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Also admitted in Massachusetts

October 28, 2013

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

Re: **Notice of Exempt Modification – Antenna Swap**
6 Mountain Road, Washington, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains six (6) wireless telecommunications antennas (three (3) at the 147-foot level and three (3) at the 157-foot level) on the existing 170-foot tower at the above-referenced address. The tower is owned by Cellco. The Council approved Cellco's use of the tower in 2007 in Docket No. 332. Cellco now intends to replace one (1) of its existing antennas with one (1) model BXA-70063-6CF LTE antenna at the 147-foot level. Included in Attachment 1 are specifications for the replacement antenna.

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 Mark E. Lyon, First Selectman for the Town of Washington. A copy of this letter is also being sent to Ray and Carol Underwood, the owners of the property where the tower is located.

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 antenna will be installed at the 147-foot level of the 170-foot tower.

2. The proposed modifications will not involve any change to ground-mounted equipment and, therefore, will not require the extension of the site 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 worst-case RF emissions calculation for Cellco's modified facility is provided in the General Power Density table included in Attachment 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:
Mark E. Lyon, Washington First Selectman
Ray and Carol Underwood
Sandy M. Carter

ATTACHMENT 1

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

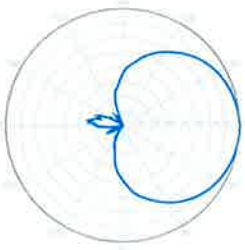
Replace "X" with desired electrical downtilt.

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

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

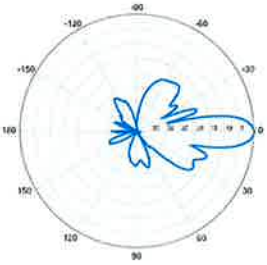
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



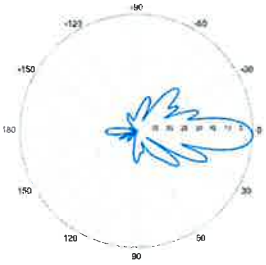
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

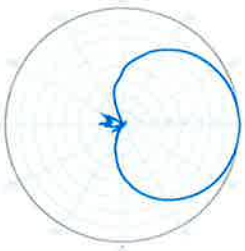


0° | Vertical | 750 MHz

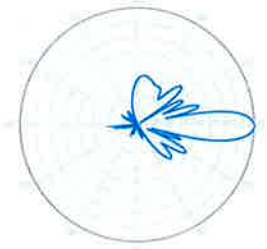
BXA-70063-6CF-EDIN-2



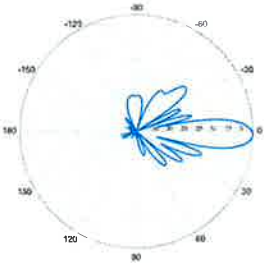
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz



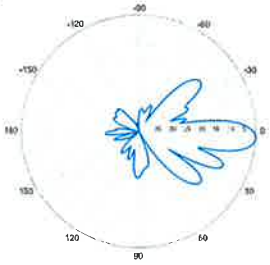
2° | Vertical | 850 MHz

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.

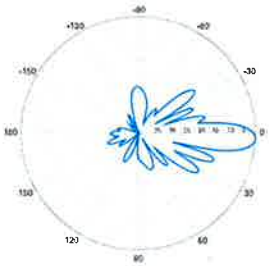
BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

BXA-70063-6CF-EDIN-3

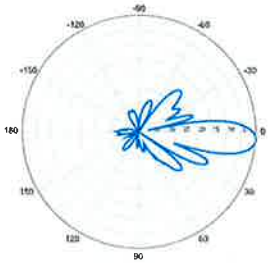


3° | Vertical | 750 MHz

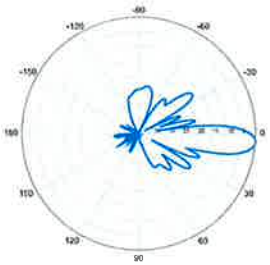


3° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-4

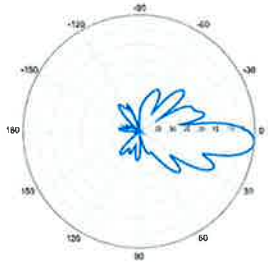


4° | Vertical | 750 MHz

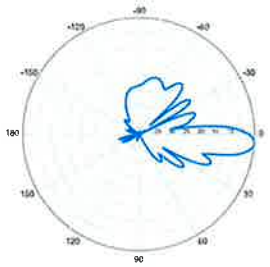


4° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-5

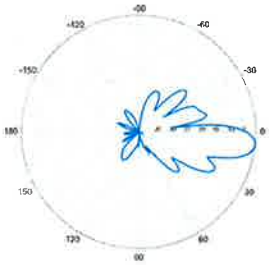


5° | Vertical | 750 MHz

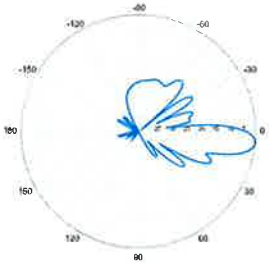


5° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-6

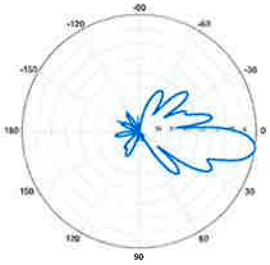


6° | Vertical | 750 MHz

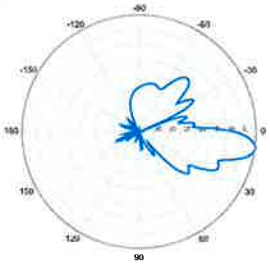


6° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-8

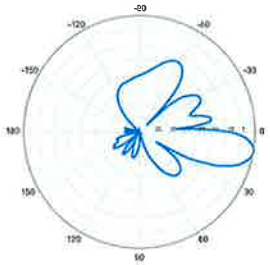


8° | Vertical | 750 MHz

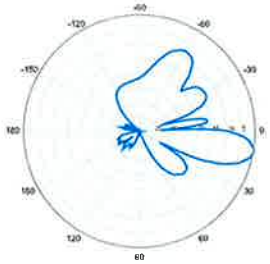


8° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-10



10° | Vertical | 750 MHz



10° | Vertical | 850 MHz

ATTACHMENT 2

	General	Power	Density					
Site Name: Washington N								
Tower Height: Verizon @ 147FT & 157ft								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*AT&T UMTS	1	500	167	0.0064	850	0.5667	1.14%	
*AT&T UMTS	1	500	167	0.0064	1900	1.0000	0.64%	
*AT&T GSM	2	500	167	0.0129	880	0.5867	2.20%	
*AT&T LTE	2	500	167	0.0129	2100	1.0000	1.29%	
*AT&T LTE	2	500	167	0.0129	700	0.4667	2.76%	
*T-Mobile GSM	8	183	127	0.0326	1945	1.0000	3.26%	
*T-Mobile UMTS	2	730	127	0.0325	2100	1.0000	3.25%	
Verizon PCS	**7**	**352**	**147**	**0.0410**	**1970**	**1.0000**	**4.10%**	
Verizon Cellular	**9**	**256**	**147**	**0.0383**	**869**	**0.5793**	**6.62%**	
Verizon AWS	**1**	**1750**	**147**	**0.0291**	**2145**	**1.0000**	**2.91%**	
Verizon 700	**1**	**699**	**147**	**0.0116**	**698**	**0.4653**	**2.50%**	
								30.68%
* Source: Siting Council								

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

160-ft Existing EEI Monopole
with 10-ft Extension

Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Washington North

6 Mountain Road
Washington, CT

Centek Project No. 13075.031

Date: September 19, 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 Wireless on the existing monopole (tower) located in Washington, CT.

The host tower is a 160-ft tall, four-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Inc.; project no. 15143 dated October 22, 2007 with a 10-ft extension designed by Centek; project no. 10079.CO3 dated December 6, 2010. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned EEI design documents. Antenna and appurtenance information were obtained from a previous structural report prepared by Centek job no. 13046.000 dated August 19, 2013 and a Verizon RF data sheet.

The tower consists of four (4) tapered vertical steel sections conforming to ASTM A572-65 and one (1) 12" Sch. 40 steel pipe extension conforming to ASTM A53 Gr. B (35 ksi). The vertical tower sections are slip joint connected. The extension is flange connected to the top of the tower. The diameter of the pole (flat-flat) is 18.00-in at the top and 47.00-in at the base.

Verizon proposes the replacement of one (1) existing panel antenna with one (1) proposed panel antenna flush mounted to the existing monopole. 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:

- AT&T (EXISTING):
  Antennas: Three (3) Powerwave P90-14-XLH-RR panel antennas, six (6) Powerwave TT08-19DB111-001 TMA's, two (2) Kathrein 800-10764 panel antennas and one (1) KMW AM-X-CD-17-65-00T-RET panel antenna mounted to three (3) T-Arms on the 10-ft monopole extension with a RAD center elevation of 167-ft above grade level.
  Appurtenances: Six (6) Ericsson Remote Radio Units (RRUS-11) and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted to three (3) Site Pro Standoff Arms (Site Pro P/N: MM02) and one (1) Site Pro Universal Ring Mount (Site Pro P/N: LWRM) on the 10-ft monopole extension with a RAD center elevation of 162-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables, one (1) fiber cable and two (2) dc control cables running on the outside of the existing tower.
- T-MOBILE (RESERVED):
  Antennas: Three (3) RFS APX16DWV-16DWVS-E-ACU panel antennas and six (6) TMAs flush mounted with a RAD center elevation of 127-ft above grade level.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- FUTURE CARRIER (RESERVED):
  Antennas: Three (3) 5-ft panel antennas flush mounted with a RAD center elevation of 117-ft above grade level.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- FUTURE CARRIER (RESERVED):
  Antennas: Three (3) 5-ft panel antennas flush mounted with a RAD center elevation of 107-ft above grade level.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- VERIZON (EXISTING TO REMAIN):
  Antennas: Three (3) Andrew DBXNH-6565A-VTM panel antennas flush mounted with a RAD center elevation of 157-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower. Six (6) 1-5/8" ∅ coax cables running inside the existing tower to the exit ports at 136-ft A.G.L. then banded to the exterior of the existing tower the remaining 20-ft.
- VERIZON (EXISTING TO REMAN):
  Antennas: Two (2) Antel BXA-70063-6CF panel antennas flush mounted with a RAD center elevation of 147-ft above grade level.
- VERIZON (EXISTING TO REMOVE):
  Antennas: One (1) Andrew LNX-6514DS-T4 panel antennas flush mounted with a RAD center elevation of 147-ft above grade level.
- **VERIZON (PROPOSED):**
  Antennas: One (1) Antel BXA-70063-6CF panel antenna flush mounted with a RAD center elevation of 147-ft above grade level.

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:	Litchfield; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Washington; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA-EIA-222-F wind speed controls.	
Load Cases:	Load Case 1; 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 69 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 69 mph wind speed velocity represents 75% of the wind pressure generated by the 80 mph wind speed.	*[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 **93.9%** of its total capacity with reinforcement.

Condition	Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Reinforced	Pole Shaft (L4)	77.28'-93.83'	93.9%	**PASS**

Note 1: Equivalent thickness of 0.25" used for pole section L3 to account for shaft with reinforcements.
Note 2: Equivalent thickness of 0.30" used for pole section L5 to account for shaft with reinforcements.

Foundation and Anchors

The existing foundation consists of a 7-ft square x 3-ft long reinforced concrete pier on a 23-ft square x 3-ft thick reinforced concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design documents; job no; 15143, dated October 22, 2007. The base of the tower is connected to the foundation by means of (16) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 5-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	20 kips
	Compression	27 kips
	Moment	2142 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	2.15	**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 and Bending	60.8%	**PASS**
Base Plate	Bending	55.2%	**PASS**

Conclusion and Recommendations

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

Reinforcements per the previous structural analysis report prepared by Centek Engineering job no. 13046 dated August 19, 2013 were considered in this report, however a second analysis was performed without AT&T's antenna upgrade and the related reinforcements and the tower was found to be structurally sufficient to support Verizon's proposed antenna upgrade without the aforementioned AT&T tower modifications.

The analysis is based, in part, on the information provided to this office by Verizon. 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. 16884
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:

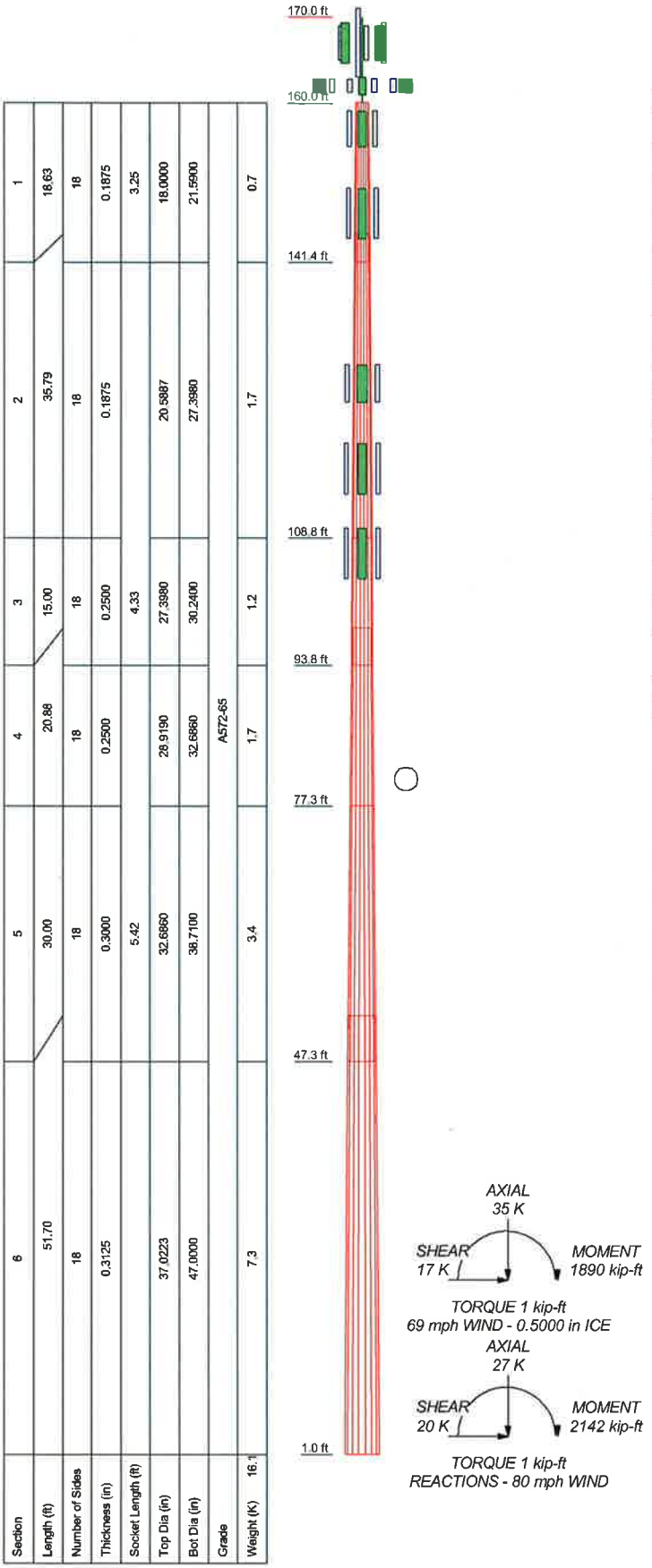
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of CENTEK engineering, Inc. or 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	4	5	6
Length (ft)	18.63	35.79	15.00	20.88	30.00	51.70
Number of Sides	18	18	18	18	18	18
Thickness (in)	0.1875	0.1875	0.2500	0.2500	0.3000	0.3125
Socket Length (ft)	3.25		4.33		5.42	
Top Dia (in)	18.0000	20.5887	27.3980	28.9190	32.6860	37.0223
Bot Dia (in)	21.5900	27.3980	30.2400	32.6860	38.7100	47.0000
Grade	A572-65					
Weight (K)	0.7	1.7	1.2	1.7	3.4	7.3

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
P90-14-XLH-RR w/ Pipe Mount (ATI - Existing)	167	DBXNH-6565A-VTM (Verizon - Existing)	157
P90-14-XLH-RR w/ Pipe Mount (ATI - Existing)	167	BXA-70063/6CF (Verizon - Existing)	147
P90-14-XLH-RR w/ Pipe Mount (ATI - Existing)	167	BXA-70063/6CF (Verizon - Existing)	147
(2) TT08-19DB111-001 TMA (ATI - Existing)	167	Valmont Uni-Tri Bracket (Verizon - Existing)	147
(2) TT08-19DB111-001 TMA (ATI - Existing)	167	BXA-70063/6CF (Verizon - Proposed)	147
(2) TT08-19DB111-001 TMA (ATI - Existing)	167	APX16DWV-16DWV-S-E-ACU (T-Mobile - Reserved)	127
AM-X-CD-17-65-00T-RET (ATI - Existing)	167	APX16DWV-16DWV-S-E-ACU (T-Mobile - Reserved)	127
800-10764 (ATI - Existing)	167	(2) DTMA-1819-DD-12 (T-Mobile - Reserved)	127
800-10764 (ATI - Existing)	167	(2) DTMA-1819-DD-12 (T-Mobile - Reserved)	127
Site-Pro Double Support Arm (ATI - Existing)	167	(2) DTMA-1819-DD-12 (T-Mobile - Reserved)	127
Coax on Extension	164.5	Valmont Uni-Tri Bracket (T-Mobile - Reserved)	127
(2) RRUS-11 (ATI - Existing)	162	APX16DWV-16DWV-S-E-ACU (T-Mobile - Reserved)	127
DC6-48-60-18-8F Surge Arrestor (ATI - Existing)	162	5' Panel Antenna (Future Carrier)	117
(2) RRUS-11 (ATI - Existing)	162	5' Panel Antenna (Future Carrier)	117
(2) RRUS-11 (ATI - Existing)	162	Valmont Uni-Tri Bracket (Future Carrier)	117
DBXNH-6565A-VTM (Verizon - Existing)	157	5' Panel Antenna (Future Carrier)	117
		5' Panel Antenna (Future Carrier)	107
DBXNH-6565A-VTM (Verizon - Existing)	157	5' Panel Antenna (Future Carrier)	107
		Valmont Uni-Tri Bracket (Future Carrier)	107
Valmont Uni-Tri Bracket (Verizon - Existing)	157	5' Panel Antenna (Future Carrier)	107

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. 10.00 ft 12" Sch. 40 x 10' Long Monopole Extension is included for load transfer only.
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. Pole Section L3 - Equivalent thickness of 0.25" used to account for stiffened section.
10. Pole Section L5 - Equivalent thickness of 0.30" used to account for stiffened section.
11. TOWER RATING: 93.9%

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

Job: 13075.031 - Washington North			
Project: 160' EEI Monopole - 6 Mountain Rd., Washington, CT			
Client: Verizon Wireless	Drawn by: TJL		App'd:
Code: TIA/EIA-222-F	Date: 09/19/13		Scale: NTS
Path: J:\Jobs\13075\00.W\031 - Washington North\Calcs\ERI\160' EEI Monopole, Washington, CT.eri			Dwg No. E-1

Tower Input Data

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

Basic wind speed of 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
Pole Section L3 - Equivalent thickness of 0.25" used to account for stiffened section..
Pole Section L5 - Equivalent thickness of 0.30" used to account for stiffened section..
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	160.00-141.37	18.63	3.25	18	18.0000	21.5900	0.1875	0.7500	A572-65 (65 ksi)
L2	141.37-108.83	35.79	0.00	18	20.5887	27.3980	0.1875	0.7500	A572-65 (65 ksi)

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
L3	108.83-93.83	15.00	4.33	18	27.3980	30.2400	0.2500	1.0000	A572-65 (65 ksi)
L4	93.83-77.28	20.88	0.00	18	28.9190	32.6860	0.2500	1.0000	A572-65 (65 ksi)
L5	77.28-47.28	30.00	5.42	18	32.6860	38.7100	0.3000	1.2000	A572-65 (65 ksi)
L6	47.28-1.00	51.70		18	37.0223	47.0000	0.3125	1.2500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	18.2777	10.6007	424.9328	6.3234	9.1440	46.4712	850.4248	5.3013	2.8380	15.136
	21.9231	12.7372	737.1216	7.5979	10.9677	67.2083	1475.2132	6.3698	3.4698	18.506
L2	21.5342	12.1413	638.4316	7.2424	10.4591	61.0409	1277.7033	6.0718	3.2936	17.566
	27.8207	16.1936	1514.7997	9.6597	13.9182	108.8360	3031.5926	8.0984	4.4920	23.958
L3	27.8207	21.5419	2005.8475	9.6375	13.9182	144.1170	4014.3343	10.7730	4.3820	17.528
	30.7065	23.7971	2704.0442	10.6465	15.3619	176.0225	5411.6464	11.9008	4.8822	19.529
L4	30.1589	22.7488	2362.2252	10.1775	14.6908	160.7957	4727.5586	11.3766	4.6497	18.599
	33.1902	25.7380	3421.1038	11.5148	16.6045	206.0349	6846.7093	12.8714	5.3127	21.251
L5	33.1902	30.8379	4086.3688	11.4970	16.6045	246.1003	8178.1146	15.4219	5.2247	17.416
	39.3072	36.5740	6817.0825	13.6356	19.6647	346.6663	13643.1351	18.2905	6.2850	20.95
L6	38.6550	36.4116	6199.2820	13.0320	18.8073	329.6203	12406.7212	18.2092	5.9659	19.091
	47.7251	46.3082	12752.5270	16.5741	23.8760	534.1149	25521.8341	23.1585	7.7220	24.71

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 160.00-141.37				1	1	1		
L2 141.37-108.83				1	1	1		
L3 108.83-93.83				1	1	1		
L4 93.83-77.28				1	1	1		
L5 77.28-47.28				1	1	1		
L6 47.28-1.00				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 plf
1 5/8 (Verizon - Existing)	C	No	Inside Pole	157.00 - 4.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon - Existing)	C	No	Inside Pole	147.00 - 4.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (T-Mobile - Reserved)	C	No	Inside Pole	127.00 - 4.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 5/8	C	No	Inside Pole	117.00 - 4.00	6	No Ice	0.00	1.04
(Future Carrier)						1/2" Ice	0.00	1.04
1 5/8	C	No	Inside Pole	107.00 - 4.00	6	No Ice	0.00	1.04
(Future Carrier)						1/2" Ice	0.00	1.04
1 5/8	C	No	CaAa (Out Of	121.00 - 4.00	2	No Ice	0.20	1.04
(AT&T - Existing)			Face)			1/2" Ice	0.30	2.55
1 5/8	C	No	CaAa (Out Of	121.00 - 4.00	10	No Ice	0.00	1.04
(AT&T - Existing)			Face)			1/2" Ice	0.00	2.55
1 5/8	C	No	CaAa (Out Of	160.00 - 121.00	6	No Ice	0.20	1.04
(AT&T - Existing)			Face)			1/2" Ice	0.30	2.55
1 5/8	C	No	CaAa (Out Of	160.00 - 121.00	6	No Ice	0.00	1.04
(AT&T - Existing)			Face)			1/2" Ice	0.00	2.55
1 5/8	C	No	Inside Pole	137.00 - 4.00	6	No Ice	0.00	1.04
(Verizon - Existing)						1/2" Ice	0.00	1.04
1 5/8	C	No	CaAa (Out Of	157.00 - 137.00	4	No Ice	0.00	1.04
(Verizon - Existing)			Face)			1/2" Ice	0.00	2.55
1 5/8	C	No	CaAa (Out Of	157.00 - 137.00	2	No Ice	0.20	1.04
(Verizon - Existing)			Face)			1/2" Ice	0.30	2.55
#8 AWG Copper WIre	C	No	CaAa (Out Of	160.00 - 4.00	2	No Ice	0.00	0.05
(AT&T - Existing)			Face)			1/2" Ice	0.00	0.43
RG6-Fiber	C	No	CaAa (Out Of	160.00 - 4.00	1	No Ice	0.00	1.00
(AT&T - Existing)			Face)			1/2" Ice	0.00	1.61

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	160.00-141.37	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	28.322	0.48
L2	141.37-108.83	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	30.749	1.22
L3	108.83-93.83	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	5.940	0.75
L4	93.83-77.28	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	6.552	0.84
L5	77.28-47.28	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	11.880	1.53
L6	47.28-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	17.140	2.21

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	160.00-141.37	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	42.625	0.99

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L2	141.37-108.83	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	46.279	1.89
L3	108.83-93.83	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	8.940	1.05
L4	93.83-77.28	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	9.862	1.17
L5	77.28-47.28	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	17.880	2.12
L6	47.28-1.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	25.797	3.05

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	160.00-141.37	-1.0310	0.5952	-1.2232	0.7062
L2	141.37-108.83	-0.8109	0.4682	-1.0267	0.5927
L3	108.83-93.83	-0.4416	0.2550	-0.6035	0.3484
L4	93.83-77.28	-0.4464	0.2577	-0.6138	0.3544
L5	77.28-47.28	-0.4540	0.2621	-0.6303	0.3639
L6	47.28-1.00	-0.4326	0.2498	-0.6090	0.3516

Antenna Pole Forces *12" Sch. 40 x 10' Long Monopole Extension*

Length of Pole ft	Ix in⁴	Iy in⁴	Modulus E ksi		Antenna Pole C_AA_A ft²/ft	Antenna Pole Weight plf	Length of Beacon ft	Beacon C_AA_A ft²	Beacon Weight K
10.00	262.0000	262.0000	29000	No Ice	0.91	49.60	0.00	0.00	0.00
				With Ice	0.92	57.80		0.00	0.00

User Defined Loads

Description	Elevation ft	Offset From Centroid ft	Azimuth Angle °		Weight K	F_x K	F_z K	Wind Force K	C_AA_C ft²
Coax on Extension	164.50	0.00	0.0000	No Ice	0.09	0.00	0.00	0.36	**8.31**
				Ice	0.22	0.00	0.00	0.29	**8.95**
				Service	0.00	0.00	0.00	**0.00**	0.00

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
P90-14-XLH-RR w/ Pipe Mount	A	From Face	1.00 -2.00	0.0000	167.00	No Ice 1/2" Ice	5.60 5.99	4.27 4.88	0.06 0.10
(AT&T - Existing)			0.00						
P90-14-XLH-RR w/ Pipe Mount	B	From Face	1.00 -2.00	0.0000	167.00	No Ice 1/2" Ice	5.60 5.99	4.27 4.88	0.06 0.10
(AT&T - Existing)			0.00						
P90-14-XLH-RR w/ Pipe Mount	C	From Face	1.00 -2.00	0.0000	167.00	No Ice 1/2" Ice	5.60 5.99	4.27 4.88	0.06 0.10
(AT&T - Existing)			0.00						
(2) TT08-19DB111-001 TMA	A	From Face	1.00 0.00	0.0000	167.00	No Ice 1/2" Ice	0.00 0.00	0.00 0.00	0.02 0.03
(AT&T - Existing)			0.00						
(2) TT08-19DB111-001 TMA	B	From Face	1.00 0.00	0.0000	167.00	No Ice 1/2" Ice	0.00 0.00	0.00 0.00	0.02 0.03
(AT&T - Existing)			0.00						
(2) TT08-19DB111-001 TMA	C	From Face	1.00 0.00	0.0000	167.00	No Ice 1/2" Ice	0.00 0.00	0.00 0.00	0.02 0.03
(AT&T - Existing)			0.00						
AM-X-CD-17-65-00T-RET	A	From Face	1.00 2.00	0.0000	167.00	No Ice 1/2" Ice	11.31 11.93	6.80 7.38	0.06 0.12
(AT&T - Existing)			0.00						
800-10764	B	From Face	1.00 2.00	0.0000	167.00	No Ice 1/2" Ice	6.33 6.77	3.39 3.74	0.04 0.08
(AT&T - Existing)			0.00						
800-10764	C	From Face	1.00 2.00	0.0000	167.00	No Ice 1/2" Ice	6.33 6.77	3.39 3.74	0.04 0.08
(AT&T - Existing)			0.00						
(2) RRUS-11	A	From Face	0.50 0.00	0.0000	162.00	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	0.05 0.07
(AT&T - Existing)			0.00						
(2) RRUS-11	B	From Face	0.50 0.00	0.0000	162.00	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	0.05 0.07
(AT&T - Existing)			0.00						
(2) RRUS-11	C	From Face	0.50 0.00	0.0000	162.00	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	0.05 0.07
(AT&T - Existing)			0.00						
DC6-48-60-18-8F Surge Arrestor	C	From Face	0.50 0.00	0.0000	162.00	No Ice 1/2" Ice	2.23 2.45	2.23 2.45	0.02 0.04
(AT&T - Existing)			0.00						
Site-Pro Double Support Arm	C	None		0.0000	167.00	No Ice 1/2" Ice	1.75 1.94	1.75 1.94	0.35 0.45
(AT&T - Existing)									
DBXNH-6565A-VTM	A	From Face	1.00 0.00	0.0000	157.00	No Ice 1/2" Ice	5.89 6.30	3.53 3.89	0.04 0.07
(Verizon - Existing)			0.00						
DBXNH-6565A-VTM	B	From Face	1.00 0.00	0.0000	157.00	No Ice 1/2" Ice	5.89 6.30	3.53 3.89	0.04 0.07
(Verizon - Existing)			0.00						
DBXNH-6565A-VTM	C	From Face	1.00 0.00	0.0000	157.00	No Ice 1/2" Ice	5.89 6.30	3.53 3.89	0.04 0.07
(Verizon - Existing)			0.00						
Valmont Uni-Tri Bracket	C	None		0.0000	157.00	No Ice	1.75	1.75	0.29

tnxTower	Job: 13075.031 - Washington North	Page: 6 of 36
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project: 160' EEI Monopole - 6 Mountain Rd., Washington, CT	Date: 14:09:34 09/19/13
	Client: Verizon Wireless	Designed by: TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(Verizon - Existing)						1/2" Ice	1.94	1.94	0.31
BXA-70063/6CF	A	From Face	1.00	0.0000	147.00	No Ice	7.73	4.16	0.02
(Verizon - Proposed)			0.00			1/2" Ice	8.27	4.60	0.06
			0.00						
BXA-70063/6CF	B	From Face	1.00	0.0000	147.00	No Ice	7.73	4.16	0.02
(Verizon - Existing)			0.00			1/2" Ice	8.27	4.60	0.06
			0.00						
BXA-70063/6CF	C	From Face	1.00	0.0000	147.00	No Ice	7.73	4.16	0.02
(Verizon - Existing)			0.00			1/2" Ice	8.27	4.60	0.06
			0.00						
Valmont Uni-Tri Bracket	C	None		0.0000	147.00	No Ice	1.75	1.75	0.29
(Verizon - Existing)						1/2" Ice	1.94	1.94	0.31
APX16DWV-16DWV-S-E-A	A	From Face	1.00	0.0000	127.00	No Ice	6.70	2.00	0.04
CU			0.00			1/2" Ice	7.13	2.33	0.07
(T-Mobile - Reserved)			0.00						
APX16DWV-16DWV-S-E-A	B	From Face	1.00	0.0000	127.00	No Ice	6.70	2.00	0.04
CU			0.00			1/2" Ice	7.13	2.33	0.07
(T-Mobile - Reserved)			0.00						
APX16DWV-16DWV-S-E-A	C	From Face	1.00	0.0000	127.00	No Ice	6.70	2.00	0.04
CU			0.00			1/2" Ice	7.13	2.33	0.07
(T-Mobile - Reserved)			0.00						
(2) DTMA-1819-DD-12	A	From Face	0.50	0.0000	127.00	No Ice	0.00	0.00	0.01
(T-Mobile - Reserved)			0.00			1/2" Ice	0.00	0.00	0.02
			0.00						
(2) DTMA-1819-DD-12	B	From Face	0.50	0.0000	127.00	No Ice	0.00	0.00	0.01
(T-Mobile - Reserved)			0.00			1/2" Ice	0.00	0.00	0.02
			0.00						
(2) DTMA-1819-DD-12	C	From Face	0.50	0.0000	127.00	No Ice	0.00	0.00	0.01
(T-Mobile - Reserved)			0.00			1/2" Ice	0.00	0.00	0.02
			0.00						
Valmont Uni-Tri Bracket	C	None		0.0000	127.00	No Ice	1.75	1.75	0.29
(T-Mobile - Reserved)						1/2" Ice	1.94	1.94	0.31
5' Panel Antenna	A	From Face	1.00	0.0000	117.00	No Ice	7.00	2.29	0.02
(Future Carrier)			0.00			1/2" Ice	7.47	2.65	0.06
			0.00						
5' Panel Antenna	B	From Face	1.00	0.0000	117.00	No Ice	7.00	2.29	0.02
(Future Carrier)			0.00			1/2" Ice	7.47	2.65	0.06
			0.00						
5' Panel Antenna	C	From Face	1.00	0.0000	117.00	No Ice	7.00	2.29	0.02
(Future Carrier)			0.00			1/2" Ice	7.47	2.65	0.06
			0.00						
Valmont Uni-Tri Bracket	C	None		0.0000	117.00	No Ice	1.75	1.75	0.29
(Future Carrier)						1/2" Ice	1.94	1.94	0.31
5' Panel Antenna	A	From Face	1.00	0.0000	107.00	No Ice	7.00	2.29	0.02
(Future Carrier)			0.00			1/2" Ice	7.47	2.65	0.06
			0.00						
5' Panel Antenna	B	From Face	1.00	0.0000	107.00	No Ice	7.00	2.29	0.02
(Future Carrier)			0.00			1/2" Ice	7.47	2.65	0.06
			0.00						
5' Panel Antenna	C	From Face	1.00	0.0000	107.00	No Ice	7.00	2.29	0.02
(Future Carrier)			0.00			1/2" Ice	7.47	2.65	0.06
			0.00						
Valmont Uni-Tri Bracket	C	None		0.0000	107.00	No Ice	1.75	1.75	0.29
(Future Carrier)						1/2" Ice	1.94	1.94	0.31

Tower Pressures - No Ice

$G_H = 1.690$

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 160.00-141.37	150.40	1.542	0	30.732	A	0.000	30.732	30.732	100.00	0.000	0.000
					B	0.000	30.732		100.00	0.000	0.000
					C	0.000	30.732		100.00	0.000	28.322
L2 141.37-108.83	124.56	1.462	0	65.900	A	0.000	65.900	65.900	100.00	0.000	0.000
					B	0.000	65.900		100.00	0.000	0.000
					C	0.000	65.900		100.00	0.000	30.749
L3 108.83-93.83	101.21	1.377	0	36.024	A	0.000	36.024	36.024	100.00	0.000	0.000
					B	0.000	36.024		100.00	0.000	0.000
					C	0.000	36.024		100.00	0.000	5.940
L4 93.83-77.28	85.42	1.312	0	43.012	A	0.000	43.012	43.012	100.00	0.000	0.000
					B	0.000	43.012		100.00	0.000	0.000
					C	0.000	43.012		100.00	0.000	6.552
L5 77.28-47.28	61.86	1.197	0	89.245	A	0.000	89.245	89.245	100.00	0.000	0.000
					B	0.000	89.245		100.00	0.000	0.000
					C	0.000	89.245		100.00	0.000	11.880
L6 47.28-1.00	23.45	1	0	164.051	A	0.000	164.051	164.051	100.00	0.000	0.000
					B	0.000	164.051		100.00	0.000	0.000
					C	0.000	164.051		100.00	0.000	17.140

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 160.00-141.37	150.40	1.542	0	0.5000	32.284	A	0.000	32.284	32.284	100.00	0.000	0.000
						B	0.000	32.284		100.00	0.000	0.000
						C	0.000	32.284		100.00	0.000	42.625
L2 141.37-108.83	124.56	1.462	0	0.5000	68.612	A	0.000	68.612	68.612	100.00	0.000	0.000
						B	0.000	68.612		100.00	0.000	0.000
						C	0.000	68.612		100.00	0.000	46.279
L3 108.83-93.83	101.21	1.377	0	0.5000	37.274	A	0.000	37.274	37.274	100.00	0.000	0.000
						B	0.000	37.274		100.00	0.000	0.000
						C	0.000	37.274		100.00	0.000	8.940
L4 93.83-77.28	85.42	1.312	0	0.5000	44.391	A	0.000	44.391	44.391	100.00	0.000	0.000
						B	0.000	44.391		100.00	0.000	0.000
						C	0.000	44.391		100.00	0.000	9.862
L5 77.28-47.28	61.86	1.197	0	0.5000	91.745	A	0.000	91.745	91.745	100.00	0.000	0.000
						B	0.000	91.745		100.00	0.000	0.000
						C	0.000	91.745		100.00	0.000	17.880
L6 47.28-1.00	23.45	1	0	0.5000	167.908	A	0.000	167.908	167.908	100.00	0.000	0.000
						B	0.000	167.908		100.00	0.000	0.000
						C	0.000	167.908		100.00	0.000	25.797

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	150.40	1.542	0	30.732	A	0.000	30.732	30.732	100.00	0.000	0.000
160.00-141.37					B	0.000	30.732		100.00	0.000	0.000
					C	0.000	30.732		100.00	0.000	28.322
L2	124.56	1.462	0	65.900	A	0.000	65.900	65.900	100.00	0.000	0.000
141.37-108.83					B	0.000	65.900		100.00	0.000	0.000
					C	0.000	65.900		100.00	0.000	30.749
L3	101.21	1.377	0	36.024	A	0.000	36.024	36.024	100.00	0.000	0.000
108.83-93.83					B	0.000	36.024		100.00	0.000	0.000
					C	0.000	36.024		100.00	0.000	5.940
L4 93.83-77.28	85.42	1.312	0	43.012	A	0.000	43.012	43.012	100.00	0.000	0.000
					B	0.000	43.012		100.00	0.000	0.000
					C	0.000	43.012		100.00	0.000	6.552
L5 77.28-47.28	61.86	1.197	0	89.245	A	0.000	89.245	89.245	100.00	0.000	0.000
					B	0.000	89.245		100.00	0.000	0.000
					C	0.000	89.245		100.00	0.000	11.880
L6 47.28-1.00	23.45	1	0	164.051	A	0.000	164.051	164.051	100.00	0.000	0.000
					B	0.000	164.051		100.00	0.000	0.000
					C	0.000	164.051		100.00	0.000	17.140

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.48	0.74	A	1	0.65	1	1	1	30.732	2.06	110.72	C
160.00-141.37			B	1	0.65	1	1	1	30.732			
			C	1	0.65	1	1	1	30.732			
L2	1.22	1.73	A	1	0.65	1	1	1	65.900	2.98	91.44	C
141.37-108.83			B	1	0.65	1	1	1	65.900			
			C	1	0.65	1	1	1	65.900			
L3	0.75	1.16	A	1	0.65	1	1	1	36.024	1.12	74.64	C
108.83-93.83			B	1	0.65	1	1	1	36.024			
			C	1	0.65	1	1	1	36.024			
L4	0.84	1.72	A	1	0.65	1	1	1	43.012	1.25	75.78	C
93.83-77.28			B	1	0.65	1	1	1	43.012			
			C	1	0.65	1	1	1	43.012			
L5	1.53	3.44	A	1	0.65	1	1	1	89.245	2.32	77.19	C
77.28-47.28			B	1	0.65	1	1	1	89.245			
			C	1	0.65	1	1	1	89.245			
L6 47.28-1.00	2.21	7.28	A	1	0.65	1	1	1	164.051	3.46	74.79	C
			B	1	0.65	1	1	1	164.051			
			C	1	0.65	1	1	1	164.051			
Sum Weight:	7.04	16.06						OTM	1112.55 kip-ft	13.19		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.48	0.74	A	1	0.65	1	1	1	30.732	2.06	110.72	C
160.00-141.37			B	1	0.65	1	1	1	30.732			
			C	1	0.65	1	1	1	30.732			
L2	1.22	1.73	A	1	0.65	1	1	1	65.900	2.98	91.44	C
141.37-108.83			B	1	0.65	1	1	1	65.900			
			C	1	0.65	1	1	1	65.900			
L3	0.75	1.16	A	1	0.65	1	1	1	36.024	1.12	74.64	C
108.83-93.83			B	1	0.65	1	1	1	36.024			
			C	1	0.65	1	1	1	36.024			
L4	0.84	1.72	A	1	0.65	1	1	1	43.012	1.25	75.78	C
93.83-77.28			B	1	0.65	1	1	1	43.012			
			C	1	0.65	1	1	1	43.012			
L5	1.53	3.44	A	1	0.65	1	1	1	89.245	2.32	77.19	C
77.28-47.28			B	1	0.65	1	1	1	89.245			
			C	1	0.65	1	1	1	89.245			
L6 47.28-1.00	2.21	7.28	A	1	0.65	1	1	1	164.051	3.46	74.79	C
			B	1	0.65	1	1	1	164.051			
			C	1	0.65	1	1	1	164.051			
Sum Weight:	7.04	16.06						OTM	1112.55 kip-ft	13.19		

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 plf	Ctrl. Face
L1	0.48	0.74	A	1	0.65	1	1	1	30.732	2.06	110.72	C
160.00-141.37			B	1	0.65	1	1	1	30.732			
			C	1	0.65	1	1	1	30.732			
L2	1.22	1.73	A	1	0.65	1	1	1	65.900	2.98	91.44	C
141.37-108.83			B	1	0.65	1	1	1	65.900			
			C	1	0.65	1	1	1	65.900			
L3	0.75	1.16	A	1	0.65	1	1	1	36.024	1.12	74.64	C
108.83-93.83			B	1	0.65	1	1	1	36.024			
			C	1	0.65	1	1	1	36.024			
L4	0.84	1.72	A	1	0.65	1	1	1	43.012	1.25	75.78	C
93.83-77.28			B	1	0.65	1	1	1	43.012			
			C	1	0.65	1	1	1	43.012			
L5	1.53	3.44	A	1	0.65	1	1	1	89.245	2.32	77.19	C
77.28-47.28			B	1	0.65	1	1	1	89.245			
			C	1	0.65	1	1	1	89.245			
L6 47.28-1.00	2.21	7.28	A	1	0.65	1	1	1	164.051	3.46	74.79	C
			B	1	0.65	1	1	1	164.051			
			C	1	0.65	1	1	1	164.051			
Sum Weight:	7.04	16.06						OTM	1112.55 kip-ft	13.19		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.48	0.74	A	1	0.65	1	1	1	30.732	2.06	110.72	C
160.00-141.37			B	1	0.65	1	1	1	30.732			
			C	1	0.65	1	1	1	30.732			
L2	1.22	1.73	A	1	0.65	1	1	1	65.900	2.98	91.44	C
141.37-108.83			B	1	0.65	1	1	1	65.900			
			C	1	0.65	1	1	1	65.900			
L3	0.75	1.16	A	1	0.65	1	1	1	36.024	1.12	74.64	C
108.83-93.83			B	1	0.65	1	1	1	36.024			
			C	1	0.65	1	1	1	36.024			
L4	0.84	1.72	A	1	0.65	1	1	1	43.012	1.25	75.78	C
93.83-77.28			B	1	0.65	1	1	1	43.012			
			C	1	0.65	1	1	1	43.012			
L5	1.53	3.44	A	1	0.65	1	1	1	89.245	2.32	77.19	C
77.28-47.28			B	1	0.65	1	1	1	89.245			
			C	1	0.65	1	1	1	89.245			
L6 47.28-1.00	2.21	7.28	A	1	0.65	1	1	1	164.051	3.46	74.79	C
			B	1	0.65	1	1	1	164.051			
			C	1	0.65	1	1	1	164.051			
Sum Weight:	7.04	16.06						OTM	1112.55 kip-ft	13.19		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.99	0.97	A	1	0.65	1	1	1	32.284	2.04	109.37	C
160.00-141.37			B	1	0.65	1	1	1	32.284			
			C	1	0.65	1	1	1	32.284			
L2	1.89	2.22	A	1	0.65	1	1	1	68.612	2.76	84.70	C
141.37-108.83			B	1	0.65	1	1	1	68.612			
			C	1	0.65	1	1	1	68.612			
L3	1.05	1.43	A	1	0.65	1	1	1	37.274	0.95	63.25	C
108.83-93.83			B	1	0.65	1	1	1	37.274			
			C	1	0.65	1	1	1	37.274			
L4	1.17	2.05	A	1	0.65	1	1	1	44.391	1.06	63.76	C
93.83-77.28			B	1	0.65	1	1	1	44.391			
			C	1	0.65	1	1	1	44.391			
L5	2.12	4.11	A	1	0.65	1	1	1	91.745	1.93	64.21	C
77.28-47.28			B	1	0.65	1	1	1	91.745			
			C	1	0.65	1	1	1	91.745			
L6 47.28-1.00	3.05	8.51	A	1	0.65	1	1	1	167.908	2.83	61.15	C
			B	1	0.65	1	1	1	167.908			
			C	1	0.65	1	1	1	167.908			
Sum Weight:	10.26	19.29						OTM	1009.88 kip-ft	11.55		

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 ft²	F K	w plf	Ctrl. Face
L1	0.99	0.97	A	1	0.65	1	1	1	32.284	2.04	109.37	C
160.00-141.37			B	1	0.65	1	1	1	32.284			
			C	1	0.65	1	1	1	32.284			
L2	1.89	2.22	A	1	0.65	1	1	1	68.612	2.76	84.70	C
141.37-108.83			B	1	0.65	1	1	1	68.612			
			C	1	0.65	1	1	1	68.612			
L3	1.05	1.43	A	1	0.65	1	1	1	37.274	0.95	63.25	C
108.83-93.83			B	1	0.65	1	1	1	37.274			
			C	1	0.65	1	1	1	37.274			
L4	1.17	2.05	A	1	0.65	1	1	1	44.391	1.06	63.76	C
93.83-77.28			B	1	0.65	1	1	1	44.391			
			C	1	0.65	1	1	1	44.391			
L5	2.12	4.11	A	1	0.65	1	1	1	91.745	1.93	64.21	C
77.28-47.28			B	1	0.65	1	1	1	91.745			
			C	1	0.65	1	1	1	91.745			
L6 47.28-1.00	3.05	8.51	A	1	0.65	1	1	1	167.908	2.83	61.15	C
			B	1	0.65	1	1	1	167.908			
			C	1	0.65	1	1	1	167.908			
Sum Weight:	10.26	19.29						OTM	1009.88 kip-ft	11.55		

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 ft²	F K	w plf	Ctrl. Face
L1	0.99	0.97	A	1	0.65	1	1	1	32.284	2.04	109.37	C
160.00-141.37			B	1	0.65	1	1	1	32.284			
			C	1	0.65	1	1	1	32.284			
L2	1.89	2.22	A	1	0.65	1	1	1	68.612	2.76	84.70	C
141.37-108.83			B	1	0.65	1	1	1	68.612			
			C	1	0.65	1	1	1	68.612			
L3	1.05	1.43	A	1	0.65	1	1	1	37.274	0.95	63.25	C
108.83-93.83			B	1	0.65	1	1	1	37.274			
			C	1	0.65	1	1	1	37.274			
L4	1.17	2.05	A	1	0.65	1	1	1	44.391	1.06	63.76	C
93.83-77.28			B	1	0.65	1	1	1	44.391			
			C	1	0.65	1	1	1	44.391			
L5	2.12	4.11	A	1	0.65	1	1	1	91.745	1.93	64.21	C
77.28-47.28			B	1	0.65	1	1	1	91.745			
			C	1	0.65	1	1	1	91.745			
L6 47.28-1.00	3.05	8.51	A	1	0.65	1	1	1	167.908	2.83	61.15	C
			B	1	0.65	1	1	1	167.908			
			C	1	0.65	1	1	1	167.908			
Sum Weight:	10.26	19.29						OTM	1009.88 kip-ft	11.55		

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 ft²	F K	w plf	Ctrl. Face
L1	0.99	0.97	A	1	0.65	1	1	1	32.284	2.04	109.37	C
160.00-141.37			B	1	0.65	1	1	1	32.284			
			C	1	0.65	1	1	1	32.284			
L2	1.89	2.22	A	1	0.65	1	1	1	68.612	2.76	84.70	C
141.37-108.83			B	1	0.65	1	1	1	68.612			
			C	1	0.65	1	1	1	68.612			
L3	1.05	1.43	A	1	0.65	1	1	1	37.274	0.95	63.25	C
108.83-93.83			B	1	0.65	1	1	1	37.274			
			C	1	0.65	1	1	1	37.274			
L4	1.17	2.05	A	1	0.65	1	1	1	44.391	1.06	63.76	C
93.83-77.28			B	1	0.65	1	1	1	44.391			
			C	1	0.65	1	1	1	44.391			
L5	2.12	4.11	A	1	0.65	1	1	1	91.745	1.93	64.21	C
77.28-47.28			B	1	0.65	1	1	1	91.745			
			C	1	0.65	1	1	1	91.745			
L6 47.28-1.00	3.05	8.51	A	1	0.65	1	1	1	167.908	2.83	61.15	C
			B	1	0.65	1	1	1	167.908			
			C	1	0.65	1	1	1	167.908			
Sum Weight:	10.26	19.29						OTM	1009.88 kip-ft	11.55		

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 ft²	F K	w plf	Ctrl. Face
L1	0.48	0.74	A	1	0.65	1	1	1	30.732	0.81	43.25	C
160.00-141.37			B	1	0.65	1	1	1	30.732			
			C	1	0.65	1	1	1	30.732			
L2	1.22	1.73	A	1	0.65	1	1	1	65.900	1.16	35.72	C
141.37-108.83			B	1	0.65	1	1	1	65.900			
			C	1	0.65	1	1	1	65.900			
L3	0.75	1.16	A	1	0.65	1	1	1	36.024	0.44	29.16	C
108.83-93.83			B	1	0.65	1	1	1	36.024			
			C	1	0.65	1	1	1	36.024			
L4	0.84	1.72	A	1	0.65	1	1	1	43.012	0.49	29.60	C
93.83-77.28			B	1	0.65	1	1	1	43.012			
			C	1	0.65	1	1	1	43.012			
L5	1.53	3.44	A	1	0.65	1	1	1	89.245	0.90	30.15	C
77.28-47.28			B	1	0.65	1	1	1	89.245			
			C	1	0.65	1	1	1	89.245			
L6 47.28-1.00	2.21	7.28	A	1	0.65	1	1	1	164.051	1.35	29.21	C
			B	1	0.65	1	1	1	164.051			
			C	1	0.65	1	1	1	164.051			
Sum Weight:	7.04	16.06						OTM	434.59 kip-ft	5.15		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.48	0.74	A	1	0.65	1	1	1	30.732	0.81	43.25	C
160.00-141.37			B	1	0.65	1	1	1	30.732			
			C	1	0.65	1	1	1	30.732			
L2	1.22	1.73	A	1	0.65	1	1	1	65.900	1.16	35.72	C
141.37-108.83			B	1	0.65	1	1	1	65.900			
			C	1	0.65	1	1	1	65.900			
L3	0.75	1.16	A	1	0.65	1	1	1	36.024	0.44	29.16	C
108.83-93.83			B	1	0.65	1	1	1	36.024			
			C	1	0.65	1	1	1	36.024			
L4	0.84	1.72	A	1	0.65	1	1	1	43.012	0.49	29.60	C
93.83-77.28			B	1	0.65	1	1	1	43.012			
			C	1	0.65	1	1	1	43.012			
L5	1.53	3.44	A	1	0.65	1	1	1	89.245	0.90	30.15	C
77.28-47.28			B	1	0.65	1	1	1	89.245			
			C	1	0.65	1	1	1	89.245			
L6 47.28-1.00	2.21	7.28	A	1	0.65	1	1	1	164.051	1.35	29.21	C
			B	1	0.65	1	1	1	164.051			
			C	1	0.65	1	1	1	164.051			
Sum Weight:	7.04	16.06						OTM	434.59 kip-ft	5.15		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.48	0.74	A	1	0.65	1	1	1	30.732	0.81	43.25	C
160.00-141.37			B	1	0.65	1	1	1	30.732			
			C	1	0.65	1	1	1	30.732			
L2	1.22	1.73	A	1	0.65	1	1	1	65.900	1.16	35.72	C
141.37-108.83			B	1	0.65	1	1	1	65.900			
			C	1	0.65	1	1	1	65.900			
L3	0.75	1.16	A	1	0.65	1	1	1	36.024	0.44	29.16	C
108.83-93.83			B	1	0.65	1	1	1	36.024			
			C	1	0.65	1	1	1	36.024			
L4	0.84	1.72	A	1	0.65	1	1	1	43.012	0.49	29.60	C
93.83-77.28			B	1	0.65	1	1	1	43.012			
			C	1	0.65	1	1	1	43.012			
L5	1.53	3.44	A	1	0.65	1	1	1	89.245	0.90	30.15	C
77.28-47.28			B	1	0.65	1	1	1	89.245			
			C	1	0.65	1	1	1	89.245			
L6 47.28-1.00	2.21	7.28	A	1	0.65	1	1	1	164.051	1.35	29.21	C
			B	1	0.65	1	1	1	164.051			
			C	1	0.65	1	1	1	164.051			
Sum Weight:	7.04	16.06						OTM	434.59 kip-ft	5.15		

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 ft²	F K	w plf	Ctrl. Face
L1	0.48	0.74	A	1	0.65	1	1	1	30.732	0.81	43.25	C
160.00-141.37			B	1	0.65	1	1	1	30.732			
			C	1	0.65	1	1	1	30.732			
L2	1.22	1.73	A	1	0.65	1	1	1	65.900	1.16	35.72	C
141.37-108.83			B	1	0.65	1	1	1	65.900			
			C	1	0.65	1	1	1	65.900			
L3	0.75	1.16	A	1	0.65	1	1	1	36.024	0.44	29.16	C
108.83-93.83			B	1	0.65	1	1	1	36.024			
			C	1	0.65	1	1	1	36.024			
L4	0.84	1.72	A	1	0.65	1	1	1	43.012	0.49	29.60	C
93.83-77.28			B	1	0.65	1	1	1	43.012			
			C	1	0.65	1	1	1	43.012			
L5	1.53	3.44	A	1	0.65	1	1	1	89.245	0.90	30.15	C
77.28-47.28			B	1	0.65	1	1	1	89.245			
			C	1	0.65	1	1	1	89.245			
L6 47.28-1.00	2.21	7.28	A	1	0.65	1	1	1	164.051	1.35	29.21	C
			B	1	0.65	1	1	1	164.051			
			C	1	0.65	1	1	1	164.051			
Sum Weight:	7.04	16.06						OTM	434.59 kip-ft	5.15		

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	16.06					
Bracing Weight	0.00					
Total Member Self-Weight	16.06			1.44	2.56	
Total Weight	26.72			1.44	2.56	
Wind 0 deg - No Ice		-0.03	-19.49	-2037.38	7.51	-0.69
Wind 30 deg - No Ice		9.74	-16.87	-1761.75	-1015.42	-0.59
Wind 45 deg - No Ice		13.79	-13.76	-1436.72	-1439.65	-0.48
Wind 60 deg - No Ice		16.90	-9.72	-1013.67	-1765.59	-0.34
Wind 90 deg - No Ice		19.53	0.03	6.40	-2041.99	0.00
Wind 120 deg - No Ice		16.93	9.77	1025.15	-1770.55	0.35
Wind 135 deg - No Ice		13.83	13.80	1446.61	-1446.66	0.49
Wind 150 deg - No Ice		9.79	16.90	1769.59	-1024.01	0.60
Wind 180 deg - No Ice		0.03	19.49	2040.26	-2.40	0.69
Wind 210 deg - No Ice		-9.74	16.87	1764.63	1020.54	0.59
Wind 225 deg - No Ice		-13.79	13.76	1439.60	1444.76	0.48
Wind 240 deg - No Ice		-16.90	9.72	1016.56	1770.70	0.34
Wind 270 deg - No Ice		-19.53	-0.03	-3.51	2047.10	-0.00
Wind 300 deg - No Ice		-16.93	-9.77	-1022.26	1775.66	-0.35
Wind 315 deg - No Ice		-13.83	-13.80	-1443.73	1451.77	-0.49
Wind 330 deg - No Ice		-9.79	-16.90	-1766.71	1029.12	-0.60
Member Ice	3.23					
Total Weight Ice	34.59			3.52	6.23	
Wind 0 deg - Ice		-0.02	-16.68	-1758.49	9.81	-0.80
Wind 30 deg - Ice		8.33	-14.43	-1520.63	-873.74	-0.62
Wind 45 deg - Ice		11.79	-11.78	-1239.88	-1240.09	-0.46
Wind 60 deg - Ice		14.45	-8.32	-874.38	-1521.51	-0.27
Wind 90 deg - Ice		16.70	0.02	7.10	-1759.92	0.16
Wind 120 deg - Ice		14.47	8.36	887.62	-1525.09	0.54
Wind 135 deg - Ice		11.82	11.81	1251.98	-1245.16	0.68

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
Wind 150 deg - Ice		8.37	14.45	1531.25	-879.95	0.77
Wind 180 deg - Ice		0.02	16.68	1765.52	2.64	0.80
Wind 210 deg - Ice		-8.33	14.43	1527.66	886.19	0.62
Wind 225 deg - Ice		-11.79	11.78	1246.91	1252.54	0.46
Wind 240 deg - Ice		-14.45	8.32	881.41	1533.96	0.27
Wind 270 deg - Ice		-16.70	-0.02	-0.07	1772.37	-0.16
Wind 300 deg - Ice		-14.47	-8.36	-880.59	1537.54	-0.54
Wind 315 deg - Ice		-11.82	-11.81	-1244.95	1257.61	-0.68
Wind 330 deg - Ice		-8.37	-14.45	-1524.22	892.40	-0.77
Total Weight	26.63			1.44	2.56	
Wind 0 deg - Service		-0.01	-7.47	-773.19	1.95	-0.27
Wind 30 deg - Service		3.73	-6.47	-668.64	-386.01	-0.23
Wind 45 deg - Service		5.28	-5.28	-545.37	-546.91	-0.19
Wind 60 deg - Service		6.48	-3.73	-384.93	-670.54	-0.13
Wind 90 deg - Service		7.49	0.01	1.91	-775.39	0.00
Wind 120 deg - Service		6.49	3.75	388.23	-672.48	0.13
Wind 135 deg - Service		5.30	5.29	548.05	-549.65	0.19
Wind 150 deg - Service		3.75	6.48	670.52	-389.37	0.23
Wind 180 deg - Service		0.01	7.47	773.14	-1.93	0.27
Wind 210 deg - Service		-3.73	6.47	668.59	386.03	0.23
Wind 225 deg - Service		-5.28	5.28	545.32	546.93	0.19
Wind 240 deg - Service		-6.48	3.73	384.88	670.56	0.13
Wind 270 deg - Service		-7.49	-0.01	-1.96	775.41	-0.00
Wind 300 deg - Service		-6.49	-3.75	-388.29	672.50	-0.13
Wind 315 deg - Service		-5.30	-5.29	-548.11	549.67	-0.19
Wind 330 deg - Service		-3.75	-6.48	-670.58	389.39	-0.23

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

Comb. No.	Description
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	160 - 141.37	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-5.07	0.56	-0.25
			Max. Mx	14	-2.56	90.40	0.55
			Max. My	10	-2.57	-0.47	-89.49
			Max. Vy	14	-6.60	90.40	0.55
			Max. Vx	10	6.56	-0.47	-89.49
			Max. Torque	14			-0.41
		Pole Antenna	Max Tension	47	0.00	-0.00	-0.00
			Max. Compression	18	-0.58	0.00	-0.00
			Max. Mx	14	-0.43	2.33	0.00
			Max. My	10	-0.43	-0.00	-2.33
			Max. Vy	14	-0.47	2.33	0.00
			Max. Vx	10	0.47	-0.00	-2.33
			Max. Torque	39			0.00
L2	141.37 - 108.83	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-10.64	1.79	-0.95
			Max. Mx	14	-6.30	408.93	1.44
			Max. My	10	-6.30	-1.13	-406.52
			Max. Vy	14	-11.48	408.93	1.44
			Max. Vx	10	11.44	-1.13	-406.52
			Max. Torque	19			0.46
L3	108.83 - 93.83	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-12.87	2.20	-1.19
			Max. Mx	14	-7.99	541.46	1.69
			Max. My	10	-8.00	-1.31	-538.59
			Max. Vy	14	-12.94	541.46	1.69
			Max. Vx	10	12.90	-1.31	-538.59

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Torque	19			0.49
L4	93.83 - 77.2833	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-16.81	3.05	-1.68
			Max. Mx	14	-11.29	829.35	2.18
			Max. My	10	-11.30	-1.65	-825.56
			Max. Vy	14	-14.56	829.35	2.18
			Max. Vx	10	14.53	-1.65	-825.56
			Max. Torque	19			0.56
L5	77.2833 - 47.2833	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-21.86	4.19	-2.33
			Max. Mx	14	-15.58	1209.12	2.71
			Max. My	10	-15.59	-1.98	-1204.23
			Max. Vy	14	-16.33	1209.12	2.71
			Max. Vx	10	16.29	-1.98	-1204.23
			Max. Torque	19			0.64
L6	47.2833 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-34.59	6.66	-3.76
			Max. Mx	14	-26.70	2140.31	3.72
			Max. My	10	-26.70	-2.56	-2133.14
			Max. Vy	14	-19.55	2140.31	3.72
			Max. Vx	10	19.52	-2.56	-2133.14
			Max. Torque	19			0.80

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	34.59	16.70	0.02
	Max. H_x	14	26.72	19.53	0.03
	Max. H_z	2	26.72	0.03	19.49
	Max. M_x	2	2130.14	0.03	19.49
	Max. M_z	6	2134.98	-19.53	-0.03
	Max. Torsion	19	0.80	0.02	16.68
	Min. Vert	1	26.72	0.00	0.00
	Min. H_x	6	26.72	-19.53	-0.03
	Min. H_z	10	26.72	-0.03	-19.49
	Min. M_x	10	-2133.14	-0.03	-19.49
	Min. M_z	14	-2140.31	19.53	0.03
	Min. Torsion	27	-0.77	-0.02	-16.68

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	26.72	-0.00	0.00	1.49	2.64	0.00
Dead+Wind 0 deg - No Ice	26.72	-0.03	-19.49	-2130.14	7.92	-0.70
Dead+Wind 30 deg - No Ice	26.72	9.74	-16.87	-1841.95	-1061.65	-0.58
Dead+Wind 45 deg - No Ice	26.72	13.79	-13.76	-1502.10	-1505.21	-0.46
Dead+Wind 60 deg - No Ice	26.72	16.90	-9.72	-1059.77	-1846.01	-0.31

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+Wind 90 deg - No Ice	26.72	19.53	0.03	6.75	-2134.98	0.02
Dead+Wind 120 deg - No Ice	26.72	16.93	9.77	1071.84	-1851.18	0.34
Dead+Wind 135 deg - No Ice	26.72	13.83	13.80	1512.47	-1512.56	0.46
Dead+Wind 150 deg - No Ice	26.72	9.79	16.90	1850.15	-1070.68	0.56
Dead+Wind 180 deg - No Ice	26.72	0.03	19.49	2133.14	-2.56	0.65
Dead+Wind 210 deg - No Ice	26.72	-9.74	16.87	1844.96	1066.99	0.58
Dead+Wind 225 deg - No Ice	26.72	-13.79	13.76	1505.11	1510.55	0.49
Dead+Wind 240 deg - No Ice	26.72	-16.90	9.72	1062.79	1851.34	0.36
Dead+Wind 270 deg - No Ice	26.72	-19.53	-0.03	-3.72	2140.31	0.02
Dead+Wind 300 deg - No Ice	26.72	-16.93	-9.77	-1068.81	1856.53	-0.34
Dead+Wind 315 deg - No Ice	26.72	-13.83	-13.80	-1509.44	1517.92	-0.49
Dead+Wind 330 deg - No Ice	26.72	-9.79	-16.90	-1847.12	1076.04	-0.61
Dead+Ice+Temp	34.59	-0.00	0.00	3.76	6.66	0.00
Dead+Wind 0 deg+Ice+Temp	34.59	-0.02	-16.68	-1875.12	10.56	-0.80
Dead+Wind 30 deg+Ice+Temp	34.59	8.33	-14.43	-1621.47	-931.66	-0.61
Dead+Wind 45 deg+Ice+Temp	34.59	11.79	-11.78	-1322.07	-1322.34	-0.45
Dead+Wind 60 deg+Ice+Temp	34.59	14.45	-8.32	-932.32	-1622.44	-0.25
Dead+Wind 90 deg+Ice+Temp	34.59	16.70	0.02	7.65	-1876.68	0.16
Dead+Wind 120 deg+Ice+Temp	34.59	14.47	8.36	946.55	-1626.28	0.52
Dead+Wind 135 deg+Ice+Temp	34.59	11.82	11.81	1335.05	-1327.78	0.65
Dead+Wind 150 deg+Ice+Temp	34.59	8.37	14.45	1632.83	-938.35	0.74
Dead+Wind 180 deg+Ice+Temp	34.59	0.02	16.68	1882.62	2.79	0.77
Dead+Wind 210 deg+Ice+Temp	34.59	-8.33	14.43	1628.96	944.98	0.61
Dead+Wind 225 deg+Ice+Temp	34.59	-11.79	11.78	1329.57	1335.65	0.46
Dead+Wind 240 deg+Ice+Temp	34.59	-14.45	8.32	939.83	1635.74	0.28
Dead+Wind 270 deg+Ice+Temp	34.59	-16.70	-0.02	-0.11	1889.98	-0.13
Dead+Wind 300 deg+Ice+Temp	34.59	-14.47	-8.36	-939.00	1639.60	-0.52
Dead+Wind 315 deg+Ice+Temp	34.59	-11.82	-11.81	-1327.51	1341.12	-0.67
Dead+Wind 330 deg+Ice+Temp	34.59	-8.37	-14.45	-1625.30	951.70	-0.77
Dead+Wind 0 deg - Service	26.72	-0.01	-7.47	-808.43	4.74	-0.27
Dead+Wind 30 deg - Service	26.72	3.73	-6.47	-698.89	-401.69	-0.23
Dead+Wind 45 deg - Service	26.72	5.28	-5.28	-569.75	-570.25	-0.19
Dead+Wind 60 deg - Service	26.72	6.48	-3.73	-401.68	-699.77	-0.13
Dead+Wind 90 deg - Service	26.72	7.49	0.01	3.57	-809.62	0.00
Dead+Wind 120 deg - Service	26.72	6.49	3.75	408.27	-701.82	0.13
Dead+Wind 135 deg - Service	26.72	5.30	5.29	575.69	-573.15	0.19
Dead+Wind 150 deg - Service	26.72	3.75	6.48	703.98	-405.24	0.23
Dead+Wind 180 deg - Service	26.72	0.01	7.47	811.46	0.64	0.26
Dead+Wind 210 deg - Service	26.72	-3.73	6.47	701.92	407.07	0.23
Dead+Wind 225 deg - Service	26.72	-5.28	5.28	572.78	575.63	0.19
Dead+Wind 240 deg - Service	26.72	-6.48	3.73	404.71	705.15	0.14
Dead+Wind 270 deg - Service	26.72	-7.49	-0.01	-0.53	815.00	0.00
Dead+Wind 300 deg - Service	26.72	-6.49	-3.75	-405.23	707.20	-0.13
Dead+Wind 315 deg - Service	26.72	-5.30	-5.29	-572.65	578.54	-0.19
Dead+Wind 330 deg - Service	26.72	-3.75	-6.48	-700.94	410.63	-0.23

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-26.72	0.00	0.00	26.72	0.00	0.000%
2	-0.03	-26.72	-19.49	0.03	26.72	19.49	0.000%
3	9.74	-26.72	-16.87	-9.74	26.72	16.87	0.000%
4	13.79	-26.72	-13.76	-13.79	26.72	13.76	0.000%
5	16.90	-26.72	-9.72	-16.90	26.72	9.72	0.000%
6	19.53	-26.72	0.03	-19.53	26.72	-0.03	0.000%
7	16.93	-26.72	9.77	-16.93	26.72	-9.77	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
8	13.83	-26.72	13.80	-13.83	26.72	-13.80	0.000%
9	9.79	-26.72	16.90	-9.79	26.72	-16.90	0.000%
10	0.03	-26.72	19.49	-0.03	26.72	-19.49	0.000%
11	-9.74	-26.72	16.87	9.74	26.72	-16.87	0.000%
12	-13.79	-26.72	13.76	13.79	26.72	-13.76	0.000%
13	-16.90	-26.72	9.72	16.90	26.72	-9.72	0.000%
14	-19.53	-26.72	-0.03	19.53	26.72	0.03	0.000%
15	-16.93	-26.72	-9.77	16.93	26.72	9.77	0.000%
16	-13.83	-26.72	-13.80	13.83	26.72	13.80	0.000%
17	-9.79	-26.72	-16.90	9.79	26.72	16.90	0.000%
18	0.00	-34.59	0.00	0.00	34.59	-0.00	0.000%
19	-0.02	-34.59	-16.68	0.02	34.59	16.68	0.000%
20	8.33	-34.59	-14.43	-8.33	34.59	14.43	0.000%
21	11.79	-34.59	-11.78	-11.79	34.59	11.78	0.000%
22	14.45	-34.59	-8.32	-14.45	34.59	8.32	0.000%
23	16.70	-34.59	0.02	-16.70	34.59	-0.02	0.000%
24	14.47	-34.59	8.36	-14.47	34.59	-8.36	0.000%
25	11.82	-34.59	11.81	-11.82	34.59	-11.81	0.000%
26	8.37	-34.59	14.45	-8.37	34.59	-14.45	0.000%
27	0.02	-34.59	16.68	-0.02	34.59	-16.68	0.000%
28	-8.33	-34.59	14.43	8.33	34.59	-14.43	0.000%
29	-11.79	-34.59	11.78	11.79	34.59	-11.78	0.000%
30	-14.45	-34.59	8.32	14.45	34.59	-8.32	0.000%
31	-16.70	-34.59	-0.02	16.70	34.59	0.02	0.000%
32	-14.47	-34.59	-8.36	14.47	34.59	8.36	0.000%
33	-11.82	-34.59	-11.81	11.82	34.59	11.81	0.000%
34	-8.37	-34.59	-14.45	8.37	34.59	14.45	0.000%
35	-0.01	-26.72	-7.47	0.01	26.72	7.47	0.000%
36	3.73	-26.72	-6.47	-3.73	26.72	6.47	0.000%
37	5.28	-26.72	-5.28	-5.28	26.72	5.28	0.000%
38	6.48	-26.72	-3.73	-6.48	26.72	3.73	0.000%
39	7.49	-26.72	0.01	-7.49	26.72	-0.01	0.000%
40	6.49	-26.72	3.75	-6.49	26.72	-3.75	0.000%
41	5.30	-26.72	5.29	-5.30	26.72	-5.29	0.000%
42	3.75	-26.72	6.48	-3.75	26.72	-6.48	0.000%
43	0.01	-26.72	7.47	-0.01	26.72	-7.47	0.000%
44	-3.73	-26.72	6.47	3.73	26.72	-6.47	0.000%
45	-5.28	-26.72	5.28	5.28	26.72	-5.28	0.000%
46	-6.48	-26.72	3.73	6.48	26.72	-3.73	0.000%
47	-7.49	-26.72	-0.01	7.49	26.72	0.01	0.000%
48	-6.49	-26.72	-3.75	6.49	26.72	3.75	0.000%
49	-5.30	-26.72	-5.29	5.30	26.72	5.29	0.000%
50	-3.75	-26.72	-6.48	3.75	26.72	6.48	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	5	0.00000001	0.00022781
3	Yes	6	0.00000001	0.00034872
4	Yes	6	0.00000001	0.00036800
5	Yes	6	0.00000001	0.00035740
6	Yes	5	0.00000001	0.00005095
7	Yes	6	0.00000001	0.00035756
8	Yes	6	0.00000001	0.00036993

9	Yes	6	0.00000001	0.00035352
10	Yes	5	0.00000001	0.00010029
11	Yes	6	0.00000001	0.00035989
12	Yes	6	0.00000001	0.00036911
13	Yes	6	0.00000001	0.00035140
14	Yes	5	0.00000001	0.00011046
15	Yes	6	0.00000001	0.00035635
16	Yes	6	0.00000001	0.00037025
17	Yes	6	0.00000001	0.00036019
18	Yes	4	0.00000001	0.00015754
19	Yes	6	0.00000001	0.00016638
20	Yes	7	0.00000001	0.00009204
21	Yes	7	0.00000001	0.00010196
22	Yes	7	0.00000001	0.00009393
23	Yes	6	0.00000001	0.00015939
24	Yes	7	0.00000001	0.00009523
25	Yes	7	0.00000001	0.00010317
26	Yes	7	0.00000001	0.00009343
27	Yes	6	0.00000001	0.00016244
28	Yes	7	0.00000001	0.00009584
29	Yes	7	0.00000001	0.00010332
30	Yes	7	0.00000001	0.00009397
31	Yes	6	0.00000001	0.00015940
32	Yes	7	0.00000001	0.00009437
33	Yes	7	0.00000001	0.00010357
34	Yes	7	0.00000001	0.00009614
35	Yes	5	0.00000001	0.00005214
36	Yes	5	0.00000001	0.00076201
37	Yes	5	0.00000001	0.00089731
38	Yes	5	0.00000001	0.00079680
39	Yes	4	0.00000001	0.00061733
40	Yes	5	0.00000001	0.00080882
41	Yes	5	0.00000001	0.00092163
42	Yes	5	0.00000001	0.00079083
43	Yes	4	0.00000001	0.00084675
44	Yes	5	0.00000001	0.00081974
45	Yes	5	0.00000001	0.00091879
46	Yes	5	0.00000001	0.00078718
47	Yes	4	0.00000001	0.00068056
48	Yes	5	0.00000001	0.00080688
49	Yes	5	0.00000001	0.00092799
50	Yes	5	0.00000001	0.00082232

Maximum Tower Deflections - Service Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load Comb.*	*Tilt*	*Twist*
	ft	*in*		°	°
Pole	170 - 160	60.263	48	3.1381	0.0043
Antenna					
L1	160 - 141.37	53.698	48	3.1345	0.0043
L2	144.62 - 108.83	43.788	48	2.9976	0.0032
L3	108.83 - 93.83	23.919	48	2.2023	0.0015
L4	98.1633 - 77.2833	19.266	48	1.9620	0.0012
L5	77.2833 - 47.2833	11.622	48	1.4856	0.0008
L6	52.7 - 1	5.338	48	0.9597	0.0005

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
167.00	P90-14-XLH-RR w/ Pipe Mount	48	58.291	3.1406	0.0044	46398
164.50	Coax on Extension	48	56.649	3.1411	0.0044	42166
162.00	(2) RRUS-11	48	55.008	3.1390	0.0044	27665
157.00	DBXNH-6565A-VTM	48	51.737	3.1222	0.0042	11872
147.00	BXA-70063/6CF	48	45.290	3.0307	0.0033	4578
127.00	APX16DWV-16DWV-S-E-ACU	48	33.280	2.6447	0.0021	2664
117.00	5' Panel Antenna	48	27.911	2.4001	0.0018	2243
107.00	5' Panel Antenna	48	23.078	2.1600	0.0014	2131

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
Pole Antenna	170 - 160	159.300	14	8.3704	0.0107
L1	160 - 141.37	141.865	14	8.3614	0.0107
L2	144.62 - 108.83	115.571	15	7.9786	0.0081
L3	108.83 - 93.83	63.030	15	5.8276	0.0044
L4	98.1633 - 77.2833	50.753	15	5.1855	0.0036
L5	77.2833 - 47.2833	30.600	15	3.9195	0.0024
L6	52.7 - 1	14.047	15	2.5278	0.0014

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
167.00	P90-14-XLH-RR w/ Pipe Mount	14	154.063	8.3778	0.0112	16892
164.50	Coax on Extension	14	149.702	8.3797	0.0112	15351
162.00	(2) RRUS-11	14	145.345	8.3739	0.0112	10101
157.00	DBXNH-6565A-VTM	14	136.658	8.3264	0.0107	4406
147.00	BXA-70063/6CF	14	119.550	8.0702	0.0084	1717
127.00	APX16DWV-16DWV-S-E-ACU	15	87.760	7.0178	0.0063	1011
117.00	5' Panel Antenna	15	73.571	6.3583	0.0052	853
107.00	5' Panel Antenna	15	60.811	5.7144	0.0042	811

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	160 - 158.975	TP21.59x18x0.1875	18.63	0.00	0.0	39.000	10.7183	-1.29	418.01	0.003
	158.975 - 157.949					39.000	10.8358	-1.34	422.60	0.003
	157.949 - 156.924					39.000	10.9534	-1.69	427.18	0.004
	156.924 - 155.899					39.000	11.0710	-1.74	431.77	0.004
	155.899 - 154.873					39.000	11.1886	-1.79	436.36	0.004
	154.873 - 153.848					39.000	11.3062	-1.85	440.94	0.004
	153.848 - 152.823					39.000	11.4238	-1.90	445.53	0.004
	152.823 - 151.797					39.000	11.5414	-1.95	450.11	0.004
	151.797 - 150.772					39.000	11.6589	-2.00	454.70	0.004
	150.772 - 149.747					39.000	11.7765	-2.06	459.28	0.004
	149.747 - 148.721					39.000	11.8941	-2.11	463.87	0.005
	148.721 - 147.696					39.000	12.0117	-2.16	468.46	0.005
	147.696 - 146.671					39.000	12.1293	-2.45	473.04	0.005
	146.671 - 145.645					39.000	12.2469	-2.50	477.63	0.005
	145.645 - 144.62					39.000	12.3645	-2.56	482.21	0.005
	144.62 - 141.37					39.000	12.7372	-1.46	496.75	0.003
L2	144.62 - 141.37	TP27.398x20.5887x0.1875	35.79	0.00	0.0	39.000	12.5093	-1.41	487.86	0.003
	141.37 - 139.657					39.000	12.7032	-2.99	495.42	0.006
	139.657 - 137.945					39.000	12.8971	-3.12	502.99	0.006
	137.945 - 136.232					39.000	13.0910	-3.25	510.55	0.006
	136.232 - 134.519					39.000	13.2849	-3.39	518.11	0.007
	134.519 - 132.807					39.000	13.4788	-3.52	525.67	0.007
	132.807 - 131.094					39.000	13.6728	-3.66	533.24	0.007
	131.094 - 129.382					39.000	13.8667	-3.79	540.80	0.007
	129.382 - 127.669					39.000	14.0606	-3.93	548.36	0.007
	127.669 - 125.956					39.000	14.2545	-4.47	555.93	0.008
	125.956 - 124.244					39.000	14.4484	-4.61	563.49	0.008
	124.244 - 122.531					39.000	14.6423	-4.76	571.05	0.008
	122.531 - 120.818					39.000	14.8362	-4.91	578.61	0.008
	120.818 - 119.106					39.000	15.0302	-5.06	586.18	0.009
	119.106 - 117.393					39.000	15.2241	-5.21	593.74	0.009
	117.393 -					39.000	15.4180	-5.65	601.30	0.009

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 $\frac{P}{P_a}$
	115.681									
	115.681 - 113.968					39.000	15.6119	-5.80	608.86	0.010
	113.968 - 112.255					39.000	15.8058	-5.96	616.43	0.010
	112.255 - 110.543					39.000	15.9997	-6.13	623.99	0.010
	110.543 - 108.83					39.000	16.1936	-6.29	631.55	0.010
L3	108.83 - 107.763	TP30.24x27.398x0.25	15.00	0.00	0.0	39.000	21.7023	-6.44	846.39	0.008
	107.763 - 106.697					39.000	21.8627	-6.86	852.64	0.008
	106.697 - 105.63					39.000	22.0230	-7.00	858.90	0.008
	105.63 - 104.563					39.000	22.1834	-7.14	865.15	0.008
	104.563 - 103.497					39.000	22.3438	-7.28	871.41	0.008
	103.497 - 102.43					39.000	22.5041	-7.42	877.66	0.008
	102.43 - 101.363					39.000	22.6645	-7.56	883.91	0.009
	101.363 - 100.297					39.000	22.8249	-7.70	890.17	0.009
	100.297 - 99.23					39.000	22.9852	-7.85	896.42	0.009
	99.23 - 98.1633					39.000	23.1456	-7.99	902.68	0.009
	98.1633 - 93.83					39.000	23.7971	-4.53	928.09	0.005
L4	98.1633 - 93.83	TP32.686x28.919x0.25	20.88	0.00	0.0	39.000	23.3692	-4.36	911.40	0.005
	93.83 - 92.7958					39.000	23.5172	-9.04	917.17	0.010
	92.7958 - 91.7617					39.000	23.6653	-9.18	922.95	0.010
	91.7617 - 90.7275					39.000	23.8133	-9.33	928.72	0.010
	90.7275 - 89.6933					39.000	23.9614	-9.47	934.49	0.010
	89.6933 - 88.6592					39.000	24.1094	-9.62	940.27	0.010
	88.6592 - 87.625					39.000	24.2575	-9.77	946.04	0.010
	87.625 - 86.5908					39.000	24.4055	-9.92	951.82	0.010
	86.5908 - 85.5567					39.000	24.5536	-10.07	957.59	0.011
	85.5567 - 84.5225					39.000	24.7016	-10.22	963.36	0.011
	84.5225 - 83.4883					39.000	24.8497	-10.37	969.14	0.011
	83.4883 - 82.4541					39.000	24.9977	-10.52	974.91	0.011
	82.4541 - 81.42					39.000	25.1458	-10.67	980.68	0.011
	81.42 - 80.3858					39.000	25.2938	-10.83	986.46	0.011
	80.3858 - 79.3516					39.000	25.4419	-10.98	992.23	0.011
	79.3516 - 78.3175					39.000	25.5899	-11.13	998.01	0.011
	78.3175 - 77.2833					39.000	25.7380	-11.29	1003.78	0.011
L5	77.2833 - 75.9894	TP38.71x32.686x0.3	30.00	0.00	0.0	39.000	31.0853	-11.50	1212.33	0.009

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 $\frac{P}{P_a}$
	75.9894 - 74.6956					39.000	31.3327	-11.72	1221.98	0.010
	74.6956 - 73.4017					39.000	31.5801	-11.94	1231.62	0.010
	73.4017 - 72.1079					39.000	31.8275	-12.15	1241.27	0.010
	72.1079 - 70.814					39.000	32.0749	-12.37	1250.92	0.010
	70.814 - 69.5202					39.000	32.3223	-12.60	1260.57	0.010
	69.5202 - 68.2263					39.000	32.5697	-12.82	1270.22	0.010
	68.2263 - 66.9324					39.000	32.8171	-13.04	1279.87	0.010
	66.9324 - 65.6386					39.000	33.0644	-13.27	1289.51	0.010
	65.6386 - 64.3447					39.000	33.3118	-13.49	1299.16	0.010
	64.3447 - 63.0509					39.000	33.5592	-13.72	1308.81	0.010
	63.0509 - 61.757					39.000	33.8066	-13.95	1318.46	0.011
	61.757 - 60.4631					39.000	34.0540	-14.18	1328.11	0.011
	60.4631 - 59.1693					39.000	34.3014	-14.41	1337.75	0.011
	59.1693 - 57.8754					39.000	34.5488	-14.64	1347.40	0.011
	57.8754 - 56.5816					39.000	34.7962	-14.87	1357.05	0.011
	56.5816 - 55.2877					39.000	35.0435	-15.11	1366.70	0.011
	55.2877 - 53.9939					39.000	35.2909	-15.34	1376.35	0.011
	53.9939 - 52.7					39.000	35.5383	-15.58	1385.99	0.011
	52.7 - 47.2833					39.000	36.5740	-8.57	1426.39	0.006
L6	52.7 - 47.2833	TP47x37.0223x0.3125	51.70	0.00	0.0	39.000	37.4484	-8.65	1460.49	0.006
	47.2833 - 44.8473					39.000	37.9147	-17.68	1478.68	0.012
	44.8473 - 42.4114					39.000	38.3810	-18.14	1496.86	0.012
	42.4114 - 39.9754					39.000	38.8473	-18.61	1515.05	0.012
	39.9754 - 37.5394					39.000	39.3136	-19.09	1533.23	0.012
	37.5394 - 35.1035					39.000	39.7799	-19.56	1551.42	0.013
	35.1035 - 32.6675					39.000	40.2463	-20.05	1569.60	0.013
	32.6675 - 30.2316					39.000	40.7126	-20.53	1587.79	0.013
	30.2316 - 27.7956					39.000	41.1789	-21.02	1605.98	0.013
	27.7956 - 25.3596					39.000	41.6452	-21.52	1624.16	0.013
	25.3596 - 22.9237					39.000	42.1115	-22.02	1642.35	0.013
	22.9237 - 20.4877					39.000	42.5778	-22.52	1660.53	0.014
	20.4877 -					39.000	43.0441	-23.03	1678.72	0.014

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 $\frac{P}{P_a}$
	18.0517									
	18.0517 - 15.6158					39.000	43.5104	-23.54	1696.90	0.014
	15.6158 - 13.1798					39.000	43.9767	-24.06	1715.09	0.014
	13.1798 - 10.7439					39.000	44.4430	-24.58	1733.28	0.014
	10.7439 - 8.30789					39.000	44.9093	-25.10	1751.46	0.014
	8.30789 - 5.87193					39.000	45.3756	-25.63	1769.65	0.014
	5.87193 - 3.43596					39.000	45.8419	-26.17	1787.83	0.015
	3.43596 - 1					39.000	46.3082	-26.70	1806.02	0.015

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	160 - 158.975	TP21.59x18x0.1875	19.79	4.999	39.000	0.128	0.00	0.000	39.000	0.000
	158.975 - 157.949		23.27	5.750	39.000	0.147	0.00	0.000	39.000	0.000
	157.949 - 156.924		26.93	6.510	39.000	0.167	0.00	0.000	39.000	0.000
	156.924 - 155.899		31.40	7.430	39.000	0.191	0.00	0.000	39.000	0.000
	155.899 - 154.873		35.99	8.338	39.000	0.214	0.00	0.000	39.000	0.000
	154.873 - 153.848		40.70	9.233	39.000	0.237	0.00	0.000	39.000	0.000
	153.848 - 152.823		45.53	10.116	39.000	0.259	0.00	0.000	39.000	0.000
	152.823 - 151.797		50.48	10.988	39.000	0.282	0.00	0.000	39.000	0.000
	151.797 - 150.772		55.56	11.848	39.000	0.304	0.00	0.000	39.000	0.000
	150.772 - 149.747		60.75	12.698	39.000	0.326	0.00	0.000	39.000	0.000
	149.747 - 148.721		66.08	13.538	39.000	0.347	0.00	0.000	39.000	0.000
	148.721 - 147.696		71.53	14.368	39.000	0.368	0.00	0.000	39.000	0.000
	147.696 - 146.671		77.39	15.245	39.000	0.391	0.00	0.000	39.000	0.000
	146.671 - 145.645		83.99	16.227	39.000	0.416	0.00	0.000	39.000	0.000
	145.645 - 144.62		90.72	17.194	39.000	0.441	0.00	0.000	39.000	0.000
	144.62 - 141.37		58.06	10.367	39.000	0.266	0.00	0.000	39.000	0.000
L2	144.62 - 141.37	TP27.398x20.5887x0.1875	54.89	10.162	39.000	0.261	0.00	0.000	39.000	0.000
	141.37 - 139.657		125.16	22.468	39.000	0.576	0.00	0.000	39.000	0.000
	139.657 -		137.64	23.968	39.000	0.615	0.00	0.000	39.000	0.000

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 $\frac{f_{by}}{F_{by}}$
	137.945									
	137.945 - 136.232		150.39	25.414	39.000	0.652	0.00	0.000	39.000	0.000
	136.232 - 134.519		163.41	26.811	39.000	0.687	0.00	0.000	39.000	0.000
	134.519 - 132.807		176.71	28.160	39.000	0.722	0.00	0.000	39.000	0.000
	132.807 - 131.094		190.27	29.465	39.000	0.756	0.00	0.000	39.000	0.000
	131.094 - 129.382		204.12	30.728	39.000	0.788	0.00	0.000	39.000	0.000
	129.382 - 127.669		218.24	31.950	39.000	0.819	0.00	0.000	39.000	0.000
	127.669 - 125.956		233.33	33.233	39.000	0.852	0.00	0.000	39.000	0.000
	125.956 - 124.244		249.13	34.534	39.000	0.885	0.00	0.000	39.000	0.000
	124.244 - 122.531		265.23	35.794	39.000	0.918	0.00	0.000	39.000	0.000
	122.531 - 120.818		281.60	37.013	39.000	0.949	0.00	0.000	39.000	0.000
	120.818 - 119.106		298.26	38.194	39.000	0.979	0.00	0.000	39.000	0.000
	119.106 - 117.393		315.21	39.339	39.000	1.009	0.00	0.000	39.000	0.000
	117.393 - 115.681		333.32	40.556	39.000	1.040	0.00	0.000	39.000	0.000
	115.681 - 113.968		351.97	41.764	39.000	1.071	0.00	0.000	39.000	0.000
	113.968 - 112.255		370.92	42.936	39.000	1.101	0.00	0.000	39.000	0.000
	112.255 - 110.543		390.16	44.071	39.000	1.130	0.00	0.000	39.000	0.000
	110.543 - 108.83		409.70	45.172	39.000	1.158	0.00	0.000	39.000	0.000
L3	108.83 - 107.763	TP30.24x27.398x0.25	422.00	34.619	39.000	0.888	0.00	0.000	39.000	0.000
	107.763 - 106.697		434.59	35.128	39.000	0.901	0.00	0.000	39.000	0.000
	106.697 - 105.63		447.75	35.664	39.000	0.914	0.00	0.000	39.000	0.000
	105.63 - 104.563		461.00	36.188	39.000	0.928	0.00	0.000	39.000	0.000
	104.563 - 103.497		474.34	36.700	39.000	0.941	0.00	0.000	39.000	0.000
	103.497 - 102.43		487.76	37.201	39.000	0.954	0.00	0.000	39.000	0.000
	102.43 - 101.363		501.28	37.690	39.000	0.966	0.00	0.000	39.000	0.000
	101.363 - 100.297		514.88	38.168	39.000	0.979	0.00	0.000	39.000	0.000
	100.297 - 99.23		528.58	38.636	39.000	0.991	0.00	0.000	39.000	0.000
	99.23 - 98.1633		542.36	39.094	39.000	1.002	0.00	0.000	39.000	0.000
	98.1633 - 93.83		307.72	20.978	39.000	0.538	0.00	0.000	39.000	0.000
L4	98.1633 - 93.83	TP32.686x28.919x0.25	291.66	20.621	39.000	0.529	0.00	0.000	39.000	0.000
	93.83 -		613.23	42.811	39.000	1.098	0.00	0.000	39.000	0.000

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 $\frac{f_{by}}{F_{by}}$
	92.7958									
	92.7958 - 91.7617		627.16	43.235	39.000	1.109	0.00	0.000	39.000	0.000
	91.7617 - 90.7275		641.17	43.651	39.000	1.119	0.00	0.000	39.000	0.000
	90.7275 - 89.6933		655.26	44.058	39.000	1.130	0.00	0.000	39.000	0.000
	89.6933 - 88.6592		669.43	44.457	39.000	1.140	0.00	0.000	39.000	0.000
	88.6592 - 87.625		683.67	44.849	39.000	1.150	0.00	0.000	39.000	0.000
	87.625 - 86.5908		698.00	45.232	39.000	1.160	0.00	0.000	39.000	0.000
	86.5908 - 85.5567		712.40	45.608	39.000	1.169	0.00	0.000	39.000	0.000
	85.5567 - 84.5225		726.88	45.977	39.000	1.179	0.00	0.000	39.000	0.000
	84.5225 - 83.4883		741.45	46.339	39.000	1.188	0.00	0.000	39.000	0.000
	83.4883 - 82.4541		756.09	46.694	39.000	1.197	0.00	0.000	39.000	0.000
	82.4541 - 81.42		770.81	47.042	39.000	1.206	0.00	0.000	39.000	0.000
	81.42 - 80.3858		785.61	47.383	39.000	1.215	0.00	0.000	39.000	0.000
	80.3858 - 79.3516		800.49	47.718	39.000	1.224	0.00	0.000	39.000	0.000
	79.3516 - 78.3175		815.45	48.047	39.000	1.232	0.00	0.000	39.000	0.000
	78.3175 - 77.2833		830.49	48.370	39.000	1.240	0.00	0.000	39.000	0.000
L5	77.2833 - 75.9894	TP38.71x32.686x0.3	849.42	40.759	39.000	1.045	0.00	0.000	39.000	0.000
	75.9894 - 74.6956		868.47	41.014	39.000	1.052	0.00	0.000	39.000	0.000
	74.6956 - 73.4017		887.63	41.262	39.000	1.058	0.00	0.000	39.000	0.000
	73.4017 - 72.1079		906.91	41.502	39.000	1.064	0.00	0.000	39.000	0.000
	72.1079 - 70.814		926.31	41.736	39.000	1.070	0.00	0.000	39.000	0.000
	70.814 - 69.5202		945.83	41.963	39.000	1.076	0.00	0.000	39.000	0.000
	69.5202 - 68.2263		965.46	42.183	39.000	1.082	0.00	0.000	39.000	0.000
	68.2263 - 66.9324		985.22	42.397	39.000	1.087	0.00	0.000	39.000	0.000
	66.9324 - 65.6386		1005.09	42.605	39.000	1.092	0.00	0.000	39.000	0.000
	65.6386 - 64.3447		1025.09	42.806	39.000	1.098	0.00	0.000	39.000	0.000
	64.3447 - 63.0509		1045.21	43.003	39.000	1.103	0.00	0.000	39.000	0.000
	63.0509 - 61.757		1065.44	43.193	39.000	1.108	0.00	0.000	39.000	0.000
	61.757 - 60.4631		1085.80	43.379	39.000	1.112	0.00	0.000	39.000	0.000
	60.4631 - 59.1693		1106.28	43.559	39.000	1.117	0.00	0.000	39.000	0.000
	59.1693 -		1126.88	43.735	39.000	1.121	0.00	0.000	39.000	0.000

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 $\frac{f_{by}}{F_{by}}$
	57.8754									
	57.8754 - 56.5816		1147.61	43.905	39.000	1.126	0.00	0.000	39.000	0.000
	56.5816 - 55.2877		1168.45	44.071	39.000	1.130	0.00	0.000	39.000	0.000
	55.2877 - 53.9939		1189.43	44.233	39.000	1.134	0.00	0.000	39.000	0.000
	53.9939 - 52.7		1210.52	44.390	39.000	1.138	0.00	0.000	39.000	0.000
	52.7 - 47.2833		653.48	22.620	39.000	0.580	0.00	0.000	39.000	0.000
L6	52.7 - 47.2833	TP47x37.0223x0.3125	646.88	22.259	39.000	0.571	0.00	0.000	39.000	0.000
	47.2833 - 44.8473		1341.53	45.028	39.000	1.155	0.00	0.000	39.000	0.000
	44.8473 - 42.4114		1383.03	45.295	39.000	1.161	0.00	0.000	39.000	0.000
	42.4114 - 39.9754		1424.88	45.548	39.000	1.168	0.00	0.000	39.000	0.000
	39.9754 - 37.5394		1467.09	45.787	39.000	1.174	0.00	0.000	39.000	0.000
	37.5394 - 35.1035		1509.65	46.013	39.000	1.180	0.00	0.000	39.000	0.000
	35.1035 - 32.6675		1552.56	46.227	39.000	1.185	0.00	0.000	39.000	0.000
	32.6675 - 30.2316		1595.81	46.428	39.000	1.190	0.00	0.000	39.000	0.000
	30.2316 - 27.7956		1639.42	46.619	39.000	1.195	0.00	0.000	39.000	0.000
	27.7956 - 25.3596		1683.38	46.799	39.000	1.200	0.00	0.000	39.000	0.000
	25.3596 - 22.9237		1727.68	46.969	39.000	1.204	0.00	0.000	39.000	0.000
	22.9237 - 20.4877		1772.33	47.130	39.000	1.208	0.00	0.000	39.000	0.000
	20.4877 - 18.0517		1817.34	47.282	39.000	1.212	0.00	0.000	39.000	0.000
	18.0517 - 15.6158		1862.70	47.425	39.000	1.216	0.00	0.000	39.000	0.000
	15.6158 - 13.1798		1908.41	47.560	39.000	1.219	0.00	0.000	39.000	0.000
	13.1798 - 10.7439		1954.47	47.688	39.000	1.223	0.00	0.000	39.000	0.000
	10.7439 - 8.30789		2000.88	47.808	39.000	1.226	0.00	0.000	39.000	0.000
	8.30789 - 5.87193		2047.63	47.921	39.000	1.229	0.00	0.000	39.000	0.000
	5.87193 - 3.43596		2094.75	48.028	39.000	1.232	0.00	0.000	39.000	0.000
	3.43596 - 1		2142.21	48.129	39.000	1.234	0.00	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	160 - 158.975	TP21.59x18x0.1875	3.33	0.311	26.000	0.024	0.34	0.041	26.000	0.002
	158.975 - 157.949		3.44	0.318	26.000	0.024	0.33	0.039	26.000	0.002

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 $\frac{f_{vt}}{F_{vt}}$
	157.949 - 156.924		4.30	0.392	26.000	0.030	0.32	0.037	26.000	0.001
	156.924 - 155.899		4.41	0.398	26.000	0.031	0.31	0.036	26.000	0.001
	155.899 - 154.873		4.53	0.405	26.000	0.031	0.30	0.034	26.000	0.001
	154.873 - 153.848		4.64	0.411	26.000	0.032	0.29	0.032	26.000	0.001
	153.848 - 152.823		4.76	0.417	26.000	0.032	0.28	0.030	26.000	0.001
	152.823 - 151.797		4.88	0.423	26.000	0.033	0.27	0.029	26.000	0.001
	151.797 - 150.772		5.00	0.429	26.000	0.033	0.26	0.027	26.000	0.001
	150.772 - 149.747		5.12	0.435	26.000	0.033	0.25	0.026	26.000	0.001
	149.747 - 148.721		5.25	0.441	26.000	0.034	0.24	0.024	26.000	0.001
	148.721 - 147.696		5.37	0.447	26.000	0.034	0.23	0.023	26.000	0.001
	147.696 - 146.671		6.37	0.525	26.000	0.040	0.22	0.021	26.000	0.001
	146.671 - 145.645		6.49	0.530	26.000	0.041	0.21	0.020	26.000	0.001
	145.645 - 144.62		6.62	0.535	26.000	0.041	0.20	0.019	26.000	0.001
	144.62 - 141.37		3.71	0.292	26.000	0.022	0.11	0.009	26.000	0.000
L2	144.62 - 141.37	TP27.398x20.5887x0.1875	3.34	0.267	26.000	0.021	0.09	0.008	26.000	0.000
	141.37 - 139.657		7.20	0.567	26.000	0.044	0.16	0.014	26.000	0.001
	139.657 - 137.945		7.36	0.571	26.000	0.044	0.15	0.013	26.000	0.000
	137.945 - 136.232		7.52	0.574	26.000	0.044	0.14	0.012	26.000	0.000
	136.232 - 134.519		7.68	0.578	26.000	0.044	0.13	0.010	26.000	0.000
	134.519 - 132.807		7.84	0.581	26.000	0.045	0.12	0.009	26.000	0.000
	132.807 - 131.094		8.00	0.585	26.000	0.045	0.11	0.008	26.000	0.000
	131.094 - 129.382		8.16	0.589	26.000	0.045	0.10	0.007	26.000	0.000
	129.382 - 127.669		8.32	0.592	26.000	0.046	0.09	0.006	26.000	0.000
	127.669 - 125.956		9.15	0.642	26.000	0.049	0.08	0.006	26.000	0.000
	125.956 - 124.244		9.31	0.644	26.000	0.050	0.07	0.005	26.000	0.000
	124.244 - 122.531		9.48	0.647	26.000	0.050	0.06	0.004	26.000	0.000
	122.531 - 120.818		9.64	0.650	26.000	0.050	0.05	0.003	26.000	0.000
	120.818 - 119.106		9.81	0.653	26.000	0.050	0.04	0.002	26.000	0.000
	119.106 - 117.393		9.98	0.655	26.000	0.050	0.03	0.002	26.000	0.000
	117.393 - 115.681		10.81	0.701	26.000	0.054	0.02	0.001	26.000	0.000

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 $\frac{f_{vt}}{F_{vt}}$
	115.681 - 113.968		10.98	0.703	26.000	0.054	0.01	0.000	26.000	0.000
	113.968 - 112.255		11.15	0.705	26.000	0.054	0.02	0.001	26.000	0.000
	112.255 - 110.543		11.32	0.708	26.000	0.054	0.03	0.002	26.000	0.000
	110.543 - 108.83		11.49	0.710	26.000	0.055	0.04	0.002	26.000	0.000
L3	108.83 - 107.763	TP30.24x27.398x0.25	11.57	0.533	26.000	0.041	0.04	0.002	26.000	0.000
	107.763 - 106.697		12.29	0.562	26.000	0.043	0.05	0.002	26.000	0.000
	106.697 - 105.63		12.38	0.562	26.000	0.043	0.05	0.002	26.000	0.000
	105.63 - 104.563		12.46	0.562	26.000	0.043	0.05	0.002	26.000	0.000
	104.563 - 103.497		12.54	0.561	26.000	0.043	0.05	0.002	26.000	0.000
	103.497 - 102.43		12.62	0.561	26.000	0.043	0.06	0.002	26.000	0.000
	102.43 - 101.363		12.71	0.561	26.000	0.043	0.06	0.002	26.000	0.000
	101.363 - 100.297		12.79	0.560	26.000	0.043	0.06	0.002	26.000	0.000
	100.297 - 99.23		12.88	0.560	26.000	0.043	0.07	0.002	26.000	0.000
	99.23 - 98.1633		12.96	0.560	26.000	0.043	0.07	0.002	26.000	0.000
	98.1633 - 93.83		6.94	0.292	26.000	0.022	0.04	0.001	26.000	0.000
L4	98.1633 - 93.83	TP32.686x28.919x0.25	6.42	0.275	26.000	0.021	0.04	0.001	26.000	0.000
	93.83 - 92.7958		13.43	0.571	26.000	0.044	0.08	0.003	26.000	0.000
	92.7958 - 91.7617		13.51	0.571	26.000	0.044	0.09	0.003	26.000	0.000
	91.7617 - 90.7275		13.58	0.570	26.000	0.044	0.09	0.003	26.000	0.000
	90.7275 - 89.6933		13.66	0.570	26.000	0.044	0.09	0.003	26.000	0.000
	89.6933 - 88.6592		13.73	0.570	26.000	0.044	0.09	0.003	26.000	0.000
	88.6592 - 87.625		13.81	0.569	26.000	0.044	0.10	0.003	26.000	0.000
	87.625 - 86.5908		13.89	0.569	26.000	0.044	0.10	0.003	26.000	0.000
	86.5908 - 85.5567		13.96	0.569	26.000	0.044	0.10	0.003	26.000	0.000
	85.5567 - 84.5225		14.04	0.568	26.000	0.044	0.11	0.003	26.000	0.000
	84.5225 - 83.4883		14.12	0.568	26.000	0.044	0.11	0.003	26.000	0.000
	83.4883 - 82.4541		14.19	0.568	26.000	0.044	0.11	0.003	26.000	0.000
	82.4541 - 81.42		14.27	0.568	26.000	0.044	0.11	0.003	26.000	0.000
	81.42 - 80.3858		14.35	0.567	26.000	0.044	0.12	0.003	26.000	0.000
	80.3858 - 79.3516		14.43	0.567	26.000	0.044	0.12	0.004	26.000	0.000

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 $\frac{f_{vt}}{F_{vt}}$
	79.3516 - 78.3175		14.50	0.567	26.000	0.044	0.12	0.004	26.000	0.000
	78.3175 - 77.2833		14.58	0.567	26.000	0.044	0.13	0.004	26.000	0.000
L5	77.2833 - 75.9894	TP38.71x32.686x0.3	14.67	0.472	26.000	0.036	0.13	0.003	26.000	0.000
	75.9894 - 74.6956		14.76	0.471	26.000	0.036	0.13	0.003	26.000	0.000
	74.6956 - 73.4017		14.85	0.470	26.000	0.036	0.14	0.003	26.000	0.000
	73.4017 - 72.1079		14.95	0.470	26.000	0.036	0.14	0.003	26.000	0.000
	72.1079 - 70.814		15.04	0.469	26.000	0.036	0.14	0.003	26.000	0.000
	70.814 - 69.5202		15.13	0.468	26.000	0.036	0.15	0.003	26.000	0.000
	69.5202 - 68.2263		15.22	0.467	26.000	0.036	0.15	0.003	26.000	0.000
	68.2263 - 66.9324		15.31	0.467	26.000	0.036	0.15	0.003	26.000	0.000
	66.9324 - 65.6386		15.41	0.466	26.000	0.036	0.16	0.003	26.000	0.000
	65.6386 - 64.3447		15.50	0.465	26.000	0.036	0.16	0.003	26.000	0.000
	64.3447 - 63.0509		15.59	0.465	26.000	0.036	0.17	0.003	26.000	0.000
	63.0509 - 61.757		15.69	0.464	26.000	0.036	0.17	0.003	26.000	0.000
	61.757 - 60.4631		15.78	0.463	26.000	0.036	0.17	0.003	26.000	0.000
	60.4631 - 59.1693		15.87	0.463	26.000	0.036	0.18	0.003	26.000	0.000
	59.1693 - 57.8754		15.97	0.462	26.000	0.036	0.18	0.003	26.000	0.000
	57.8754 - 56.5816		16.06	0.462	26.000	0.036	0.19	0.003	26.000	0.000
	56.5816 - 55.2877		16.16	0.461	26.000	0.035	0.19	0.003	26.000	0.000
	55.2877 - 53.9939		16.25	0.461	26.000	0.035	0.19	0.003	26.000	0.000
	53.9939 - 52.7		16.35	0.460	26.000	0.035	0.20	0.004	26.000	0.000
	52.7 - 47.2833		8.57	0.234	26.000	0.018	0.11	0.002	26.000	0.000
L6	52.7 - 47.2833	TP47x37.0223x0.3125	8.27	0.221	26.000	0.017	0.10	0.002	26.000	0.000
	47.2833 - 44.8473		16.98	0.448	26.000	0.034	0.22	0.004	26.000	0.000
	44.8473 - 42.4114		17.12	0.446	26.000	0.034	0.23	0.004	26.000	0.000
	42.4114 - 39.9754		17.26	0.444	26.000	0.034	0.23	0.004	26.000	0.000
	39.9754 - 37.5394		17.41	0.443	26.000	0.034	0.24	0.004	26.000	0.000
	37.5394 - 35.1035		17.55	0.441	26.000	0.034	0.24	0.004	26.000	0.000
	35.1035 - 32.6675		17.70	0.440	26.000	0.034	0.25	0.004	26.000	0.000
	32.6675 - 30.2316		17.84	0.438	26.000	0.034	0.26	0.004	26.000	0.000
	30.2316 - 27.7956		17.98	0.437	26.000	0.034	0.26	0.004	26.000	0.000
	27.7956 -		18.13	0.435	26.000	0.033	0.27	0.004	26.000	0.000

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 $\frac{f_{vt}}{F_{vt}}$
	25.3596									
	25.3596 - 22.9237		18.27	0.434	26.000	0.033	0.28	0.004	26.000	0.000
	22.9237 - 20.4877		18.42	0.433	26.000	0.033	0.28	0.004	26.000	0.000
	20.4877 - 18.0517		18.56	0.431	26.000	0.033	0.29	0.004	26.000	0.000
	18.0517 - 15.6158		18.71	0.430	26.000	0.033	0.30	0.004	26.000	0.000
	15.6158 - 13.1798		18.85	0.429	26.000	0.033	0.30	0.004	26.000	0.000
	13.1798 - 10.7439		18.99	0.427	26.000	0.033	0.31	0.004	26.000	0.000
	10.7439 - 8.30789		19.14	0.426	26.000	0.033	0.32	0.004	26.000	0.000
	8.30789 - 5.87193		19.28	0.425	26.000	0.033	0.32	0.004	26.000	0.000
	5.87193 - 3.43596		19.43	0.424	26.000	0.033	0.33	0.004	26.000	0.000
	3.43596 - 1		19.57	0.423	26.000	0.033	0.34	0.004	26.000	0.000

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	160 - 158.975	0.003	0.128	0.000	0.024	0.002	0.131 ✔	1.333	H1-3+VT ✔
	158.975 - 157.949	0.003	0.147	0.000	0.024	0.002	0.151 ✔	1.333	H1-3+VT ✔
	157.949 - 156.924	0.004	0.167	0.000	0.030	0.001	0.171 ✔	1.333	H1-3+VT ✔
	156.924 - 155.899	0.004	0.191	0.000	0.031	0.001	0.195 ✔	1.333	H1-3+VT ✔
	155.899 - 154.873	0.004	0.214	0.000	0.031	0.001	0.218 ✔	1.333	H1-3+VT ✔
	154.873 - 153.848	0.004	0.237	0.000	0.032	0.001	0.241 ✔	1.333	H1-3+VT ✔
	153.848 - 152.823	0.004	0.259	0.000	0.032	0.001	0.264 ✔	1.333	H1-3+VT ✔
	152.823 - 151.797	0.004	0.282	0.000	0.033	0.001	0.286 ✔	1.333	H1-3+VT ✔
	151.797 - 150.772	0.004	0.304	0.000	0.033	0.001	0.309 ✔	1.333	H1-3+VT ✔
	150.772 - 149.747	0.004	0.326	0.000	0.033	0.001	0.330 ✔	1.333	H1-3+VT ✔
	149.747 - 148.721	0.005	0.347	0.000	0.034	0.001	0.352 ✔	1.333	H1-3+VT ✔
	148.721 - 147.696	0.005	0.368	0.000	0.034	0.001	0.373 ✔	1.333	H1-3+VT ✔
	147.696 -	0.005	0.391	0.000	0.040	0.001	0.397	1.333	H1-3+VT ✔

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
	146.671						✔		
	146.671 - 145.645	0.005	0.416	0.000	0.041	0.001	0.422 ✔	1.333	H1-3+VT ✔
	145.645 - 144.62	0.005	0.441	0.000	0.041	0.001	0.447 ✔	1.333	H1-3+VT ✔
	144.62 - 141.37	0.003	0.266	0.000	0.022	0.000	0.269 ✔	1.333	H1-3+VT ✔
L2	144.62 - 141.37	0.003	0.261	0.000	0.021	0.000	0.264 ✔	1.333	H1-3+VT ✔
	141.37 - 139.657	0.006	0.576	0.000	0.044	0.001	0.583 ✔	1.333	H1-3+VT ✔
	139.657 - 137.945	0.006	0.615	0.000	0.044	0.000	0.621 ✔	1.333	H1-3+VT ✔
	137.945 - 136.232	0.006	0.652	0.000	0.044	0.000	0.659 ✔	1.333	H1-3+VT ✔
	136.232 - 134.519	0.007	0.687	0.000	0.044	0.000	0.695 ✔	1.333	H1-3+VT ✔
	134.519 - 132.807	0.007	0.722	0.000	0.045	0.000	0.729 ✔	1.333	H1-3+VT ✔
	132.807 - 131.094	0.007	0.756	0.000	0.045	0.000	0.763 ✔	1.333	H1-3+VT ✔
	131.094 - 129.382	0.007	0.788	0.000	0.045	0.000	0.795 ✔	1.333	H1-3+VT ✔
	129.382 - 127.669	0.007	0.819	0.000	0.046	0.000	0.827 ✔	1.333	H1-3+VT ✔
	127.669 - 125.956	0.008	0.852	0.000	0.049	0.000	0.861 ✔	1.333	H1-3+VT ✔
	125.956 - 124.244	0.008	0.885	0.000	0.050	0.000	0.894 ✔	1.333	H1-3+VT ✔
	124.244 - 122.531	0.008	0.918	0.000	0.050	0.000	0.927 ✔	1.333	H1-3+VT ✔
	122.531 - 120.818	0.008	0.949	0.000	0.050	0.000	0.958 ✔	1.333	H1-3+VT ✔
	120.818 - 119.106	0.009	0.979	0.000	0.050	0.000	0.989 ✔	1.333	H1-3+VT ✔
	119.106 - 117.393	0.009	1.009	0.000	0.050	0.000	1.018 ✔	1.333	H1-3+VT ✔
	117.393 - 115.681	0.009	1.040	0.000	0.054	0.000	1.050 ✔	1.333	H1-3+VT ✔
	115.681 - 113.968	0.010	1.071	0.000	0.054	0.000	1.081 ✔	1.333	H1-3+VT ✔
	113.968 - 112.255	0.010	1.101	0.000	0.054	0.000	1.111 ✔	1.333	H1-3+VT ✔
	112.255 - 110.543	0.010	1.130	0.000	0.054	0.000	1.141 ✔	1.333	H1-3+VT ✔
	110.543 - 108.83	0.010	1.158	0.000	0.055	0.000	1.169 ✔	1.333	H1-3+VT ✔
L3	108.83 - 107.763	0.008	0.888	0.000	0.041	0.000	0.896 ✔	1.333	H1-3+VT ✔
	107.763 - 106.697	0.008	0.901	0.000	0.043	0.000	0.909 ✔	1.333	H1-3+VT ✔
	106.697 - 105.63	0.008	0.914	0.000	0.043	0.000	0.923	1.333	H1-3+VT ✔

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
	105.63 - 104.563	0.008	0.928	0.000	0.043	0.000	0.937 ✔	1.333	H1-3+VT ✔
	104.563 - 103.497	0.008	0.941	0.000	0.043	0.000	0.950 ✔	1.333	H1-3+VT ✔
	103.497 - 102.43	0.008	0.954	0.000	0.043	0.000	0.963 ✔	1.333	H1-3+VT ✔
	102.43 - 101.363	0.009	0.966	0.000	0.043	0.000	0.975 ✔	1.333	H1-3+VT ✔
	101.363 - 100.297	0.009	0.979	0.000	0.043	0.000	0.988 ✔	1.333	H1-3+VT ✔
	100.297 - 99.23	0.009	0.991	0.000	0.043	0.000	1.000 ✔	1.333	H1-3+VT ✔
	99.23 - 98.1633	0.009	1.002	0.000	0.043	0.000	1.012 ✔	1.333	H1-3+VT ✔
	98.1633 - 93.83	0.005	0.538	0.000	0.022	0.000	0.543 ✔	1.333	H1-3+VT ✔
L4	98.1633 - 93.83	0.005	0.529	0.000	0.021	0.000	0.534 ✔	1.333	H1-3+VT ✔
	93.83 - 92.7958	0.010	1.098	0.000	0.044	0.000	1.108 ✔	1.333	H1-3+VT ✔
	92.7958 - 91.7617	0.010	1.109	0.000	0.044	0.000	1.119 ✔	1.333	H1-3+VT ✔
	91.7617 - 90.7275	0.010	1.119	0.000	0.044	0.000	1.130 ✔	1.333	H1-3+VT ✔
	90.7275 - 89.6933	0.010	1.130	0.000	0.044	0.000	1.140 ✔	1.333	H1-3+VT ✔
	89.6933 - 88.6592	0.010	1.140	0.000	0.044	0.000	1.151 ✔	1.333	H1-3+VT ✔
	88.6592 - 87.625	0.010	1.150	0.000	0.044	0.000	1.161 ✔	1.333	H1-3+VT ✔
	87.625 - 86.5908	0.010	1.160	0.000	0.044	0.000	1.171 ✔	1.333	H1-3+VT ✔
	86.5908 - 85.5567	0.011	1.169	0.000	0.044	0.000	1.180 ✔	1.333	H1-3+VT ✔
	85.5567 - 84.5225	0.011	1.179	0.000	0.044	0.000	1.190 ✔	1.333	H1-3+VT ✔
	84.5225 - 83.4883	0.011	1.188	0.000	0.044	0.000	1.199 ✔	1.333	H1-3+VT ✔
	83.4883 - 82.4541	0.011	1.197	0.000	0.044	0.000	1.209 ✔	1.333	H1-3+VT ✔
	82.4541 - 81.42	0.011	1.206	0.000	0.044	0.000	1.218 ✔	1.333	H1-3+VT ✔
	81.42 - 80.3858	0.011	1.215	0.000	0.044	0.000	1.226 ✔	1.333	H1-3+VT ✔
	80.3858 - 79.3516	0.011	1.224	0.000	0.044	0.000	1.235 ✔	1.333	H1-3+VT ✔
	79.3516 - 78.3175	0.011	1.232	0.000	0.044	0.000	1.244 ✔	1.333	H1-3+VT ✔
	78.3175 - 77.2833	0.011	1.240	0.000	0.044	0.000	1.252 ✔	1.333	H1-3+VT ✔
L5	77.2833 - 75.9894	0.009	1.045	0.000	0.036	0.000	1.055	1.333	H1-3+VT ✔

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
	75.9894 - 74.6956	0.010	1.052	0.000	0.036	0.000	1.062 ✔	1.333	H1-3+VT ✔
	74.6956 - 73.4017	0.010	1.058	0.000	0.036	0.000	1.068 ✔	1.333	H1-3+VT ✔
	73.4017 - 72.1079	0.010	1.064	0.000	0.036	0.000	1.074 ✔	1.333	H1-3+VT ✔
	72.1079 - 70.814	0.010	1.070	0.000	0.036	0.000	1.080 ✔	1.333	H1-3+VT ✔
	70.814 - 69.5202	0.010	1.076	0.000	0.036	0.000	1.086 ✔	1.333	H1-3+VT ✔
	69.5202 - 68.2263	0.010	1.082	0.000	0.036	0.000	1.092 ✔	1.333	H1-3+VT ✔
	68.2263 - 66.9324	0.010	1.087	0.000	0.036	0.000	1.098 ✔	1.333	H1-3+VT ✔
	66.9324 - 65.6386	0.010	1.092	0.000	0.036	0.000	1.103 ✔	1.333	H1-3+VT ✔
	65.6386 - 64.3447	0.010	1.098	0.000	0.036	0.000	1.108 ✔	1.333	H1-3+VT ✔
	64.3447 - 63.0509	0.010	1.103	0.000	0.036	0.000	1.113 ✔	1.333	H1-3+VT ✔
	63.0509 - 61.757	0.011	1.108	0.000	0.036	0.000	1.118 ✔	1.333	H1-3+VT ✔
	61.757 - 60.4631	0.011	1.112	0.000	0.036	0.000	1.123 ✔	1.333	H1-3+VT ✔
	60.4631 - 59.1693	0.011	1.117	0.000	0.036	0.000	1.128 ✔	1.333	H1-3+VT ✔
	59.1693 - 57.8754	0.011	1.121	0.000	0.036	0.000	1.133 ✔	1.333	H1-3+VT ✔
	57.8754 - 56.5816	0.011	1.126	0.000	0.036	0.000	1.137 ✔	1.333	H1-3+VT ✔
	56.5816 - 55.2877	0.011	1.130	0.000	0.035	0.000	1.141 ✔	1.333	H1-3+VT ✔
	55.2877 - 53.9939	0.011	1.134	0.000	0.035	0.000	1.146 ✔	1.333	H1-3+VT ✔
	53.9939 - 52.7	0.011	1.138	0.000	0.035	0.000	1.150 ✔	1.333	H1-3+VT ✔
	52.7 - 47.2833	0.006	0.580	0.000	0.018	0.000	0.586 ✔	1.333	H1-3+VT ✔
L6	52.7 - 47.2833	0.006	0.571	0.000	0.017	0.000	0.577 ✔	1.333	H1-3+VT ✔
	47.2833 - 44.8473	0.012	1.155	0.000	0.034	0.000	1.167 ✔	1.333	H1-3+VT ✔
	44.8473 - 42.4114	0.012	1.161	0.000	0.034	0.000	1.174 ✔	1.333	H1-3+VT ✔
	42.4114 - 39.9754	0.012	1.168	0.000	0.034	0.000	1.180 ✔	1.333	H1-3+VT ✔
	39.9754 - 37.5394	0.012	1.174	0.000	0.034	0.000	1.187 ✔	1.333	H1-3+VT ✔
	37.5394 - 35.1035	0.013	1.180	0.000	0.034	0.000	1.193 ✔	1.333	H1-3+VT ✔
	35.1035 - 32.6675	0.013	1.185	0.000	0.034	0.000	1.198	1.333	H1-3+VT ✔

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
	32.6675 - 30.2316	0.013	1.190	0.000	0.034	0.000	1.204 ✔	1.333	H1-3+VT ✔
	30.2316 - 27.7956	0.013	1.195	0.000	0.034	0.000	1.209 ✔	1.333	H1-3+VT ✔
	27.7956 - 25.3596	0.013	1.200	0.000	0.033	0.000	1.214 ✔	1.333	H1-3+VT ✔
	25.3596 - 22.9237	0.013	1.204	0.000	0.033	0.000	1.218 ✔	1.333	H1-3+VT ✔
	22.9237 - 20.4877	0.014	1.208	0.000	0.033	0.000	1.222 ✔	1.333	H1-3+VT ✔
	20.4877 - 18.0517	0.014	1.212	0.000	0.033	0.000	1.226 ✔	1.333	H1-3+VT ✔
	18.0517 - 15.6158	0.014	1.216	0.000	0.033	0.000	1.230 ✔	1.333	H1-3+VT ✔
	15.6158 - 13.1798	0.014	1.219	0.000	0.033	0.000	1.234 ✔	1.333	H1-3+VT ✔
	13.1798 - 10.7439	0.014	1.223	0.000	0.033	0.000	1.237 ✔	1.333	H1-3+VT ✔
	10.7439 - 8.30789	0.014	1.226	0.000	0.033	0.000	1.240 ✔	1.333	H1-3+VT ✔
	8.30789 - 5.87193	0.014	1.229	0.000	0.033	0.000	1.244 ✔	1.333	H1-3+VT ✔
	5.87193 - 3.43596	0.015	1.232	0.000	0.033	0.000	1.246 ✔	1.333	H1-3+VT ✔
	3.43596 - 1	0.015	1.234	0.000	0.033	0.000	1.249 ✔	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	160 - 141.37	Pole	TP21.59x18x0.1875	2	-2.56	642.79	33.5	Pass
L2	141.37 - 108.83	Pole	TP27.398x20.5887x0.1875	3	-6.29	841.86	87.7	Pass
L3	108.83 - 93.83	Pole	TP30.24x27.398x0.25	4	-7.99	1203.27	75.9	Pass
L4	93.83 - 77.2833	Pole	TP32.686x28.919x0.25	5	-11.29	1338.04	93.9	Pass
L5	77.2833 - 47.2833	Pole	TP38.71x32.686x0.3	6	-15.58	1847.52	86.3	Pass
L6	47.2833 - 1	Pole	TP47x37.0223x0.3125	7	-26.70	2407.42	93.7	Pass
							Summary	
						Pole (L4)	93.9	Pass
						RATING =	**93.9**	**Pass**

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Subject:	Anchor Bolt and Baseplate Analysis
Location:	160-ft EEI Monopole Washington, CT
Rev. 0: 9/19/13	Prepared by: T.J.L. Checked by: C.F.C. Job No. 13075.031

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	$OM := 2142 \cdot ft \cdot kips$	(Input From RisaTower)
Shear Force =	$Shear := 20 \cdot kips$	(Input From RisaTower)
Axial Force =	$Axial := 27 \cdot kips$	(Input From RisaTower)

Anchor Bolt Data:

ASTM A615 Grade 75

Number of Anchor Bolts =	$N := 16$	(User Input)
Diameter of Bolt Circle =	$D_{bc} := 55.0 \cdot in$	(User Input)
Bolt "Column" Distance =	$l := 3.0 \cdot in$	(User Input)
Bolt Ultimate Strength =	$F_u := 100 \cdot ksi$	(User Input)
Bolt Yield Strength =	$F_y := 75 \cdot ksi$	(User Input)
Bolt Modulus =	$E := 29000 \cdot ksi$	(User Input)
Diameter of Anchor Bolts =	$D := 2.25 \cdot in$	(User Input)
Threads per Inch =	$n := 4.5$	(User Input)

Base Plate Data:

Use ASTM A572 Grade 50

Plate Yield Strength =	$Fy_{bp} := 50 \cdot ksi$	(User Input)
Base Plate Thickness =	$t_{bp} := 2.5 \cdot in$	(User Input)
Base Plate Diameter =	$D_{bp} := 61.00 \cdot in$	(User Input)
Outer Pole Diameter =	$D_{pole} := 47.00 \cdot in$	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 27.5\,in$

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

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

$d_1 = 10.52\,in$ $d_7 = 10.52\,in$

$d_2 = 19.45\,in$ $d_8 = 0.00\,in$

$d_3 = 25.41\,in$ $d_9 = -10.52\,in$

$d_4 = 27.50\,in$ $d_{10} = -19.45\,in$

$d_5 = 25.41\,in$ $d_{11} = -25.41\,in$

$d_6 = 19.45\,in$ $d_{12} = -27.50\,in$

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 23.5\,in$

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

$MA_1 = 0.00\,in$ $MA_7 = 0.00\,in$

$MA_2 = 0.00\,in$ $MA_8 = 0.00\,in$

$MA_3 = 1.91\,in$ $MA_9 = 0.00\,in$

$MA_4 = 4.00\,in$ $MA_{10} = 0.00\,in$

$MA_5 = 1.91\,in$ $MA_{11} = 0.00\,in$

$MA_6 = 0.00\,in$ $MA_{12} = 0.00\,in$

Effective Width of Baseplate for Bending = $B_{eff} := .8\cdot 2\cdot\sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 31.1\,in$

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Location:	160-ft EEI Monopole Washington, CT
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Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 6.05 \times 10^3 \cdot in^2$

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 = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 115.1 \cdot kips$

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)

$T_{ALL.Net} := 1.333 \cdot \left(0.60 \cdot A_n \cdot F_y\right) = 194.812 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 59.1 \cdot \%$ 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 = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.312 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 4.5 \cdot ksi$

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 =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 118.5 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 36.5 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 60.8 \cdot \%$$

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 = $C_{Ai} := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$

$C_1 = 46.4 \cdot kips$
$C_2 = 84.3 \cdot kips$
$C_3 = 109.6 \cdot kips$
$C_4 = 118.5 \cdot kips$
$C_5 = 109.6 \cdot kips$
$C_6 = 84.3 \cdot kips$
$C_7 = 46.4 \cdot kips$
$C_8 = 1.7 \cdot kips$
$C_9 = -43.0 \cdot kips$
$C_{10} = -80.9 \cdot kips$
$C_{11} = -106.3 \cdot kips$
$C_{12} = -115.1 \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 27.5 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 49.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 55.2 \cdot \%$

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

Condition3 = "Ok"

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Subject:		Foundation Analysis
Location:		160-ft EEI Monopole Washington, CT
Rev. 0: 9/19/13		Prepared by: T.J.L. Checked by: C.F.C. Job No. 13075.031

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 2142 \cdot ft \cdot kips$	(User Input from RISATower)	
Shear Force =	$Shear := 20 \cdot kip$	(User Input from RISATower)	
Axial Force =	$Axial := 27 \cdot kip$	(User Input from RISATower)	
Tower Height =	$H_t := 160 \cdot ft$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 5 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 3 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 1.0 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 7.0 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 3 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 23 \cdot ft$	(User Input)	

Anchor Bolt Data:

Length of Anchor Bolts =	$L_{st} := 72 \cdot in$	(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 =	$MP := 55.0 \cdot in$	(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 =	$q_s := 4000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 110 \cdot pcf$	(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 =	$n := 0.5 \cdot ft$	(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 =	$d_{bpier} := 1.00 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 30$	(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 =	$d_{Tie} := 0.5 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.00 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 24$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.00 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 40$	(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 =

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

Stability of Footing:

Adjusted Concrete Unit Weight =

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

Adjusted Soil Unit Weight =

$$\gamma_s := \text{if}\left(\text{Bouyancy} = 1, \gamma_{soil} - 62.4\text{pcf}, \gamma_{soil}\right) = 110\cdot\text{pcf}$$

Passive Pressure =

$$P_{pn} := K_p\cdot\gamma_s\cdot n + c\cdot 2\cdot\sqrt{K_p} = 0.165\cdot\text{ksf}$$

$$P_{pt} := K_p\cdot\gamma_s\cdot\left(D_f - T_f\right) + c\cdot 2\cdot\sqrt{K_p} = 0.66\cdot\text{ksf}$$

$$P_{top} := \text{if}\left[n < \left(D_f - T_f\right), P_{pt}, P_{pn}\right] = 0.66\cdot\text{ksf}$$

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

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.155\cdot\text{ksf}$$

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

$$A_p := W_f\cdot T_p = 69$$

Ultimate Shear =

$$S_u := P_{ave}\cdot A_p = 79.695\cdot\text{kip}$$

Weight of Concrete Pad =

$$WT_c := \left[\left(W_f^{\,2}\cdot T_f\right) + d_p^{\,2}\cdot L_p\right]\cdot\gamma_c = 260.1\cdot\text{kip}$$

Weight of Soil Above Footing =

$$WT_{s1} := \left[\left(W_f^{\,2} - d_p^{\,2}\right)\cdot\begin{cases}\left(L_p - L_{pag} - n\right) & \text{if } \left(L_p - L_{pag} - n\right) \geq 0 \\ 0 & \text{if } \left(L_p - L_{pag} - n\right) \leq 0\end{cases}\right]\cdot\gamma_s = 79.2\cdot\text{kip}$$

Weight of Soil Wedge at Back Face =

$$WT_{s2} := \left(\frac{D_f^{\,2}\cdot\tan\left(\Phi_s\right)}{2}\cdot W_f\right)\cdot\gamma_s = 18.259\cdot\text{kip}$$

Weight of Soil Wedge at back face Corners =

$$WT_{s3} := 2\cdot\left[\left(D_f\right)^3\cdot\frac{\tan\left(\Phi_s\right)}{3}\right]\cdot\gamma_s = 5.292\cdot\text{kips}$$

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 366.3\cdot\text{kip}$$

Resisting Moment =

$$M_r := \left(WT_{tot}\right)\cdot\frac{W_f}{2} + S_u\cdot\frac{T_f}{3} + \left[\left(WT_{s2} + WT_{s3}\right)\cdot\left(W_f + \frac{D_f\cdot\tan\left(\Phi_s\right)}{3}\right)\right] = 4856\cdot\text{kip}\cdot\text{ft}$$

Overturning Moment =

$$M_{ot} := \text{OM} + \text{Shear}\cdot\left(L_p + T_f\right) = 2262\cdot\text{kip}\cdot\text{ft}$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.147$$

Factor of Safety Required =

$$FS_{req} := 2$$

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

OverTurning_Moment_Check = "Okay"

Shear Capacity in Pier:

Shear Resistance of Pier =

$$S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 82.418 \cdot kips$$

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

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Area of the Mat =

$$A_{mat} := W_f^{\,2} = 529$$

Section Modulus of Mat =

$$S := \frac{W_f^{\,3}}{6} = 2027.83 \cdot ft^3$$

Maximum Pressure in Mat =

$$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.808 \cdot ksf$$

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

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat =

$$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.423 \cdot ksf$$

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

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution =

$$X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 6.213$$

Distance to Kern =

$$X_k := \frac{W_f}{6} = 3.833$$

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

Eccentricity =

$$e := \frac{M_{ot}}{WT_{tot}} = 6.175$$

Adjusted Soil Pressure =

$$P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \left(\frac{W_f}{2} - e\right)} = 1.994 \cdot ksf$$

$$q_{adj} := if\left(P_{min} < 0, P_a, P_{max}\right) = 1.994 \cdot ksf$$

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

Pressure_Check = "Okay"

Concrete Bearing Capacity:

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

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.225 \times 10^4 \cdot kips$ (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)

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

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

$d_2 := d_1 - d$

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

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

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

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \, d$ (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 = $b_o := \left(d_p + d\right) \cdot \pi = 30.4$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 73.4$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 455.6$

Guess Value = $v_u := 1ksf$

(From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

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

$v_u := \text{Find}(v_u) = 4.5 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 277.4 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 369.8 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 2507.6 \cdot kip$ (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)

$q_b := q_{adj} - d_1 \cdot Slope = 0.995 \cdot ksf$

Maximum Bending at Face of Pier = $M_n := \frac{LF}{\phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 1810.8 \cdot kip \cdot ft$

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

(ACI-200810.2.7.3)

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2} = 85.4 \cdot psi$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f_c}} \right) = 0.0014$

$\rho_{min} := \rho = 0.00144$

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:

$$As := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \frac{d}{2} & \text{otherwise} \end{cases} = 12.737 \cdot in^2$$

$$As_{prov} := A_{bbot} \cdot NB_{bot} = 31.4 \cdot in^2$$

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

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$$As := \rho_{sh} \cdot \left(W_f \cdot \frac{d}{2}\right) = 7.9 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 18.8 \cdot in^2$$

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

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 5.9 \cdot in$$

Spacing or Cover Dimension =

$$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 2.949 \cdot in$$

Transverse Reinforcement Index =

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

$$L_{dbt} := \frac{3 \cdot f_y \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 24.1 \cdot in$$

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 =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 93 \cdot in$$

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

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier =

$$A_p := \frac{\pi \cdot d_p^2}{4} = 5541.77 \cdot in^2$$

$$A_{smin} := 0.01 \cdot 0.05 \cdot A_p = 2.77 \cdot in^2 \qquad \text{(ACI-2008 10.8.4 \& 10.9.1)}$$

$$A_{sprov} := NB_{pier} \cdot A_{bpier} = 23.56 \cdot in^2$$

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

Steel_Area_Check = "Okay"

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 7.796 \cdot in$$

Diameter of Reinforcement Cage =

$$Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 78 \cdot in$$

Maximum Moment in Pier =

$$M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 35383.2 \cdot in \cdot kips$$

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

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

$$(D \; N \; n \; P_u \; M_{xu}) = (84 \;\; 30 \;\; 8 \;\; 35.991 \;\; 3.538 \times 10^4)$$

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

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

$$(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho) = (48.164 \;\; 4.735 \times 10^4 \;\; -60 \;\; 4.277 \times 10^{-3})$$

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

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:

$L_{pier} := L_p - Cvr_{pier} = 33 \cdot in$

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

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension = $c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 3 \cdot in$

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

$L_{dbt} := \frac{3 \cdot f_y \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 23.72 \cdot in$

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)

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

$s_{lim2} := 48 \cdot d_{Tie} \cdot z = 24 \cdot in$

$s_{lim3} := D_f \cdot z = 60 \cdot in$

$s_{lim4} := 18in$

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 =

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 2.875$$

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	WASHINGTON NORTH CT	ECP - CELL #	0	2	300
LATITUDE	41-40-08.93 N	LONGITUDE	73-21-55.01 W		
		SAVE BUTTON			
Additional Comments:		STRUCTURE TYPE	MONOPOLE		

700 Mhz - LTE Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	700 eNodeB	700 eNodeB	700 eNodeB
ANTENNA TYPE	LNX-6514DS-T4M-750_4	BXA-70063-6CF-2°	BXA-70063-6CF-2°
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	40	140	230
DOWN TILT (MECH/DEG)	2	2	2
RAD CTR (FT AGL)	147	147	147
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

700 Mhz - LTE Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	700 eNodeB	700 eNodeB	700 eNodeB
ANTENNA TYPE	BXA-70063-6CF-2°	BXA-70063-6CF-2°	BXA-70063-6CF-2°
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	40	140	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	147	147	147
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Mod 4.0B	Cellular Mod 4.0B	Cellular Mod 4.0B
ANTENNA TYPE	BXNH-6565A-VTM_04DT_08	DBXNH-6565A-VTM_04DT_0850	DBXNH-6565A-VTM_04DT_0850
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	40	140	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	157	157	157
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Mod 4.0B	Cellular Mod 4.0B	Cellular Mod 4.0B
ANTENNA TYPE	BXNH-6565A-VTM_04DT_08	DBXNH-6565A-VTM_04DT_0850	DBXNH-6565A-VTM_04DT_0850
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	40	140	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	157	157	157
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEX WITH LTE CABLE			

1900 PCS - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Mod 4.0B	PCS Mod 4.0B	PCS Mod 4.0B
ANTENNA TYPE	BXNH-6565A-VTM_02DT_19	DBXNH-6565A-VTM_02DT_1950	DBXNH-6565A-VTM_02DT_1950
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	40	140	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	157	157	157
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

1900 PCS - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Mod 4.0B	PCS Mod 4.0B	PCS Mod 4.0B
ANTENNA TYPE	BXNH-6565A-VTM_02DT_19	DBXNH-6565A-VTM_02DT_1950	DBXNH-6565A-VTM_02DT_1950
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	40	140	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	157	157	157
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE			

TX / RX FREQUENCIES								TX POWER OUTPUT			
Cellular A-Band				PCS F / AWS-Band			700 Mhz C - E	Cellular (Watts)			20
TX - 869-880,890-891.5 MHz				TX - 1970-1975 / 2145-21			TX - 746-757	PCS (Watts)			16
RX - 824-835,845-846.5 MHz				RX - 1890-1895 / 1745-17			RX - 776-787	LTE/ AWS (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/ WHITE	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/ ORANGE	A9	700	Tx2/Rx0	BLUE/ ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE
A4	700	Tx4/Rx1	RED/RED/ ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A5	1900	Tx4/Rx1	RED/RED/ WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN
F1-A	1700	Tx/Rx	RED/ BROWN	F1-B	1700	Tx/Rx	BLUE/BROWN	F1-C	1700	Tx/Rx	GREEN/BROWN
F1-D	1700	Tx/Rx	RED/RED/ BROWN	F1-E	1700	Tx/Rx	BLUE/BLUE/BR OWN	F1-F	1700	Tx/Rx	GREEN/GREEN/BROWN
RF ENGINEER				RF MANAGER				INITIALS			DATE
Prepared By: Maria Montrose				Robert Hesselbach							8/13/2013

Amphenol ANTENNA SOLUTIONS

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

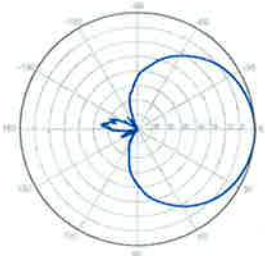
Replace "X" with desired electrical downtilt.

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

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

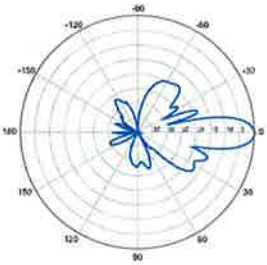
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



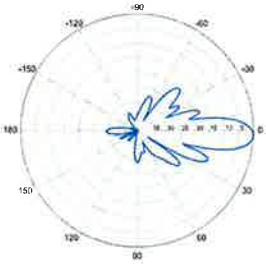
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

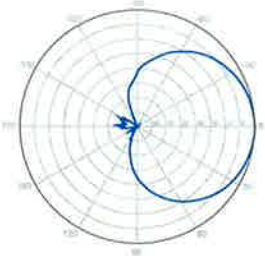


0° | Vertical | 750 MHz

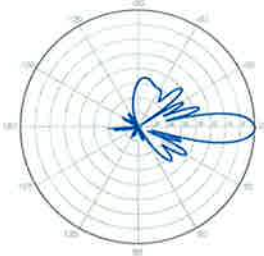
BXA-70063-6CF-EDIN-2



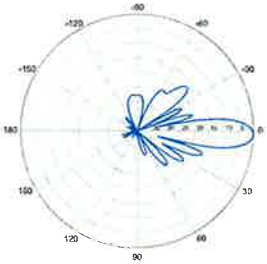
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz



2° | Vertical | 850 MHz