site Configuration

BXA-171085-8BF-EDIN-X

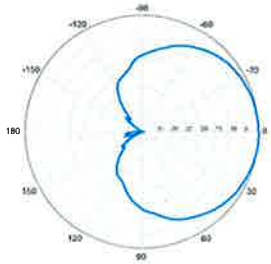
Replace "X" with desired electrical downtilt

X-Pol | FET Panel | 85° | 16.4 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	7°	7°	7°
Gain	13.5 dBd / 15.6 dBi	13.9 dBd / 16.0 dBi	14.3 dBd / 16.4 dBi
Electrical downtilt (X)	0, 2, 4		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back isolation	> 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	1232 x 154 x 105 mm		48.5 x 6.1 x 4.1 in
Depth with t-brackets	133 mm		5.2 in
Weight without mounting brackets	4.8 kg		10.5 lbs
Survival wind speed	296 km/hr		184 mph
Wind area	Front: 0.19 m² Side: 0.14 m²		Front: 2.0 ft² Side: 1.5 ft²
Wind load @ 161 km/hr (100 mph)	Front: 281 N Side: 223 N		Front: 63 lbf Side: 50 lbf

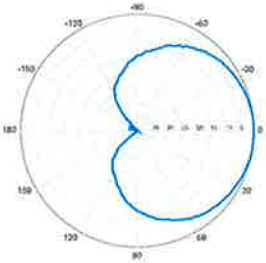
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171085-8BF-EDIN-X-FP		

BXA-171085-8BF-EDIN-X



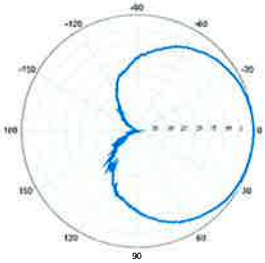
Horizontal | 1710-1880 MHz

BXA-171085-8BF-EDIN-X



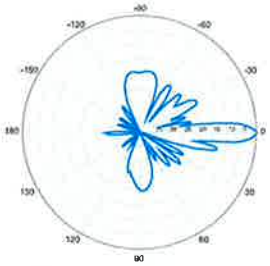
Horizontal | 1850-1990 MHz

BXA-171085-8BF-EDIN-X



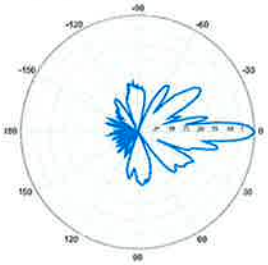
Horizontal | 1920-2170 MHz

BXA-171085-8BF-EDIN-0



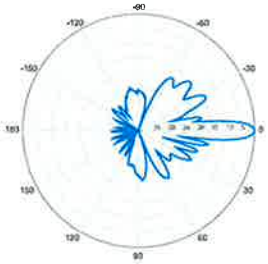
0° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-0



0° | Vertical | 1920-2170 MHz

Quoted performance parameters are provided to offer typical or range values only and may vary as a result of normal manufacturing and operational conditions. Extreme operational conditions and/or stress on structural supports is beyond our control. Such conditions may result in damage to this product. Improvements to product may be made without notice.

Product Data Sheet FD9R6004/2C-3L

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

Product Description

The ShareLite FD9R6004 Series of diplexers are designed to enable feeder sharing between systems in the 698-960 MHz range and in the 1710-2200 MHz range. The diplexer is equipped with in-line connector placement so it can be installed in the BTS cabinet or at the tower top. This is especially valuable in crowded sites or when the feeders are not easily accessible. Due to its wideband design, the FD9R6004 Series can accommodate many combining solutions between 698-960 MHz and 1710-2200 MHz systems such as LTE 700 MHz, Cellular 800 MHz with PCS, GSM900 with GSM1800, or GSM900 with UMTS. This diplexer features a highly selective filter. It provides a high level of isolation between ports, while keeping the insertion loss on both paths at an extremely low level. The FD9R6004 diplexers are available with various DC pass options, helpful in configurations with or without the Tower Mount Amplifiers installed.

Features/Benefits

- **LTE ready design**
- **Extremely Low Insertion Loss**
- **High level of Rejection between bands – Protection against interferences**
- **Extremely High Power Handling Capability**
- **Integrated DC block/bypass versions available**
- **Very compact & small size design – Easy installation and reduced tower load**
- **In-line long-neck connectors for easy connection & waterproofing**
- **Exceptional reliability & environmental protection (IP 67)**
- **Mounting hardware for Wall and Pole mount provided (P/N SEM2-1A)**
- **Grounding already provided through the mounting bracket**
- **Kit available for easy dual mount**

Technical Specifications

Product Type	Diplexer/Cross Band Coupler
Frequency Band, MHz	698-2200
Configuration	Sharelite Single diplexer, outdoor, DC pass in the 1710 - 2170 MHz path, with mounting hardware SEM2-1A
Mounting	Wall, pole
Frequency Range Low Frequency Path, MHz	698-960
Frequency Range High Frequency Path, MHz	1710-2200
Return Loss All Ports, Min, dB	19
Power Handling Continuous, Max, W	1250 at common port; 750 in low frequency path & 500 in high frequency path
Power Handling Peak, Max, W	15000 in low frequency path & 8000 in high frequency path
Impedance, Ohms	50
Insertion Loss 698-960 MHz Path, Typ, dB	0.07
Insertion Loss 1710-2200MHz path, Typ, dB	0.13
Rejection Between Bands Min/Typ, dB	58/64@698-960MHz; 60/70@1710-2200MHz
Rejection between Bands, Min, dB	60
IMP Level at the COM Port, Typ, dBm	-112 @ 2x43
DC Pass in Low Frequency Path	No
DC Pass in High Frequency Path	Yes
Temperature Range, °C (°F)	-40 to +60 (-40 to +140)
Environmental	ETSI 300-019-2-4 Class 4.1E
Ingress Protection	IP 67
Lightning Protection	EN/IEC61000-4-5 Level 4
Connectors	In-line long-neck 7-16-Female
Weight, kg (lb)	1.2 (2.6)
Shipping Weight, kg (lb)	3.2 (7) for 2 * single units in 1 * box, 9.8 (21.6) for 6 * units = 3 * Boxes in 1 * overwrap
Application	LTE 700MHz, GSM900/3G/UMTS, GSM900/GSM1800, Cellular 800/PCS
Dimensions, H x W x D, mm (in)	147 x 164 x 37 (5.8 x 6.5 x 1.5)
Shipping Dimensions, H x W x D, mm (in)	254 x 406 x 82 (10 x 16 x 3.2) for 2 * Single Units in 1 * box, 280 x 406 x 241 (11 x 16 x 9.5) for 6 * units = 3 * Boxes in 1 * overwrap
Volume, L	0.43
Housing	Aluminum

Notes