Robinson+Cole

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January 7, 2015

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

Re: **Notice of Exempt Modification – Facility Modification**
5 Perryridge Road, Greenwich, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) antennas at the 124-foot level of the existing 164-foot tower at 5 Perryridge Road in Greenwich (the "Property"). The tower and the Property are owned by Greenwich Hospital. Cellco's shared use of this tower was approved by the Council in 2002. Cellco now intends to replace six (6) of its existing antennas with three (3) model LNX-6514DS-VTM, 700 MHz antennas and three (3) model HBXX-6517DS-VTM, 2100 MHz antennas, all at the same 124-foot level on the tower. Included in Attachment 1 are specifications for the replacement antennas.

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

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

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's replacement antennas will be installed on its existing antenna platform at the 124-foot level.

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 replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. A cumulative General Power Density table for Cellco's modified facility is included 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:
Peter Tesei, Greenwich First Selectman
Sandy M. Carter

ATTACHMENT 1

Product Specifications

COMMSCOPE®

LNX-6514DS-VTM

Andrew® Antenna, 698–896 MHz, 65° horizontal beamwidth, RET compatible

POWERED BY ANDREW.

Electrical Specifications

Frequency Band, MHz	698–806	806–896
Gain, dBi	15.7	16.3
Beamwidth, Horizontal, degrees	65	65
Beamwidth, Horizontal Tolerance, degrees	±3	±3
Beamwidth, Vertical, degrees	12.5	11.2
Beam Tilt, degrees	0–10	0–10
USLS, typical, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	20	20
CPR at Sector, dB	10	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°

Mechanical Specifications

Color | Radome Material	Light gray | Fiberglass, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 2
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph
Antenna Dimensions, L x W x D	1847.0 mm x 301.0 mm x 181.0 mm | 72.7 in x 11.9 in x 7.1 in
Net Weight	17.6 kg | 38.8 lb
Model with factory installed AISG 2.0 RET	LNX-6514DS-A1M

Product Specifications

COMMSCOPE®

HBXX-6517DS-VTM

Andrew® Quad Port Teletilt® Antenna, 1710–2180 MHz, 65° horizontal beamwidth, RET compatible

POWERED BY ANDREW

Electrical Specifications

Frequency Band, MHz	1710–1880	1850–1990	1920–2180
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°

**Values calculated using NGMN Alliance N-P-BASTA v9.6*

Mechanical Specifications

Color | Radome Material	Light gray | PVC, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph
Antenna Dimensions, L x W x D	1903.0 mm x 305.0 mm x 166.0 mm | 74.9 in x 12.0 in x 6.5 in
Net Weight	19.5 kg | 43.0 lb
Model with factory installed AISG 2.0 RET	HBXX-6517DS-A2M

ATTACHMENT 2

	General	Power	Density					
Site Name: Greenwich Relo								
Tower Height: 164ft								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*AT&T GSM	6	427	134	0.0513	1900	1.0000	5.13%	
*AT&T GSM	15	296	134	0.0889	880	0.5867	15.16%	
*AT&T UMTS	1	500	134	0.0100	880	0.5867	1.71%	
*AT&T UMTS	2	500	134	0.0200	1900	1.0000	2.00%	
*AT&T LTE	1	500	134	0.0100	740	0.4933	2.03%	
*MW to Bruce	1	4878	160	0.0685	17960	1.0000	6.85%	
*MW to PD	1	122	160	0.0017	18762	1.0000	0.17%	
*MW to Putnam	1	4878	160	0.0685	17500	1.0000	6.85%	
*Trunked System	1	148	164	0.0020	886.7875	0.5912	0.33%	
*Trunked System	1	148	164	0.0020	867.0625	0.5780	0.34%	
*Trunked System	1	148	164	0.0020	868.15	0.5788	0.34%	
*Trunked System	1	148	164	0.0020	868.4	0.5789	0.34%	
*Trunked System	1	148	164	0.0020	868.7	0.5791	0.34%	
*Trunked System	1	148	164	0.0020	868.7	0.5791	0.34%	
*Mutual Aid	1	218.3	155	0.0033	866.0125	0.5773	0.57%	
*Mutual Aid	1	218.3	155	0.0033	866.5125	0.5777	0.57%	
*CMED	1	150	151	0.0024	463	0.3087	0.77%	
*Fire Paging	1	100	125	0.0023	164.175	0.2000	1.15%	
*SP Hotline	1	100	110	0.0030	154.175	0.2000	1.49%	
*Sprint CDMA/LTE	3	69.3	155	0.0031	1900	1.0000	0.31%	
*Sprint CDMA/LTE	1	39	155	0.0006	850	0.5667	0.10%	
*Sprint CDMA/LTE	2	69.3	155	0.0021	2500	1.0000	0.21%	
*Clearwire	2	153	154	0.0046	2496	1.0000	0.46%	
*Clearwire	1	211	154	0.0032	11 GHz	1.0000	0.32%	
*T-Mobile PCS (GSM/UMTS)	2	12.0815	144	0.0004	1950	1.0000	0.04%	
*T-Mobile AWS (UMTS)	2	12.0815	144	0.0004	2100	1.0000	0.04%	
*T-Mobile AWS (LTE)	2	24.16301	144	0.0008	2100	1.0000	0.08%	
*Nextel	12	100	113	0.0338	851	0.5673	5.96%	
*Sprint/Nextel WiMAX	3	562	154	0.0256	2657	1.0000	2.56%	
Verizon PCS	**15**	**434**	**124**	**0.1522**	**1970**	**1.0000**	**15.22%**	
Verizon Cellular	**9**	**319**	**124**	**0.0671**	**869**	**0.5793**	**11.59%**	
Verizon AWS	**1**	**1750**	**124**	**0.0409**	**2145**	**1.0000**	**4.09%**	
Verizon 700	**1**	**675**	**124**	**0.0158**	**746**	**0.4973**	**3.17%**	
								90.64%
* Source: Siting Council								

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

164-ft Existing EEI Monopole

Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Greenwich

5 Perryridge Road
Greenwich, CT

CENTEK Project No. 14067.063

Date: December 15, 2014

Prepared for:

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

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) owned and operated by Greenwich Hospital located in Greenwich, Connecticut.

The host tower is a 164-ft tall, five-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI); project no. 11030 dated August 21, 2002. The tower geometry, structure member sizes and foundation system information were obtained from the original manufacturers design documents.

Antenna and appurtenance information were obtained a previous structural analysis report prepared by Centek; job no; 14263.000, dated December 11, 2014 and a Verizon RF data sheet.

The tower is made up of five (5) tapered vertical sections consisting of A572-65 pole sections. The bottom four (4) vertical tower sections are slip joint connected while the top section is flange connected. The diameter of the pole (flat-flat) is 47.0-in at the top and 76.0-in at the base.

Verizon proposes the replacement of six (6) existing panel antennas with six (6) proposed panel antennas mounted to the existing low profile platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing tower was designed to support several communication antennas. The existing, proposed and future loads considered in this analysis consist of the following:

- TOWN (EXISTING):
  Antennas: One (1) 12-ft Omni-directional whip antenna, two (2) 10-ft Omni-directional whip antennas, two (2) 8-ft Omni-directional whip antennas, one (1) Kathrein Scala 2' square panel and one (1) camera mounted on a PiROD 13-ft low profile platform with an elevation of 164-ft above grade level.
  Coax Cables: Six (6) 1/2" ∅, one (1) 5/8" ∅, three (3) 7/8" ∅ and two (2) 1-1/4" ∅ coax cables running on the inside of the existing tower.
- TOWN (EXISTING):
  Antennas: Two (2) 4 FT Dishes and one (1) 2 Ft Dish mounted on three (3) 4'x4" pipe mounts with a RAD center elevation of 160-ft above grade level.
  Coax Cables: Three (3) 1-1/4" ∅ coax cables running on the inside of the existing tower.
- CLEARWIRE (EXISTING):
  Antennas: Three (3) Argus LLPX310R panel antennas, three (3) Samsung FDD-R6-RRH, two (2) Dragonwave Horizon ODU's and two (2) Dragonwave A-ANT-23-G-2-C dishes mounted on the Sprint 13-ft low profile platform with a RAD center elevation of 154-ft above the existing tower base plate.
  Coax Cables: Two (2) 2" ∅ conduits and two (2) 5/8" ∅ coax cables running on the inside of the existing tower.

- SPRINT (EXISTING):
  Antennas: Two (2) RFS APXVSPP18-C-A20 panel antennas, one (1) Powerwave P40-16-XLPP-RR-A panel antennas, three (3) RFS APXVTM14 panel antennas and one (1) GPS antenna mounted to a low profile platform with a RAD center elevation of 154-ft above the existing tower base plate. Three (3) ALU 1900 MHz RRH's, three (3) ALU 800 MHz RRH's and three (3) ALU TD-RRH-8x20 remote radio heads mounted on a universal tr-bracket below the existing low profile platform.
  Coax Cables: Six (6) 1-5/8" ∅ Hybriflex cables and one (1) 1/2" ∅ coax cable running on the inside of the existing tower.
- T-MOBILE (EXISTING/RESERVED):
  Antennas: Six (6) Ericsson AIR21 panel antennas, three (3) TMA's and three (3) Bias Tee's mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 144-ft above grade level.
  Coax Cables: Fourteen (14) 1-5/8" ∅ coax cables and three (3) 1-5/8" ∅ fiber cables running on the inside of the existing tower.
- AT&T (EXISTING):
  Antennas: Six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted to one (1) universal ring mount with a RAD center elevation of 138-ft above grade level.
  Coax Cables: One (1) fiber cable and two (2) dc control cables running on the inside of the existing tower.
- AT&T (EXISTING):
  Antennas: Six (6) Powerwave 7770.00 panel antennas, three (3) Powerwave P65-16-XLH-RR panel antennas, six (6) LGP21401 TMA's and six (6) LGP21901 diplexers mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 134-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower
- NORTHEAST UTILITIES (EXISTING):
  Antennas: Two (2) Decibel DB586-Y (one upright and one inverted), one (1) Telewave ANT150F2 and one (1) Comprod 731-50HD whip antennas mounted on a PiROD 13-ft low profile platform with an elevation of 114-ft above grade level.
  Coax Cables: Two (2) 1-5/8" ∅ and two (2) 7/8" ∅ coax cables running on the inside of the existing tower.
- UNKNOWN (EXISTING):
  Antennas: Three GPS antennas mounted on three (3) standoffs with a RAD center elevation of 50-ft above grade level.
  Coax Cables: Three (3) 7/8" ∅ coax cables running on the exterior of the existing tower.

- VERIZON (EXISTING TO REMAIN):
  Antennas: Six (6) Decibel DB844H65E-XY panel antennas, three (3) RYMSA MG D3-800T0 panel antennas, three (3) Alcatel-Lucent RRH2x40-AWS Remote Radio Heads, three (3) Alcatel-Lucent RRH2x40-07-U Remote Radio Heads, one (1) Raycap RC2DC-3315-PF-48 main distribution box and six (6) RFS FD9R6004/2C-3L Diplexers mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 124-ft above grade level.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables and one (1) 1-5/8" ∅ fiber cable running on the inside of the existing tower.
- VERIZON (EXISTING TO REMOVE):
  Antennas: Three (3) Andrew LNX-6514DS-T4M and three (3) RYMSA MG D3-800T0 panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 124-ft above grade level.
- **VERIZON (PROPOSED):**
  Antennas: Three (3) Andrew LNX-6514DS-A1M and three (3) Andrew HBXX-6517DS panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 124-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 coax cables to be installed as indicated in this report.

Analysis

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

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

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

Tower Loading

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

Basic Wind Speed:	Fairfield; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Greenwich; v = 100 mph (3 second gust) equivalent to v = 80 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed controls.	
Load Cases:	Load Case 1; 85 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; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 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 **46.0%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L5)	1.50'-39.88'	46.0%	**PASS**

- The tower deflection (tilt) was found to be within allowable limits.

Deflection (degrees)	Proposed	Allowable (1)	Result
Tilt	1.36	1.9	**PASS**

(1) Allowable tilt taken from original EEI design documents job no. 11030 dated 8/21/02.

Foundation and Anchors

The existing foundation consists of a 9.0 ∅ x 28.0-ft long reinforced concrete caisson. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; project no. 11030 dated August 21, 2002. The base of the tower is connected to the foundation by means of (30) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 7-ft into the concrete foundation structure.

- 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	43 kips
	Compression	82 kips
	Moment	4791 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	Proposed Loading	Result
Reinforced Concrete Caisson	Moment Capacity	52.0%	**PASS**
	Lateral Deflection	0.52 in.(1)	**PASS**

(1) Lateral deflection typically limited to 1.0 in. for monopole tower structures.

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Flange Bolts	Tension	54.3%	**PASS**
Flange Plate	Bending	42.1%	**PASS**

- 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	47.2%	**PASS**
Base Plate	Bending	37.0%	**PASS**

Conclusion

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

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:

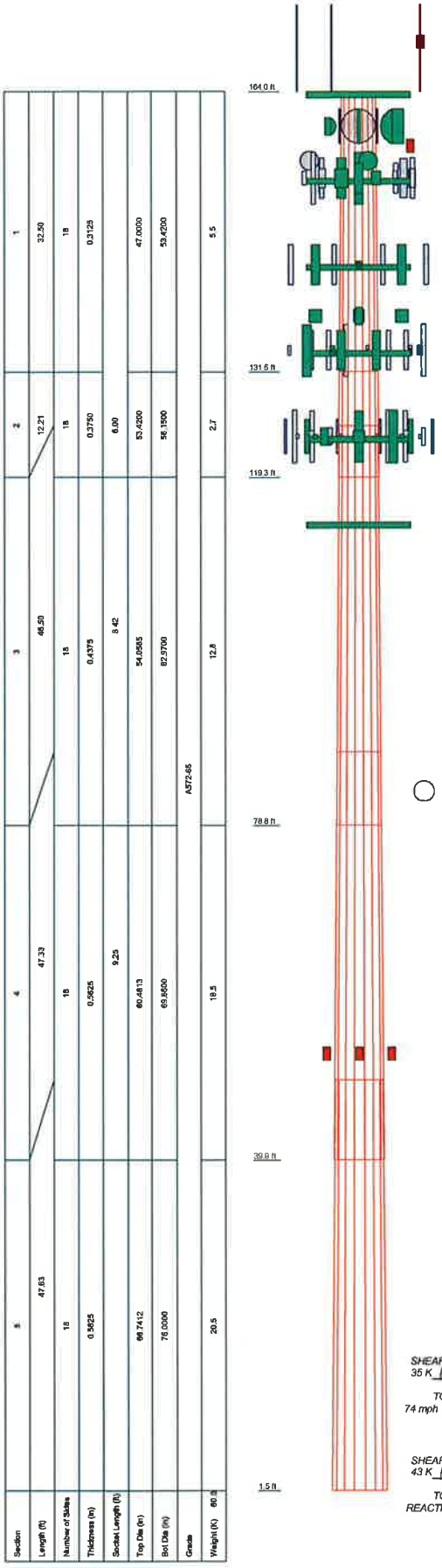
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provided 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				
Length (ft)	32.50	12.21	46.50	47.33	47.63				
Number of Sides	18	18	18	18	18				
Thickness (in)	0.3125	0.3750	0.4375	0.5625	0.5625				
Socket Length (ft)		6.00	8.42	9.25					
Top Dia (in)	47.0000	53.4200	54.0585	60.4813	66.7412				
Bot Dia (in)	53.4200	56.1500	82.9700	69.8800	76.0000				
Grade	A572-65								
Weight (K)	5.5	2.7	12.8	18.5	20.5				60.0

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
12' x 3" Dia Omni (Town Existing)	164	(2) RRUS-11 (AT&T Existing)	138
8' x 3" Dia Omni (Town Existing)	164	(2) RRUS-11 (AT&T Existing)	138
2'x2' Panel (Town Existing)	164	(2) RRUS-11 (AT&T Existing)	138
10' x 3" Dia Omni (Town Existing)	164	DC6-48-60-18-8F Surge Arrestor (AT&T Existing)	138
10' x 3" Dia Omni (Town Existing)	164	Valmont Uni-Tri Bracket (AT&T Existing)	138
8' x 3" Dia Omni (Town Existing)	164	P65-16-XLH-RR (AT&T Existing)	134
Camera (Town Existing)	164	7770.00 (AT&T Existing)	134
Low Profile Platform (Town Existing)	164	7770.00 (AT&T Existing)	134
4'x4" Pipe Mount (Town Existing)	160	P65-16-XLH-RR (AT&T Existing)	134
4'x4" Pipe Mount (Town Existing)	160	(2) LGP21401 TMA (AT&T Existing)	134
4'x4" Pipe Mount (Town Existing)	160	(2) LGP21401 TMA (AT&T Existing)	134
4 FT DISH (Town Existing)	160	(2) LGP21401 TMA (AT&T Existing)	134
4 FT DISH (Town Existing)	160	(2) LGP21901 Diplexer (AT&T Existing)	134
2 FT DISH (Town Existing)	160	(2) LGP21901 Diplexer (AT&T Existing)	134
Horizon ODU (Clearwire Existing)	154	(2) LGP21901 Diplexer (AT&T Existing)	134
Horizon ODU (Clearwire Existing)	154	Low Profile Platform (AT&T Existing)	134
APXV18PP18-C-A20 (Sprint Existing)	154	7770.00 (AT&T Existing)	134
P40-16-XLPP-RR-A (Sprint Existing)	154	7770.00 (AT&T Existing)	134
APXV18PP18-C-A20 (Sprint Existing)	154	P65-16-XLH-RR (AT&T Existing)	134
FD-RRH 4x45 1900 (Sprint Existing)	154	7770.00 (AT&T Existing)	134
FD-RRH 4x45 1900 (Sprint Existing)	154	7770.00 (AT&T Existing)	134
FD-RRH 4x45 1900 (Sprint Existing)	154	DB844H65E-XY (Verizon Existing)	124
FD-RRH 2x50 800 (Sprint Existing)	154	HBXX-6517DS (Verizon Proposed)	124
FD-RRH 2x50 800 (Sprint Existing)	154	LNX-6514DS-VTM (Verizon Proposed)	124
FD-RRH 2x50 800 (Sprint Existing)	154	MG 03-800TX (Verizon Existing)	124
GPS (Sprint Existing)	154	DB844H65E-XY (Verizon Existing)	124
Low Profile Platform (Sprint Existing)	154	DB844H65E-XY (Verizon Existing)	124
APXVTM14 (Sprint Existing)	154	HBXX-6517DS (Verizon Proposed)	124
APXVTM14 (Sprint Existing)	154	LNX-6514DS-VTM (Verizon Proposed)	124
APXVTM14 (Sprint Existing)	154	MG 03-800TX (Verizon Existing)	124
TD-RRH8x20-25 (Sprint Existing)	154	DB844H65E-XY (Verizon Existing)	124
TD-RRH8x20-25 (Sprint Existing)	154	(2) FD9R6004/2C-3L Diplexer (Verizon Existing)	124
TD-RRH8x20-25 (Sprint Existing)	154	(2) FD9R6004/2C-3L Diplexer (Verizon Existing)	124
LLPX310R (Clearwire Existing)	154	(2) FD9R6004/2C-3L Diplexer (Verizon Existing)	124
LLPX310R (Clearwire Existing)	154	RRHZx40-AWS (Verizon Existing)	124
LLPX310R (Clearwire Existing)	154	RRHZx40-AWS (Verizon Existing)	124
A-Ant-23G-2-C (Clearwire Existing)	154	RRHZx40-AWS (Verizon Existing)	124
A-Ant-23G-2-C (Clearwire Existing)	154	RRHZx40-07-U (Verizon Existing)	124
Remote Radio Head FD R6 RRH (Clearwire Existing)	151.5	RRHZx40-07-U (Verizon Existing)	124
Remote Radio Head FD R6 RRH (Clearwire Existing)	151.5	RRHZx40-07-U (Verizon Existing)	124
Remote Radio Head FD R6 RRH (Clearwire Existing)	151.5	RC2DC-3315-PF-48 (Verizon Existing)	124
Valmont Uni-Tri Bracket (Sprint Existing)	151.5	Low Profile Platform (Verizon Existing)	124
TMA 10"x8"x3" (T-Mobile Reserved)	144	DB844H65E-XY (Verizon Existing)	124
Smart Bias T (T-Mobile Reserved)	144	HBXX-6517DS (Verizon Proposed)	124
Smart Bias T (T-Mobile Reserved)	144	LNX-6514DS-VTM (Verizon Proposed)	124
Smart Bias T (T-Mobile Reserved)	144	MG 03-800TX (Verizon Existing)	124
Low Profile Platform (T-Mobile Existing)	144	DB844H65E-XY (Verizon Existing)	124
(2) AIR21 (T-Mobile Reserved)	144	DB586-Y (NU - Existing)	114
(2) AIR21 (T-Mobile Reserved)	144	DB586-Y (NU - Existing)	114
TMA 10"x8"x3" (T-Mobile Reserved)	144	ANT150F2 (NU - Existing)	114
TMA 10"x8"x3" (T-Mobile Reserved)	144	Low Profile Platform	114
(2) AIR21 (T-Mobile Reserved)	144	20' x 3" Dia Omni (NU - Existing)	114
		GPS	51.5
		GPS	51.5
		GPS	51.5

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
5. Welds are fabricated with ER-70S-6 electrodes.
6. TOWER RATING: 46%

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

Job:	14067.063 - Greenwich
Project:	164' EEI Monopole - 5 Perryridge Rd., Greenwich, CT
Client:	Verizon Wireless
Drawn by:	TJL
App'd:	
Code:	TIA/EIA-222-F
Date:	12/15/14
Scale:	NTS
Path:	
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 85 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	164.00-131.50	32.50	0.00	18	47.0000	53.4200	0.3125	1.2500	A572-65 (65 ksi)
L2	131.50-119.29	12.21	6.00	18	53.4200	56.1500	0.3750	1.5000	A572-65 (65 ksi)
L3	119.29-78.79	46.50	8.42	18	54.0585	62.9700	0.4375	1.7500	A572-65 (65 ksi)
L4	78.79-39.88	47.33	9.25	18	60.4813	69.6600	0.5625	2.2500	A572-65 (65 ksi)
L5	39.88-1.50	47.63		18	66.7412	76.0000	0.5625	2.2500	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	47.7251	46.3082	12752.5270	16.5741	23.8760	534.1149	25521.8341	23.1585	7.7220	24.71
	54.2441	52.6760	18769.9004	18.8532	27.1374	691.6627	37564.4987	26.3430	8.8519	28.326
L2	54.2441	63.1368	22444.4518	18.8310	27.1374	827.0684	44918.4365	31.5744	8.7419	23.312
	57.0162	66.3862	26091.2194	19.8001	28.5242	914.7047	52216.7704	33.1994	9.2224	24.593
L3	56.0600	74.4594	27047.4669	19.0354	27.4617	984.9157	54130.5236	37.2368	8.7443	19.987
	63.9414	86.8342	42898.2727	22.1990	31.9888	1341.0421	85852.9920	43.4253	10.3127	23.572
L4	63.0724	106.9776	48524.0652	21.2712	30.7245	1579.3269	97111.9796	53.4990	9.6547	17.164
	70.7346	123.3649	74413.8720	24.5296	35.3873	2102.8424	148925.6597	61.6942	11.2702	20.036
L5	69.5966	118.1537	65376.3617	23.4934	33.9045	1928.2498	130838.7474	59.0881	10.7564	19.123
	77.1724	134.6842	96834.1984	26.7803	38.6080	2508.1382	193795.8137	67.3549	12.3860	22.02

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 164.00-131.50				1	1	1		
L2 131.50-119.29				1	1	1		
L3 119.29-78.79				1	1	1		
L4 78.79-39.88				1	1	1		
L5 39.88-1.50				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
1/2 (Town Existing)	A	No	Inside Pole	164.00 - 4.50	6	No Ice	0.00	0.25
						1/2" Ice	0.00	0.25
5/8 (Town Existing)	A	No	Inside Pole	164.00 - 4.50	1	No Ice	0.00	0.40
						1/2" Ice	0.00	0.40
7/8 (Town Existing)	A	No	Inside Pole	164.00 - 4.50	3	No Ice	0.00	0.54
						1/2" Ice	0.00	0.54
1 1/4 (Town Existing)	A	No	Inside Pole	164.00 - 4.50	5	No Ice	0.00	0.66
						1/2" Ice	0.00	0.66
1/2 (Sprint Existing)	B	No	Inside Pole	154.00 - 7.50	1	No Ice	0.00	0.25
						1/2" Ice	0.00	0.25
2" Rigid Conduit (Clearwire Existing)	B	No	Inside Pole	154.00 - 7.50	2	No Ice	0.00	2.80
						1/2" Ice	0.00	2.80
LDF4.5-50 (5/8 FOAM) (Clearwire Existing)	B	No	Inside Pole	154.00 - 7.50	2	No Ice	0.00	0.15
						1/2" Ice	0.00	0.15
1 5/8 (T-Mobile Existing)	B	No	Inside Pole	144.00 - 4.50	14	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8	A	No	Inside Pole	134.00 - 11.50	12	No 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
(AT&T Existing)						1/2" Ice	0.00	1.04
1 5/8	C	No	Inside Pole	124.00 - 7.50	6	No Ice	0.00	1.04
(Verizon Existing)						1/2" Ice	0.00	1.04
RG6-Fiber	A	No	Inside Pole	134.00 - 11.50	1	No Ice	0.00	0.00
(AT&T Existing)						1/2" Ice	0.00	0.00
#8 AWG Copper WIre	A	No	Inside Pole	134.00 - 11.50	2	No Ice	0.00	0.00
(AT&T Existing)						1/2" Ice	0.00	0.00
7/8	B	No	CaAa (Out Of Face)	51.50 - 4.50	3	No Ice	0.11	0.54
						1/2" Ice	0.21	1.52
HYBRIFLEX 1-5/8"	B	No	Inside Pole	154.00 - 7.50	6	No Ice	0.00	1.90
(Sprint Existing)						1/2" Ice	0.00	1.90
HYBRIFLEX 1-5/8"	B	No	Inside Pole	144.00 - 7.50	3	No Ice	0.00	1.90
(T-Mobile - Reserved)						1/2" Ice	0.00	1.90
HYBRIFLEX 1-5/8"	C	No	Inside Pole	124.00 - 7.50	1	No Ice	0.00	1.90
(Verizon Existing)						1/2" Ice	0.00	1.90
7/8	C	No	Inside Pole	114.00 - 1.50	2	No Ice	0.00	0.54
(NU - Existing)						1/2" Ice	0.00	0.54
1 5/8	C	No	Inside Pole	114.00 - 1.50	2	No Ice	0.00	1.04
(NU - Existing)						1/2" Ice	0.00	1.04

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	164.00-131.50	A	0.000	0.000	0.000	0.000	0.25
		B	0.000	0.000	0.000	0.000	0.65
		C	0.000	0.000	0.000	0.000	0.00
L2	131.50-119.29	A	0.000	0.000	0.000	0.000	0.24
		B	0.000	0.000	0.000	0.000	0.46
		C	0.000	0.000	0.000	0.000	0.04
L3	119.29-78.79	A	0.000	0.000	0.000	0.000	0.78
		B	0.000	0.000	0.000	0.000	1.53
		C	0.000	0.000	0.000	0.000	0.44
L4	78.79-39.88	A	0.000	0.000	0.000	0.000	0.75
		B	0.000	0.000	0.000	3.869	1.49
		C	0.000	0.000	0.000	0.000	0.44
L5	39.88-1.50	A	0.000	0.000	0.000	0.000	0.60
		B	0.000	0.000	0.000	11.782	1.33
		C	0.000	0.000	0.000	0.000	0.38

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	164.00-131.50	A	0.500	0.000	0.000	0.000	0.000	0.25
		B		0.000	0.000	0.000	0.000	0.65
		C		0.000	0.000	0.000	0.000	0.00
L2	131.50-119.29	A	0.500	0.000	0.000	0.000	0.000	0.24
		B		0.000	0.000	0.000	0.000	0.46
		C		0.000	0.000	0.000	0.000	0.04
L3	119.29-78.79	A	0.500	0.000	0.000	0.000	0.000	0.78
		B		0.000	0.000	0.000	0.000	1.53
		C		0.000	0.000	0.000	0.000	0.44

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
L4	78.79-39.88	A	0.500	0.000	0.000	0.000	0.000	0.75
		B		0.000	0.000	0.000	7.355	1.52
		C		0.000	0.000	0.000	0.000	0.44
L5	39.88-1.50	A	0.500	0.000	0.000	0.000	0.000	0.60
		B		0.000	0.000	0.000	22.395	1.43
		C		0.000	0.000	0.000	0.000	0.38

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	164.00-131.50	0.0000	0.0000	0.0000	0.0000
L2	131.50-119.29	0.0000	0.0000	0.0000	0.0000
L3	119.29-78.79	0.0000	0.0000	0.0000	0.0000
L4	78.79-39.88	0.1320	0.0762	0.2434	0.1405
L5	39.88-1.50	0.3779	0.2182	0.6797	0.3924

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
4'x4" Pipe Mount	A	From Face	0.50	0.0000	160.00	No Ice	1.32	1.32	0.04
(Town Existing)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00						
4'x4" Pipe Mount	B	From Face	0.50	0.0000	160.00	No Ice	1.32	1.32	0.04
(Town Existing)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00						
4'x4" Pipe Mount	C	From Face	0.50	0.0000	160.00	No Ice	1.32	1.32	0.04
(Town Existing)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00						
12' x 3" Dia Omni	A	From Face	4.00	0.0000	164.00	No Ice	3.60	3.60	0.04
(Town Existing)			-4.00			1/2" Ice	4.83	4.83	0.06
			5.00						
8' x 3" Dia Omni	A	From Face	4.00	0.0000	164.00	No Ice	2.40	2.40	0.03
(Town Existing)			4.00			1/2" Ice	3.19	3.19	0.04
			5.00						
2'x2' Panel	B	From Face	4.00	0.0000	164.00	No Ice	5.60	0.72	0.02
(Town Existing)			4.00			1/2" Ice	5.92	0.88	0.05
			5.00						
10' x 3" Dia Omni	B	From Face	4.00	0.0000	164.00	No Ice	3.00	3.00	0.03
(Town Existing)			4.00			1/2" Ice	4.03	4.03	0.05
			5.00						
10' x 3" Dia Omni	A	From Face	4.00	0.0000	164.00	No Ice	3.00	3.00	0.03
(Town Existing)			-4.00			1/2" Ice	4.03	4.03	0.05
			5.00						
8' x 3" Dia Omni	A	From Face	4.00	0.0000	164.00	No Ice	2.40	2.40	0.03

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
(Town Existing)			4.00 5.00			1/2" Ice	3.19	3.19	0.04
Camera	C	From Face	4.00	0.0000	164.00	No Ice	3.00	3.00	0.10
(Town Existing)			-4.00 2.00			1/2" Ice	4.00	4.00	0.15
Low Profile Platform	C	None		0.0000	164.00	No Ice	15.70	15.70	1.30
(Town Existing)						1/2" Ice	20.10	20.10	1.76
LLPX310R	A	From Face	3.00	0.0000	154.00	No Ice	4.83	1.95	0.03
(Clearwire Existing)			0.00 0.00			1/2" Ice	5.18	2.21	0.05
LLPX310R	B	From Face	3.00	0.0000	154.00	No Ice	4.83	1.95	0.03
(Clearwire Existing)			0.00 0.00			1/2" Ice	5.18	2.21	0.05
LLPX310R	C	From Face	3.00	0.0000	154.00	No Ice	4.83	1.95	0.03
(Clearwire Existing)			0.00 0.00			1/2" Ice	5.18	2.21	0.05
Remote Radio Head FD R6 RRH	A	From Face	3.00 0.00	0.0000	151.50	No Ice 1/2" Ice	1.80 1.99	0.78 0.92	0.03 0.04
(Clearwire Existing)			0.00						
Remote Radio Head FD R6 RRH	B	From Face	3.00 0.00	0.0000	151.50	No Ice 1/2" Ice	1.80 1.99	0.78 0.92	0.03 0.04
(Clearwire Existing)			0.00						
Remote Radio Head FD R6 RRH	C	From Face	3.00 0.00	0.0000	151.50	No Ice 1/2" Ice	1.80 1.99	0.78 0.92	0.03 0.04
(Clearwire Existing)			0.00						
Horizon ODU	A	None		0.0000	154.00	No Ice	0.79	0.17	0.00
(Clearwire Existing)						1/2" Ice	0.91	0.25	0.00
Horizon ODU	C	None		0.0000	154.00	No Ice	0.79	0.17	0.00
(Clearwire Existing)						1/2" Ice	0.91	0.25	0.00
APXVSPP18-C-A20	A	From Face	4.00	0.0000	154.00	No Ice	8.26	5.28	0.06
(Sprint Existing)			0.00 0.00			1/2" Ice	8.81	5.74	0.11
P40-16-XLPP-RR-A	B	From Face	4.00	0.0000	154.00	No Ice	10.50	3.52	0.05
(Sprint Existing)			0.00 0.00			1/2" Ice	10.98	3.87	0.11
APXVSPP18-C-A20	C	From Face	4.00	0.0000	154.00	No Ice	8.26	5.28	0.06
(Sprint Existing)			0.00 0.00			1/2" Ice	8.81	5.74	0.11
FD-RRH 4x45 1900	A	From Face	4.00	0.0000	154.00	No Ice	2.71	2.78	0.06
(Sprint Existing)			2.00 0.00			1/2" Ice	2.94	3.02	0.08
FD-RRH 4x45 1900	B	From Face	4.00	0.0000	154.00	No Ice	2.71	2.78	0.06
(Sprint Existing)			2.00 0.00			1/2" Ice	2.94	3.02	0.08
FD-RRH 4x45 1900	C	From Face	4.00	0.0000	154.00	No Ice	2.71	2.78	0.06
(Sprint Existing)			2.00 0.00			1/2" Ice	2.94	3.02	0.08
FD-RRH 2x50 800	A	From Face	4.00	0.0000	154.00	No Ice	2.40	2.25	0.06
(Sprint Existing)			-2.00 0.00			1/2" Ice	2.61	2.46	0.09
FD-RRH 2x50 800	B	From Face	4.00	0.0000	154.00	No Ice	2.40	2.25	0.06
(Sprint Existing)			-2.00 0.00			1/2" Ice	2.61	2.46	0.09
FD-RRH 2x50 800	C	From Face	4.00	0.0000	154.00	No Ice	2.40	2.25	0.06
(Sprint Existing)			-2.00 0.00			1/2" Ice	2.61	2.46	0.09
Valmont Uni-Tri Bracket	A	None		0.0000	151.50	No Ice	1.75	1.75	0.29

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(Sprint Existing)						1/2" Ice	1.94	1.94	0.31
GPS	C	From Face	4.00	0.0000	154.00	No Ice	1.00	1.00	0.01
(Sprint Existing)			-6.00			1/2" Ice	1.50	1.50	0.01
			3.00						
Low Profile Platform	C	None		0.0000	154.00	No Ice	15.70	15.70	1.30
(Sprint Existing)						1/2" Ice	20.10	20.10	1.76
APXVTM14	A	From Face	4.00	0.0000	154.00	No Ice	6.90	3.61	0.06
(Sprint Existing)			2.00			1/2" Ice	7.35	3.97	0.10
			0.00						
APXVTM14	B	From Face	4.00	0.0000	154.00	No Ice	6.90	3.61	0.06
(Sprint Existing)			2.00			1/2" Ice	7.35	3.97	0.10
			0.00						
APXVTM14	C	From Face	4.00	0.0000	154.00	No Ice	6.90	3.61	0.06
(Sprint Existing)			2.00			1/2" Ice	7.35	3.97	0.10
			0.00						
TD-RRH8x20-25	A	From Face	4.00	0.0000	154.00	No Ice	4.72	1.70	0.07
(Sprint Existing)			2.00			1/2" Ice	5.01	1.92	0.10
			0.00						
TD-RRH8x20-25	B	From Face	4.00	0.0000	154.00	No Ice	4.72	1.70	0.07
(Sprint Existing)			2.00			1/2" Ice	5.01	1.92	0.10
			0.00						
TD-RRH8x20-25	C	From Face	4.00	0.0000	154.00	No Ice	4.72	1.70	0.07
(Sprint Existing)			2.00			1/2" Ice	5.01	1.92	0.10
			0.00						
(2) AIR21	A	From Face	4.00	0.0000	144.00	No Ice	6.53	4.36	0.08
(T-Mobile Reserved)			0.00			1/2" Ice	6.98	4.77	0.12
			0.00						
(2) AIR21	B	From Face	4.00	0.0000	144.00	No Ice	6.53	4.36	0.08
(T-Mobile Reserved)			0.00			1/2" Ice	6.98	4.77	0.12
			0.00						
(2) AIR21	C	From Face	4.00	0.0000	144.00	No Ice	6.53	4.36	0.08
(T-Mobile Reserved)			0.00			1/2" Ice	6.98	4.77	0.12
			0.00						
TMA 10"x8"x3"	A	From Face	4.00	0.0000	144.00	No Ice	0.78	0.29	0.02
(T-Mobile Reserved)			0.00			1/2" Ice	0.90	0.38	0.02
			0.00						
TMA 10"x8"x3"	B	From Face	4.00	0.0000	144.00	No Ice	0.78	0.29	0.02
(T-Mobile Reserved)			0.00			1/2" Ice	0.90	0.38	0.02
			0.00						
TMA 10"x8"x3"	C	From Face	4.00	0.0000	144.00	No Ice	0.78	0.29	0.02
(T-Mobile Reserved)			0.00			1/2" Ice	0.90	0.38	0.02
			0.00						
Smart Bias T	A	From Face	4.00	0.0000	144.00	No Ice	0.16	0.08	0.00
(T-Mobile Reserved)			0.00			1/2" Ice	0.21	0.12	0.00
			0.00						
Smart Bias T	B	From Face	4.00	0.0000	144.00	No Ice	0.16	0.08	0.00
(T-Mobile Reserved)			0.00			1/2" Ice	0.21	0.12	0.00
			0.00						
Smart Bias T	C	From Face	4.00	0.0000	144.00	No Ice	0.16	0.08	0.00
(T-Mobile Reserved)			0.00			1/2" Ice	0.21	0.12	0.00
			0.00						
Low Profile Platform	C	None		0.0000	144.00	No Ice	15.70	15.70	1.30
(T-Mobile Existing)						1/2" Ice	20.10	20.10	1.76
(2) RRUS-11	A	From Face	0.50	0.0000	138.00	No Ice	2.99	1.25	0.05
(AT&T Existing)			0.00			1/2" Ice	3.23	1.41	0.07
			0.00						
(2) RRUS-11	B	From Face	0.50	0.0000	138.00	No Ice	2.99	1.25	0.05

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(AT&T Existing)			0.00			1/2" Ice	3.23	1.41	0.07
			0.00						
(2) RRUS-11	C	From Face	0.50	0.0000	138.00	No Ice	2.99	1.25	0.05
(AT&T Existing)			0.00			1/2" Ice	3.23	1.41	0.07
			0.00						
DC6-48-60-18-8F Surge	C	From Face	0.50	0.0000	138.00	No Ice	2.23	2.23	0.02
Arrestor			0.00			1/2" Ice	2.45	2.45	0.04
(AT&T Existing)			0.00						
Valmont Uni-Tri Bracket	C	None		0.0000	138.00	No Ice	1.75	1.75	0.29
(AT&T Existing)						1/2" Ice	1.94	1.94	0.31
7770.00	A	From Face	3.00	0.0000	134.00	No Ice	5.88	2.93	0.04
(AT&T Existing)			-2.00			1/2" Ice	6.31	3.27	0.07
			0.00						
7770.00	A	From Face	3.00	0.0000	134.00	No Ice	5.88	2.93	0.04
(AT&T Existing)			2.00			1/2" Ice	6.31	3.27	0.07
			0.00						
P65-16-XLH-RR	A	From Face	3.00	0.0000	134.00	No Ice	8.40	4.70	0.06
(AT&T Existing)			6.00			1/2" Ice	8.95	5.15	0.11
			0.00						
7770.00	B	From Face	3.00	0.0000	134.00	No Ice	5.88	2.93	0.04
(AT&T Existing)			-2.00			1/2" Ice	6.31	3.27	0.07
			0.00						
7770.00	B	From Face	3.00	0.0000	134.00	No Ice	5.88	2.93	0.04
(AT&T Existing)			2.00			1/2" Ice	6.31	3.27	0.07
			0.00						
P65-16-XLH-RR	B	From Face	3.00	0.0000	134.00	No Ice	8.40	4.70	0.06
(AT&T Existing)			6.00			1/2" Ice	8.95	5.15	0.11
			0.00						
7770.00	C	From Face	3.00	0.0000	134.00	No Ice	5.88	2.93	0.04
(AT&T Existing)			2.00			1/2" Ice	6.31	3.27	0.07
			0.00						
7770.00	C	From Face	3.00	0.0000	134.00	No Ice	5.88	2.93	0.04
(AT&T Existing)			-2.00			1/2" Ice	6.31	3.27	0.07
			0.00						
P65-16-XLH-RR	C	From Face	3.00	0.0000	134.00	No Ice	8.40	4.70	0.06
(AT&T Existing)			6.00			1/2" Ice	8.95	5.15	0.11
			0.00						
(2) LGP21401 TMA	A	From Face	3.00	0.0000	134.00	No Ice	0.95	0.37	0.02
(AT&T Existing)			-2.00			1/2" Ice	1.09	0.48	0.02
			0.00						
(2) LGP21401 TMA	B	From Face	3.00	0.0000	134.00	No Ice	0.95	0.37	0.02
(AT&T Existing)			-2.00			1/2" Ice	1.09	0.48	0.02
			0.00						
(2) LGP21401 TMA	C	From Face	3.00	0.0000	134.00	No Ice	0.95	0.37	0.02
(AT&T Existing)			-2.00			1/2" Ice	1.09	0.48	0.02
			0.00						
(2) LGP21901 Diplexer	A	From Face	3.00	0.0000	134.00	No Ice	0.23	0.12	0.01
(AT&T Existing)			-2.00			1/2" Ice	0.30	0.17	0.01
			0.00						
(2) LGP21901 Diplexer	B	From Face	3.00	0.0000	134.00	No Ice	0.23	0.12	0.01
(AT&T Existing)			-2.00			1/2" Ice	0.30	0.17	0.01
			0.00						
(2) LGP21901 Diplexer	C	From Face	3.00	0.0000	134.00	No Ice	0.23	0.12	0.01
(AT&T Existing)			-2.00			1/2" Ice	0.30	0.17	0.01
			0.00						
Low Profile Platform	C	None		0.0000	134.00	No Ice	15.70	15.70	1.30
(AT&T Existing)						1/2" Ice	20.10	20.10	1.76

Description	Face or Leg	Offset Type	Offsets: Horz Lateral / Vert (ft / ft / ft)	Azimuth Adjustment (°)	Placement (ft)		C_AA_A Front (ft^2)	C_AA_A Side (ft^2)	Weight (K)
DB844H65E-XY	A	From Face	4.00	0.0000	124.00	No Ice	2.87	4.20	0.01
(Verizon Existing)			-6.00			1/2" Ice	3.18	4.57	0.04
			0.00						
HBXX-6517DS	A	From Face	4.00	0.0000	124.00	No Ice	8.74	5.24	0.05
(Verizon Proposed)			-4.00			1/2" Ice	9.31	5.71	0.10
			0.00						
LNX-6514DS-VTM	A	From Face	4.00	0.0000	124.00	No Ice	8.41	5.41	0.04
(Verizon Proposed)			0.00			1/2" Ice	8.96	5.86	0.09
			0.00						
MG D3-800TX	A	From Face	4.00	0.0000	124.00	No Ice	3.45	2.22	0.00
(Verizon Existing)			4.00			1/2" Ice	3.80	2.55	0.02
			0.00						
DB844H65E-XY	A	From Face	4.00	0.0000	124.00	No Ice	2.87	4.20	0.01
(Verizon Existing)			6.00			1/2" Ice	3.18	4.57	0.04
			0.00						
DB844H65E-XY	B	From Face	4.00	0.0000	124.00	No Ice	2.87	4.20	0.01
(Verizon Existing)			-6.00			1/2" Ice	3.18	4.57	0.04
			0.00						
HBXX-6517DS	B	From Face	4.00	0.0000	124.00	No Ice	8.74	5.24	0.05
(Verizon Proposed)			-4.00			1/2" Ice	9.31	5.71	0.10
			0.00						
LNX-6514DS-VTM	B	From Face	4.00	0.0000	124.00	No Ice	8.41	5.41	0.04
(Verizon Proposed)			0.00			1/2" Ice	8.96	5.86	0.09
			0.00						
MG D3-800TX	B	From Face	4.00	0.0000	124.00	No Ice	3.45	2.22	0.00
(Verizon Existing)			4.00			1/2" Ice	3.80	2.55	0.02
			0.00						
DB844H65E-XY	B	From Face	4.00	0.0000	124.00	No Ice	2.87	4.20	0.01
(Verizon Existing)			6.00			1/2" Ice	3.18	4.57	0.04
			0.00						
DB844H65E-XY	C	From Face	4.00	0.0000	124.00	No Ice	2.87	4.20	0.01
(Verizon Existing)			-6.00			1/2" Ice	3.18	4.57	0.04
			0.00						
HBXX-6517DS	C	From Face	4.00	0.0000	124.00	No Ice	8.74	5.24	0.05
(Verizon Proposed)			-4.00			1/2" Ice	9.31	5.71	0.10
			0.00						
LNX-6514DS-VTM	C	From Face	4.00	0.0000	124.00	No Ice	8.41	5.41	0.04
(Verizon Proposed)			0.00			1/2" Ice	8.96	5.86	0.09
			0.00						
MG D3-800TX	C	From Face	4.00	0.0000	124.00	No Ice	3.45	2.22	0.00
(Verizon Existing)			4.00			1/2" Ice	3.80	2.55	0.02
			0.00						
DB844H65E-XY	C	From Face	4.00	0.0000	124.00	No Ice	2.87	4.20	0.01
(Verizon Existing)			6.00			1/2" Ice	3.18	4.57	0.04
			0.00						
(2) FD9R6004/2C-3L	B	From Face	3.00	0.0000	124.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon Existing)			0.00						
(2) FD9R6004/2C-3L	C	From Face	3.00	0.0000	124.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon Existing)			0.00						
(2) FD9R6004/2C-3L	A	From Face	3.00	0.0000	124.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon Existing)			0.00						
RRH2x40-AWS	A	From Face	4.00	0.0000	124.00	No Ice	2.52	1.59	0.04
(Verizon Existing)			4.00			1/2" Ice	2.75	1.80	0.06
			0.00						

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
RRH2x40-AWS	B	From Face	4.00	0.0000	124.00	No Ice	2.52	1.59	0.04
(Verizon Existing)			4.00			1/2" Ice	2.75	1.80	0.06
			0.00						
RRH2x40-AWS	C	From Face	4.00	0.0000	124.00	No Ice	2.52	1.59	0.04
(Verizon Existing)			4.00			1/2" Ice	2.75	1.80	0.06
			0.00						
RRH2x40-07-U	A	From Face	4.00	0.0000	124.00	No Ice	2.25	1.23	0.05
(Verizon Existing)			0.00			1/2" Ice	2.45	1.39	0.07
			0.00						
RRH2x40-07-U	B	From Face	4.00	0.0000	124.00	No Ice	2.25	1.23	0.05
(Verizon Existing)			0.00			1/2" Ice	2.45	1.39	0.07
			0.00						
RRH2x40-07-U	C	From Face	4.00	0.0000	124.00	No Ice	2.25	1.23	0.05
(Verizon Existing)			0.00			1/2" Ice	2.45	1.39	0.07
			0.00						
RC2DC-3315-PF-48	A	From Face	4.00	0.0000	124.00	No Ice	3.52	2.29	0.03
(Verizon Existing)			4.00			1/2" Ice	3.77	2.51	0.05
			0.00						
Low Profile Platform	C	None		0.0000	124.00	No Ice	15.70	15.70	1.30
(Verizon Existing)						1/2" Ice	20.10	20.10	1.76
Low Profile Platform	C	None		0.0000	114.00	No Ice	15.70	15.70	1.30
						1/2" Ice	20.10	20.10	1.76
GPS	A	From Face	1.50	0.0000	51.50	No Ice	1.00	1.00	0.01
			0.00			1/2" Ice	1.50	1.50	0.01
			0.00						
GPS	B	From Face	1.50	0.0000	51.50	No Ice	1.00	1.00	0.01
			0.00			1/2" Ice	1.50	1.50	0.01
			0.00						
GPS	C	From Face	1.50	0.0000	51.50	No Ice	1.00	1.00	0.01
			0.00			1/2" Ice	1.50	1.50	0.01
			0.00						
20' x 3" Dia Omni	B	From Face	3.00	0.0000	114.00	No Ice	6.00	6.00	0.05
(NU - Existing)			2.00			1/2" Ice	8.03	8.03	0.09
			2.50						
DB586-Y	B	From Face	3.00	0.0000	114.00	No Ice	1.01	1.01	0.01
(NU - Existing)			2.00			1/2" Ice	1.28	1.28	0.02
			2.50						
DB586-Y	B	From Face	3.00	0.0000	114.00	No Ice	1.01	1.01	0.01
(NU - Existing)			2.00			1/2" Ice	1.28	1.28	0.02
			-2.50						
ANT150F2	B	From Face	3.00	0.0000	114.00	No Ice	1.29	1.29	0.02
(NU - Existing)			-2.00			1/2" Ice	1.60	1.60	0.03
			2.50						

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft	Aperture Area ft^2	Weight K

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft²	Weight K
4 FT DISH	A	Paraboloid	From	1.00	Worst		160.00	4.00	No Ice	12.56	0.17
(Town Existing)		w/Shroud (HP)	Leg	0.00					1/2" Ice	13.09	0.24
				0.00							
4 FT DISH	B	Paraboloid	From	1.00	Worst		160.00	4.00	No Ice	12.56	0.17
(Town Existing)		w/Shroud (HP)	Leg	0.00					1/2" Ice	13.09	0.24
				0.00							
2 FT DISH	C	Paraboloid	From	1.00	Worst		160.00	2.00	No Ice	3.14	0.03
(Town Existing)		w/Shroud (HP)	Leg	0.00					1/2" Ice	3.41	0.04
				0.00							
A-Ant-23G-2-C	A	Paraboloid	From	3.10	Worst		154.00	2.17	No Ice	3.72	0.03
(Clearwire Existing)		w/Radome	Face	-2.52					1/2" Ice	4.01	0.05
				2.00							
A-Ant-23G-2-C	C	Paraboloid	From	3.80	Worst		154.00	2.17	No Ice	3.72	0.03
(Clearwire Existing)		w/Radome	Face	-1.24					1/2" Ice	4.01	0.05
				2.00							

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg % %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	147.53	1.534	28	135.985	A	0.000	135.985	135.985	100.00	0.000	0.000
164.00-131.50					B	0.000	135.985		100.00	0.000	0.000
					C	0.000	135.985		100.00	0.000	0.000
L2	125.34	1.464	27	55.744	A	0.000	55.744	55.744	100.00	0.000	0.000
131.50-119.29					B	0.000	55.744		100.00	0.000	0.000
					C	0.000	55.744		100.00	0.000	0.000
L3	98.89	1.368	25	199.426	A	0.000	199.426	199.426	100.00	0.000	0.000
119.29-78.79					B	0.000	199.426		100.00	0.000	0.000
					C	0.000	199.426		100.00	0.000	0.000
L4 78.79-39.88	59.42	1.183	22	213.639	A	0.000	213.639	213.639	100.00	0.000	0.000
					B	0.000	213.639		100.00	0.000	3.869
					C	0.000	213.639		100.00	0.000	0.000
L5 39.88-1.50	20.36	1	18	231.142	A	0.000	231.142	231.142	100.00	0.000	0.000
					B	0.000	231.142		100.00	0.000	11.782
					C	0.000	231.142		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	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	147.53	1.534	21	0.5000	138.694	A	0.000	138.694	138.694	100.00	0.000	0.000
164.00-131.50						B	0.000	138.694		100.00	0.000	0.000
						C	0.000	138.694		100.00	0.000	0.000
L2	125.34	1.464	20	0.5000	56.761	A	0.000	56.761	56.761	100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z psf	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
131.50-119.29						B	0.000	56.761		100.00	0.000	0.000
						C	0.000	56.761		100.00	0.000	0.000
L3 119.29-78.79	98.89	1.368	19	0.5000	202.801	A	0.000	202.801	202.801	100.00	0.000	0.000
						B	0.000	202.801		100.00	0.000	0.000
						C	0.000	202.801		100.00	0.000	0.000
L4 78.79-39.88	59.42	1.183	16	0.5000	216.881	A	0.000	216.881	216.881	100.00	0.000	0.000
						B	0.000	216.881		100.00	0.000	7.355
						C	0.000	216.881		100.00	0.000	0.000
L5 39.88-1.50	20.36	1	14	0.5000	234.341	A	0.000	234.341	234.341	100.00	0.000	0.000
						B	0.000	234.341		100.00	0.000	22.395
						C	0.000	234.341		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	147.53	1.534	10	135.985	A	0.000	135.985	135.985	100.00	0.000	0.000
164.00-131.50					B	0.000	135.985		100.00	0.000	0.000
					C	0.000	135.985		100.00	0.000	0.000
L2	125.34	1.464	9	55.744	A	0.000	55.744	55.744	100.00	0.000	0.000
131.50-119.29					B	0.000	55.744		100.00	0.000	0.000
					C	0.000	55.744		100.00	0.000	0.000
L3	98.89	1.368	9	199.426	A	0.000	199.426	199.426	100.00	0.000	0.000
119.29-78.79					B	0.000	199.426		100.00	0.000	0.000
					C	0.000	199.426		100.00	0.000	0.000
L4 78.79-39.88	59.42	1.183	8	213.639	A	0.000	213.639	213.639	100.00	0.000	0.000
					B	0.000	213.639		100.00	0.000	3.869
					C	0.000	213.639		100.00	0.000	0.000
L5 39.88-1.50	20.36	1	6	231.142	A	0.000	231.142	231.142	100.00	0.000	0.000
					B	0.000	231.142		100.00	0.000	11.782
					C	0.000	231.142		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.90	5.47	A	1	0.65	1	1	1	135.985	4.24	130.34	C
164.00-131.50			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2	0.74	2.69	A	1	0.65	1	1	1	55.744	1.66	135.82	C
131.50-119.29			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3	2.75	12.76	A	1	0.65	1	1	1	199.426	5.53	136.63	C
119.29-78.79			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4	2.68	18.55	A	1	0.65	1	1	1	213.639	5.25	134.97	C

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
78.79-39.88			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.31	20.49	A	1	0.65	1	1	1	231.142	5.06	131.96	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	9.38	59.96						OTM	1762.61 kip-ft	21.74		

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	0.90	5.47	A	1	0.65	1	1	1	135.985	4.24	130.34	C
164.00-131.50			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2	0.74	2.69	A	1	0.65	1	1	1	55.744	1.66	135.82	C
131.50-119.29			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3	2.75	12.76	A	1	0.65	1	1	1	199.426	5.53	136.63	C
119.29-78.79			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4	2.68	18.55	A	1	0.65	1	1	1	213.639	5.25	134.97	C
78.79-39.88			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.31	20.49	A	1	0.65	1	1	1	231.142	5.06	131.96	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	9.38	59.96						OTM	1762.61 kip-ft	21.74		

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	0.90	5.47	A	1	0.65	1	1	1	135.985	4.24	130.34	C
164.00-131.50			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2	0.74	2.69	A	1	0.65	1	1	1	55.744	1.66	135.82	C
131.50-119.29			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3	2.75	12.76	A	1	0.65	1	1	1	199.426	5.53	136.63	C
119.29-78.79			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4	2.68	18.55	A	1	0.65	1	1	1	213.639	5.25	134.97	C
78.79-39.88			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.31	20.49	A	1	0.65	1	1	1	231.142	5.06	131.96	C

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
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	9.38	59.96						OTM	1762.61 kip-ft	21.74		

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	0.90	6.49	A	1	0.65	1	1	1	138.694	3.24	99.70	C
164.00-131.50			B	1	0.65	1	1	1	138.694			
			C	1	0.65	1	1	1	138.694			
L2	0.74	3.11	A	1	0.65	1	1	1	56.761	1.27	103.72	C
131.50-119.29			B	1	0.65	1	1	1	56.761			
			C	1	0.65	1	1	1	56.761			
L3	2.75	14.25	A	1	0.65	1	1	1	202.801	4.22	104.21	C
119.29-78.79			B	1	0.65	1	1	1	202.801			
			C	1	0.65	1	1	1	202.801			
L4	2.71	20.14	A	1	0.65	1	1	1	216.881	4.09	105.20	C
78.79-39.88			B	1	0.65	1	1	1	216.881			
			C	1	0.65	1	1	1	216.881			
L5 39.88-1.50	2.41	22.21	A	1	0.65	1	1	1	234.341	4.10	106.72	C
			B	1	0.65	1	1	1	234.341			
			C	1	0.65	1	1	1	234.341			
Sum Weight:	9.52	66.20						OTM	1355.40 kip-ft	16.92		

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	0.90	6.49	A	1	0.65	1	1	1	138.694	3.24	99.70	C
164.00-131.50			B	1	0.65	1	1	1	138.694			
			C	1	0.65	1	1	1	138.694			
L2	0.74	3.11	A	1	0.65	1	1	1	56.761	1.27	103.72	C
131.50-119.29			B	1	0.65	1	1	1	56.761			
			C	1	0.65	1	1	1	56.761			
L3	2.75	14.25	A	1	0.65	1	1	1	202.801	4.22	104.21	C
119.29-78.79			B	1	0.65	1	1	1	202.801			
			C	1	0.65	1	1	1	202.801			
L4	2.71	20.14	A	1	0.65	1	1	1	216.881	4.09	105.20	C
78.79-39.88			B	1	0.65	1	1	1	216.881			
			C	1	0.65	1	1	1	216.881			
L5 39.88-1.50	2.41	22.21	A	1	0.65	1	1	1	234.341	4.10	106.72	C
			B	1	0.65	1	1	1	234.341			
			C	1	0.65	1	1	1	234.341			
Sum Weight:	9.52	66.20						OTM	1355.40	16.92		

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

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1	0.90	6.49	A	1	0.65	1	1	1	138.694	3.24	99.70	C
164.00-131.50			B	1	0.65	1	1	1	138.694			
			C	1	0.65	1	1	1	138.694			
L2	0.74	3.11	A	1	0.65	1	1	1	56.761	1.27	103.72	C
131.50-119.29			B	1	0.65	1	1	1	56.761			
			C	1	0.65	1	1	1	56.761			
L3	2.75	14.25	A	1	0.65	1	1	1	202.801	4.22	104.21	C
119.29-78.79			B	1	0.65	1	1	1	202.801			
			C	1	0.65	1	1	1	202.801			
L4	2.71	20.14	A	1	0.65	1	1	1	216.881	4.09	105.20	C
78.79-39.88			B	1	0.65	1	1	1	216.881			
			C	1	0.65	1	1	1	216.881			
L5 39.88-1.50	2.41	22.21	A	1	0.65	1	1	1	234.341	4.10	106.72	C
			B	1	0.65	1	1	1	234.341			
			C	1	0.65	1	1	1	234.341			
Sum Weight:	9.52	66.20						OTM	1355.40 kip-ft	16.92		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1	0.90	5.47	A	1	0.65	1	1	1	135.985	1.47	45.10	C
164.00-131.50			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2	0.74	2.69	A	1	0.65	1	1	1	55.744	0.57	47.00	C
131.50-119.29			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3	2.75	12.76	A	1	0.65	1	1	1	199.426	1.91	47.28	C
119.29-78.79			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4	2.68	18.55	A	1	0.65	1	1	1	213.639	1.82	46.70	C
78.79-39.88			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.31	20.49	A	1	0.65	1	1	1	231.142	1.75	45.66	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	9.38	59.96						OTM	609.90 kip-ft	7.52		

tnxTower	Job	Page
	14067.063 - Greenwich	15 of 23
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project 164' EEI Monopole - 5 Perryridge Rd., Greenwich, CT	Date 17:27:57 12/15/14
	Client Verizon Wireless	Designed by TJL

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	0.90	5.47	A	1	0.65	1	1	1	135.985	1.47	45.10	C
164.00-131.50			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2	0.74	2.69	A	1	0.65	1	1	1	55.744	0.57	47.00	C
131.50-119.29			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3	2.75	12.76	A	1	0.65	1	1	1	199.426	1.91	47.28	C
119.29-78.79			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4	2.68	18.55	A	1	0.65	1	1	1	213.639	1.82	46.70	C
78.79-39.88			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.31	20.49	A	1	0.65	1	1	1	231.142	1.75	45.66	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	9.38	59.96						OTM	609.90 kip-ft	7.52		

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	0.90	5.47	A	1	0.65	1	1	1	135.985	1.47	45.10	C
164.00-131.50			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2	0.74	2.69	A	1	0.65	1	1	1	55.744	0.57	47.00	C
131.50-119.29			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3	2.75	12.76	A	1	0.65	1	1	1	199.426	1.91	47.28	C
119.29-78.79			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4	2.68	18.55	A	1	0.65	1	1	1	213.639	1.82	46.70	C
78.79-39.88			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.31	20.49	A	1	0.65	1	1	1	231.142	1.75	45.66	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	9.38	59.96						OTM	609.90 kip-ft	7.52		

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	59.96					
Bracing Weight	0.00					
Total Member Self-Weight	59.96			0.12	-0.86	
Total Weight	81.86			0.12	-0.86	
Wind 0 deg - No Ice		0.17	-42.51	-4668.56	-28.38	2.16
Wind 30 deg - No Ice		21.52	-36.90	-4056.84	-2378.35	1.82
Wind 60 deg - No Ice		37.11	-21.40	-2358.06	-4091.27	0.99
Wind 90 deg - No Ice		42.75	-0.17	-27.40	-4708.17	-0.10
Wind 120 deg - No Ice		36.94	21.11	2310.63	-4063.75	-1.17
Wind 150 deg - No Ice		21.23	36.73	4029.56	-2330.68	-1.92
Wind 180 deg - No Ice		-0.17	42.51	4668.81	26.67	-2.16
Wind 210 deg - No Ice		-21.52	36.90	4057.08	2376.64	-1.82
Wind 240 deg - No Ice		-37.11	21.40	2358.30	4089.56	-0.99
Wind 270 deg - No Ice		-42.75	0.17	27.65	4706.46	0.10
Wind 300 deg - No Ice		-36.94	-21.11	-2310.38	4062.04	1.17
Wind 330 deg - No Ice		-21.23	-36.73	-4029.31	2328.96	1.92
Member Ice	6.24					
Total Weight Ice	93.59			0.37	-1.76	
Wind 0 deg - Ice		0.13	-34.76	-3850.22	-22.86	2.03
Wind 30 deg - Ice		17.58	-30.17	-3344.88	-1960.15	1.73
Wind 60 deg - Ice		30.33	-17.49	-1943.19	-3372.69	0.96
Wind 90 deg - Ice		34.95	-0.13	-20.72	-3882.00	-0.07
Wind 120 deg - Ice		30.20	17.27	1907.40	-3351.60	-1.08
Wind 150 deg - Ice		17.37	30.04	3324.54	-1923.61	-1.80
Wind 180 deg - Ice		-0.13	34.76	3850.97	19.33	-2.03
Wind 210 deg - Ice		-17.58	30.17	3345.63	1956.62	-1.73
Wind 240 deg - Ice		-30.33	17.49	1943.94	3369.17	-0.96
Wind 270 deg - Ice		-34.95	0.13	21.47	3878.47	0.07
Wind 300 deg - Ice		-30.20	-17.27	-1906.65	3348.07	1.08
Wind 330 deg - Ice		-17.37	-30.04	-3323.79	1920.09	1.80
Total Weight	81.86			0.12	-0.86	
Wind 0 deg - Service		0.06	-14.71	-1615.45	-10.18	0.75
Wind 30 deg - Service		7.45	-12.77	-1403.78	-823.32	0.63
Wind 60 deg - Service		12.84	-7.40	-815.97	-1416.03	0.34
Wind 90 deg - Service		14.79	-0.06	-9.52	-1629.49	-0.04
Wind 120 deg - Service		12.78	7.30	799.49	-1406.51	-0.40
Wind 150 deg - Service		7.35	12.71	1394.28	-806.83	-0.66
Wind 180 deg - Service		-0.06	14.71	1615.47	8.86	-0.75
Wind 210 deg - Service		-7.45	12.77	1403.80	822.00	-0.63
Wind 240 deg - Service		-12.84	7.40	815.99	1414.71	-0.34
Wind 270 deg - Service		-14.79	0.06	9.53	1628.17	0.04
Wind 300 deg - Service		-12.78	-7.30	-799.47	1405.19	0.40
Wind 330 deg - Service		-7.35	-12.71	-1394.26	805.51	0.66

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 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice

Comb. No.	Description
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	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	164 - 131.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-20.22	-0.59	-0.63
			Max. Mx	5	-15.09	-350.04	5.56
			Max. My	8	-15.10	5.57	-343.27
			Max. Vy	5	19.66	-350.04	5.56
			Max. Vx	8	19.44	5.57	-343.27
			Max. Torque	11			1.27
L2	131.5 - 119.29	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-22.15	-0.59	-0.63
			Max. Mx	5	-16.81	-474.82	6.76
			Max. My	8	-16.82	6.76	-466.67
			Max. Vy	5	20.53	-474.82	6.76
			Max. Vx	8	20.30	6.76	-466.67
			Max. Torque	11			1.27
L3	119.29 - 78.79	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-42.71	-1.21	-0.06
			Max. Mx	5	-34.25	-1565.10	13.55
			Max. My	8	-34.26	12.91	-1546.69
			Max. Vy	5	31.74	-1565.10	13.55
			Max. Vx	8	31.49	12.91	-1546.69
			Max. Torque	2			-1.95
L4	78.79 - 39.88	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-64.10	-1.31	-0.11

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Mx	5	-54.22	-2874.65	19.98
			Max. My	8	-54.23	19.31	-2846.61
			Max. Vy	5	37.01	-2874.65	19.98
			Max. Vx	8	36.76	19.31	-2846.61
			Max. Torque	2			-2.00
L5	39.88 - 1.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-93.59	-1.76	-0.37
			Max. Mx	5	-81.85	-4777.16	27.87
			Max. My	8	-81.85	27.13	-4737.15
			Max. Vy	5	42.77	-4777.16	27.87
			Max. Vx	8	42.53	27.13	-4737.15
			Max. Torque	2			-2.17

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	93.59	-34.95	0.13
	Max. H_x	11	81.86	42.75	-0.17
	Max. H_z	2	81.86	-0.17	42.51
	Max. M_x	2	4736.90	-0.17	42.51
	Max. M_z	5	4777.16	-42.75	0.17
	Max. Torsion	8	2.14	0.17	-42.51
	Min. Vert	29	81.86	-12.84	7.40
	Min. H_x	5	81.86	-42.75	0.17
	Min. H_z	8	81.86	0.17	-42.51
	Min. M_x	8	-4737.15	0.17	-42.51
	Min. M_z	11	-4775.42	42.75	-0.17
	Min. Torsion	2	-2.17	-0.17	42.51

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	81.86	0.00	0.00	0.12	-0.86	0.00
Dead+Wind 0 deg - No Ice	81.86	0.17	-42.51	-4736.90	-28.87	2.17
Dead+Wind 30 deg - No Ice	81.86	21.52	-36.90	-4116.25	-2413.26	1.83
Dead+Wind 60 deg - No Ice	81.86	37.11	-21.40	-2392.63	-4151.26	1.00
Dead+Wind 90 deg - No Ice	81.86	42.75	-0.17	-27.87	-4777.16	-0.10
Dead+Wind 120 deg - No Ice	81.86	36.94	21.11	2344.39	-4123.27	-1.17
Dead+Wind 150 deg - No Ice	81.86	21.23	36.73	4088.51	-2364.78	-1.91
Dead+Wind 180 deg - No Ice	81.86	-0.17	42.51	4737.15	27.13	-2.14
Dead+Wind 210 deg - No Ice	81.86	-21.52	36.90	4116.50	2411.52	-1.81
Dead+Wind 240 deg - No Ice	81.86	-37.11	21.40	2392.88	4149.51	-1.00
Dead+Wind 270 deg - No Ice	81.86	-42.75	0.17	28.12	4775.42	0.08
Dead+Wind 300 deg - No Ice	81.86	-36.94	-21.11	-2344.14	4121.53	1.15
Dead+Wind 330 deg - No Ice	81.86	-21.23	-36.73	-4088.26	2363.03	1.91
Dead+Ice+Temp	93.59	0.00	0.00	0.37	-1.76	0.00
Dead+Wind 0 deg+Ice+Temp	93.59	0.13	-34.76	-3919.49	-23.34	2.05
Dead+Wind 30 deg+Ice+Temp	93.59	17.58	-30.17	-3405.09	-1995.51	1.75
Dead+Wind 60 deg+Ice+Temp	93.59	30.33	-17.49	-1978.20	-3433.47	0.97

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+Ice+Temp	93.59	34.95	-0.13	-21.16	-3951.92	-0.06
Dead+Wind 120 deg+Ice+Temp	93.59	30.20	17.27	1941.66	-3411.94	-1.08
Dead+Wind 150 deg+Ice+Temp	93.59	17.37	30.04	3384.32	-1958.21	-1.80
Dead+Wind 180 deg+Ice+Temp	93.59	-0.13	34.76	3920.25	19.74	-2.03
Dead+Wind 210 deg+Ice+Temp	93.59	-17.58	30.17	3405.85	1991.91	-1.73
Dead+Wind 240 deg+Ice+Temp	93.59	-30.33	17.49	1978.96	3429.86	-0.97
Dead+Wind 270 deg+Ice+Temp	93.59	-34.95	0.13	21.92	3948.31	0.05
Dead+Wind 300 deg+Ice+Temp	93.59	-30.20	-17.27	-1940.90	3408.33	1.06
Dead+Wind 330 deg+Ice+Temp	93.59	-17.37	-30.04	-3383.56	1954.60	1.80
Dead+Wind 0 deg - Service	81.86	0.06	-14.71	-1639.12	-10.56	0.75
Dead+Wind 30 deg - Service	81.86	7.45	-12.77	-1424.35	-835.68	0.63
Dead+Wind 60 deg - Service	81.86	12.84	-7.40	-827.89	-1437.11	0.35
Dead+Wind 90 deg - Service	81.86	14.79	-0.06	-9.57	-1653.71	-0.03
Dead+Wind 120 deg - Service	81.86	12.78	7.30	811.35	-1427.42	-0.40
Dead+Wind 150 deg - Service	81.86	7.35	12.71	1414.91	-818.90	-0.66
Dead+Wind 180 deg - Service	81.86	-0.06	14.71	1639.37	8.82	-0.75
Dead+Wind 210 deg - Service	81.86	-7.45	12.77	1424.59	833.94	-0.63
Dead+Wind 240 deg - Service	81.86	-12.84	7.40	828.14	1435.37	-0.35
Dead+Wind 270 deg - Service	81.86	-14.79	0.06	9.81	1651.96	0.03
Dead+Wind 300 deg - Service	81.86	-12.78	-7.30	-811.11	1425.68	0.40
Dead+Wind 330 deg - Service	81.86	-7.35	-12.71	-1414.66	817.15	0.66

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	-81.86	0.00	0.00	81.86	0.00	0.000%
2	0.17	-81.86	-42.51	-0.17	81.86	42.51	0.000%
3	21.52	-81.86	-36.90	-21.52	81.86	36.90	0.000%
4	37.11	-81.86	-21.40	-37.11	81.86	21.40	0.000%
5	42.75	-81.86	-0.17	-42.75	81.86	0.17	0.000%
6	36.94	-81.86	21.11	-36.94	81.86	-21.11	0.000%
7	21.23	-81.86	36.73	-21.23	81.86	-36.73	0.000%
8	-0.17	-81.86	42.51	0.17	81.86	-42.51	0.000%
9	-21.52	-81.86	36.90	21.52	81.86	-36.90	0.000%
10	-37.11	-81.86	21.40	37.11	81.86	-21.40	0.000%
11	-42.75	-81.86	0.17	42.75	81.86	-0.17	0.000%
12	-36.94	-81.86	-21.11	36.94	81.86	21.11	0.000%
13	-21.23	-81.86	-36.73	21.23	81.86	36.73	0.000%
14	0.00	-93.59	0.00	0.00	93.59	0.00	0.000%
15	0.13	-93.59	-34.76	-0.13	93.59	34.76	0.000%
16	17.58	-93.59	-30.17	-17.58	93.59	30.17	0.000%
17	30.33	-93.59	-17.49	-30.33	93.59	17.49	0.000%
18	34.95	-93.59	-0.13	-34.95	93.59	0.13	0.000%
19	30.20	-93.59	17.27	-30.20	93.59	-17.27	0.000%
20	17.37	-93.59	30.04	-17.37	93.59	-30.04	0.000%
21	-0.13	-93.59	34.76	0.13	93.59	-34.76	0.000%
22	-17.58	-93.59	30.17	17.58	93.59	-30.17	0.000%
23	-30.33	-93.59	17.49	30.33	93.59	-17.49	0.000%
24	-34.95	-93.59	0.13	34.95	93.59	-0.13	0.000%
25	-30.20	-93.59	-17.27	30.20	93.59	17.27	0.000%
26	-17.37	-93.59	-30.04	17.37	93.59	30.04	0.000%
27	0.06	-81.86	-14.71	-0.06	81.86	14.71	0.000%
28	7.45	-81.86	-12.77	-7.45	81.86	12.77	0.000%
29	12.84	-81.86	-7.40	-12.84	81.86	7.40	0.000%
30	14.79	-81.86	-0.06	-14.79	81.86	0.06	0.000%
31	12.78	-81.86	7.30	-12.78	81.86	-7.30	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
32	7.35	-81.86	12.71	-7.35	81.86	-12.71	0.000%
33	-0.06	-81.86	14.71	0.06	81.86	-14.71	0.000%
34	-7.45	-81.86	12.77	7.45	81.86	-12.77	0.000%
35	-12.84	-81.86	7.40	12.84	81.86	-7.40	0.000%
36	-14.79	-81.86	0.06	14.79	81.86	-0.06	0.000%
37	-12.78	-81.86	-7.30	12.78	81.86	7.30	0.000%
38	-7.35	-81.86	-12.71	7.35	81.86	12.71	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00006860
3	Yes	4	0.00000001	0.00051676
4	Yes	4	0.00000001	0.00048256
5	Yes	4	0.00000001	0.00003302
6	Yes	4	0.00000001	0.00046240
7	Yes	4	0.00000001	0.00049672
8	Yes	4	0.00000001	0.00005555
9	Yes	4	0.00000001	0.00047276
10	Yes	4	0.00000001	0.00050831
11	Yes	4	0.00000001	0.00003328
12	Yes	4	0.00000001	0.00048771
13	Yes	4	0.00000001	0.00045224
14	Yes	4	0.00000001	0.00000001
15	Yes	5	0.00000001	0.00002298
16	Yes	5	0.00000001	0.00002964
17	Yes	5	0.00000001	0.00002950
18	Yes	5	0.00000001	0.00002313
19	Yes	5	0.00000001	0.00002899
20	Yes	5	0.00000001	0.00002913
21	Yes	5	0.00000001	0.00002297
22	Yes	5	0.00000001	0.00002937
23	Yes	5	0.00000001	0.00002961
24	Yes	5	0.00000001	0.00002310
25	Yes	5	0.00000001	0.00002909
26	Yes	5	0.00000001	0.00002884
27	Yes	4	0.00000001	0.00001530
28	Yes	4	0.00000001	0.00003672
29	Yes	4	0.00000001	0.00003287
30	Yes	4	0.00000001	0.00001320
31	Yes	4	0.00000001	0.00003171
32	Yes	4	0.00000001	0.00003552
33	Yes	4	0.00000001	0.00001492
34	Yes	4	0.00000001	0.00003219
35	Yes	4	0.00000001	0.00003550
36	Yes	4	0.00000001	0.00001318
37	Yes	4	0.00000001	0.00003425
38	Yes	4	0.00000001	0.00003100

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	164 - 131.5	10.136	29	0.4709	0.0005
L2	131.5 - 119.29	6.981	29	0.4460	0.0005
L3	125.29 - 78.79	6.408	29	0.4351	0.0005
L4	87.21 - 39.88	3.285	29	0.3296	0.0003
L5	49.13 - 1.5	1.107	29	0.2008	0.0001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
164.00	12' x 3" Dia Omni	29	10.136	0.4709	0.0005	230724
160.00	4 FT DISH	29	9.741	0.4694	0.0005	230724
156.00	A-Ant-23G-2-C	29	9.346	0.4677	0.0005	144203
154.00	LLPX310R	29	9.149	0.4667	0.0005	115362
151.50	Remote Radio Head FD R6 RRH	29	8.903	0.4654	0.0005	92290
144.00	(2) AIR21	29	8.172	0.4603	0.0005	57681
138.00	(2) RRUS-11	29	7.595	0.4546	0.0005	44370
134.00	7770.00	29	7.216	0.4496	0.0005	38439
124.00	DB844H65E-XY	29	6.291	0.4325	0.0005	28938
114.00	Low Profile Platform	29	5.407	0.4093	0.0004	25540
51.50	GPS	29	1.204	0.2096	0.0001	11750

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	164 - 131.5	29.275	4	1.3600	0.0014
L2	131.5 - 119.29	20.163	4	1.2880	0.0013
L3	125.29 - 78.79	18.508	4	1.2566	0.0013
L4	87.21 - 39.88	9.488	4	0.9522	0.0008
L5	49.13 - 1.5	3.197	4	0.5801	0.0004

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
164.00	12' x 3" Dia Omni	4	29.275	1.3600	0.0015	80039
160.00	4 FT DISH	4	28.132	1.3555	0.0014	80039
156.00	A-Ant-23G-2-C	4	26.992	1.3506	0.0014	50024
154.00	LLPX310R	4	26.423	1.3479	0.0014	40019
151.50	Remote Radio Head FD R6 RRH	4	25.714	1.3442	0.0014	32015
144.00	(2) AIR21	4	23.602	1.3295	0.0014	20009
138.00	(2) RRUS-11	4	21.936	1.3128	0.0014	15391
134.00	7770.00	4	20.840	1.2985	0.0014	13333
124.00	DB844H65E-XY	4	18.169	1.2492	0.0014	10032

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
114.00	Low Profile Platform	4	15.616	1.1823	0.0013	8854
51.50	GPS	4	3.479	0.6056	0.0004	4069

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	164 - 131.5 (1)	TP53.42x47x0.3125	32.50	162.50	103.4	13.959	52.6760	-15.09	735.30	0.021
L2	131.5 - 119.29 (2)	TP56.15x53.42x0.375	12.21	162.50	100.9	14.665	64.7894	-16.81	950.11	0.018
L3	119.29 - 78.79 (3)	TP62.97x54.0585x0.4375	46.50	162.50	90.2	18.264	84.5934	-34.25	1545.03	0.022
L4	78.79 - 39.88 (4)	TP69.66x60.4813x0.5625	47.33	162.50	81.6	21.155	120.1620	-54.22	2542.07	0.021
L5	39.88 - 1.5 (5)	TP76x66.7412x0.5625	47.63	162.50	72.8	23.922	134.6840	-81.85	3221.92	0.025

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	164 - 131.5 (1)	TP53.42x47x0.3125	353.22	-6.128	36.775	0.167	0.00	0.000	36.775	0.000
L2	131.5 - 119.29 (2)	TP56.15x53.42x0.375	478.69	-6.594	39.000	0.169	0.00	0.000	39.000	0.000
L3	119.29 - 78.79 (3)	TP62.97x54.0585x0.4375	1572.31	-14.827	39.000	0.380	0.00	0.000	39.000	0.000
L4	78.79 - 39.88 (4)	TP69.66x60.4813x0.5625	2885.03	-17.357	39.000	0.445	0.00	0.000	39.000	0.000
L5	39.88 - 1.5 (5)	TP76x66.7412x0.5625	4791.41	-22.924	39.000	0.588	0.00	0.000	39.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	164 - 131.5 (1)	TP53.42x47x0.3125	0.021	0.167	0.000	0.187 ✔	1.333	H1-3 ✔
L2	131.5 - 119.29 (2)	TP56.15x53.42x0.375	0.018	0.169	0.000	0.187 ✔	1.333	H1-3 ✔
L3	119.29 - 78.79 (3)	TP62.97x54.0585x0.4375	0.022	0.380	0.000	0.402 ✔	1.333	H1-3 ✔
L4	78.79 - 39.88 (4)	TP69.66x60.4813x0.5625	0.021	0.445	0.000	0.466 ✔	1.333	H1-3 ✔

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L5	39.88 - 1.5 (5)	TP76x66.7412x0.5625	0.025	0.588	0.000	0.613 ✔	1.333	H1-3 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	164 - 131.5	Pole	TP53.42x47x0.3125	1	-15.09	980.15	14.0	Pass
L2	131.5 - 119.29	Pole	TP56.15x53.42x0.375	2	-16.81	1266.50	14.0	Pass
L3	119.29 - 78.79	Pole	TP62.97x54.0585x0.4375	3	-34.25	2059.52	30.2	Pass
L4	78.79 - 39.88	Pole	TP69.66x60.4813x0.5625	4	-54.22	3388.58	35.0	Pass
L5	39.88 - 1.5	Pole	TP76x66.7412x0.5625	5	-81.85	4294.82	46.0	Pass
							Summary	
						Pole (L5)	46.0	Pass
						RATING =	**46.0**	**Pass**

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Subject:	Flange Bolt and Plate Analysis
Location:	164-ft EEI Monopole Greenwich, CT
Rev. 0: 12/15/14	Prepared by: T.J.L. Checked by: C.F.C. Job No. 14067.063

Flange Bolt and Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 351ft·kips	(Input From tnxTower)
Shear Force =	Shear := 20·kips	(Input From tnxTower)
Axial Force =	Axial := 20.5·kips	(Input From tnxTower)

Flange Bolt Data:

Use ASTM A325

Number of Flange Bolts =	N := 12	(User Input)
Diameter of Bolt Circle =	D_{bc} := 58.00·in	(User Input)
Bolt Ultimate Strength =	F_u := 120·ksi	(User Input)
Bolt Yield Strength =	F_y := 92·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Flange Bolts =	D := 1.00·in	(User Input)

Flange Plate Data:

Use ASTM A36

Plate Yield Strength =	Fy_{bp} := 36.00·ksi	(User Input)
Flange Plate Thickness =	t_{bp} := 1.00·in	(User Input)
Flange Plate Diameter =	D_{bp} := 61.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 53.42·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 29 \cdot in$

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

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

$d_1 = 14.50 \cdot in$ $d_7 = -14.50 \cdot in$

$d_2 = 25.11 \cdot in$ $d_8 = -25.11 \cdot in$

$d_3 = 29.00 \cdot in$ $d_9 = -29.00 \cdot in$

$d_4 = 25.11 \cdot in$ $d_{10} = -25.11 \cdot in$

$d_5 = 14.50 \cdot in$ $d_{11} = -14.50 \cdot in$

$d_6 = 0.00 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 26.7 \cdot in$

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

$MA_1 = 0.00 \cdot in$ $MA_7 = 0.00 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 0.00 \cdot in$

$MA_3 = 2.29 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 0.00 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_5 = 0.00 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_6 = 0.00 \cdot in$ etc

Effective Width of Plate for Bending = $B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 23.6 \cdot in$

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Subject: Flange Bolt and Plate Analysis

Location: 164-ft EEI Monopole
Greenwich, CT

Rev. 0: 12/15/14

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 14067.063

Flange Bolt Analysis:

Calculated Flange Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 5.046 \times 10^3 \cdot in^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 0.785 \cdot in^2$

Check Flange Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 22.5 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 41.5 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Gross}} = 54.3 \cdot \%$

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

Condition1 = "OK"

Flange Plate Analysis:

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

$C_1 = 13.8 \cdot kips$ $C_7 = -10.4 \cdot kips$

$C_2 = 22.7 \cdot kips$ $C_8 = -19.3 \cdot kips$

$C_3 = 25.9 \cdot kips$ $C_9 = -22.5 \cdot kips$

$C_4 = 22.7 \cdot kips$ $C_{10} = -19.3 \cdot kips$

$C_5 = 13.8 \cdot kips$ $C_{11} = -10.4 \cdot kips$

$C_6 = 1.7 \cdot kips$ etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 15.1 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 35.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 42.1 \cdot \%$

Condition3 = $Condition2 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$

Condition2 = "Ok"

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Subject:		Anchor Bolt and Baseplate Analysis
Location:		164-ft EEI Monopole Greenwich, CT
Rev. 0: 12/15/14		Prepared by: T.J.L. Checked by: C.F.C. Job No. 14067.063

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 4791·ft·kips	(Input From tnxTower)
Shear Force =	Shear := 43·kips	(Input From tnxTower)
Axial Force =	Axial := 82·kips	(Input From tnxTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 30	(User Input)
Diameter of Bolt Circle =	D_{bc} := 86.00·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strenght =	F_u := 100·ksi	(User Input)
Bolt Yeild Strenght =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 GR 60

Plate Yield Strength =	Fy_{bp} := 60·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 3.0·in	(User Input)
Base Plate Diameter =	D_{bp} := 92.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 76.00·in	(User Input)

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Subject:	Anchor Bolt and Baseplate Analysis
Location:	164-ft EEI Monopole Greenwich, CT
Rev. 0: 12/15/14	Prepared by: T.J.L. Checked by: C.F.C. Job No. 14067.063

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 43 \cdot in$$

Distance to Bolts =

$$i := 1 .. N$$

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

$d_1 = 8.94 \cdot in$ $d_7 = 42.76 \cdot in$

$d_2 = 17.49 \cdot in$ $d_8 = 42.76 \cdot in$

$d_3 = 25.27 \cdot in$ $d_9 = 40.90 \cdot in$

$d_4 = 31.96 \cdot in$ $d_{10} = 37.24 \cdot in$

$d_5 = 37.24 \cdot in$ $d_{11} = 31.96 \cdot in$

$d_6 = 40.90 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 38 \cdot in$$

Moment Arms of Bolts about Neutral Axis =

$$MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$$

$MA_1 = 0.00 \cdot in$ $MA_7 = 4.76 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 4.76 \cdot in$

$MA_3 = 0.00 \cdot in$ $MA_9 = 2.90 \cdot in$

$MA_4 = 0.00 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_5 = 0.00 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_6 = 2.90 \cdot in$ etc

Effective Width of Baseplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 41.5 \cdot in$$

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Subject:	Anchor Bolt and Baseplate Analysis
Location:	164-ft EEI Monopole Greenwich, CT
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Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 2.773 \times 10^4 \cdot in^2$

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

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

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

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

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 86.4 \cdot kips$

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 = $\frac{T_{Max}}{T_{ALL.Net}} = 44.4 \%$ 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 = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.358 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 5.2 \cdot ksi$

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 =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 91.9 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 28.3 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 47.2 \cdot \%$$

Condition 2 =

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

Condition2 = "OK"

Base Plate Analysis:

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

$C_1 = 21.3 \cdot kips$ $C_7 = 91.4 \cdot kips$

$C_2 = 39.0 \cdot kips$ $C_8 = 91.4 \cdot kips$

$C_3 = 55.1 \cdot kips$ $C_9 = 87.5 \cdot kips$

$C_4 = 69.0 \cdot kips$ $C_{10} = 79.9 \cdot kips$

$C_5 = 79.9 \cdot kips$ $C_{11} = 69.0 \cdot kips$

$C_6 = 87.5 \cdot kips$ etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 22.1 \cdot ksi$

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

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 37.0 \cdot \%$

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

Condition3 = "Ok"

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Subject:	CAISSON FOUNDATION
Location:	164-ft EEI Monopole Greenwich, CT
Rev. 0: 12/15/14	Prepared by: TJL Checked by: C.F.C. Job No. 14067.063

Caisson Foundation:

Input Data:

Shear Force =	S := 43k	*USER INPUT-FROM tnxTower*
Overturning Moment =	M := 4791ft·k	*USER INPUT-FROM tnxTower*
Applied Axial Load =	A1 := 82k	*USER INPUT-FROM tnxTower*
Bending Moment =	Mu := 5019ft·k	*USER INPUT–FROM LPILE*
Moment Capacity =	Mn := 12301ft·k	*USER INPUT–FROM LPILE*
Foundation Diameter =	d := 9.0ft	*USER INPUT*
Overall Length of Caisson =	L_c := 28.0ft	*USER INPUT*
Depth From Top of Caisson to Grade =	L_{pag} := 1.0ft	*USER INPUT*
Number of Rebar =	n := 33	*USER INPUT*
Area of Rebar =	Ar := $1.560in^2$	*USER INPUT*
Rebar Yield Strength =	fy := 60ksi	*USER INPUT*
Concrete Comp Strength =	f'c := 3ksi	*USER INPUT*

Check Moment Capacity:

Factor of Safety = $FS := \frac{Mn}{Mu} = 2.5$

Factor of Safety Required = $FS_{reqd} := 1.3$

$FOSCheck := if(FS \geq FS_{reqd}, "OK", "NO GOOD")$

FOSCheck = "OK"

LPILE Plus for Windows, Version 5.0 (5.0.47)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

This program is licensed to:

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Files Used for Analysis

Path to file locations: J:\Jobs\1406700.WI\063 - Greenwich\Backup Documentation\Foundation\
Name of input data file: Greenwich Hospital Caisson Analysis.lpd
Name of output file: Greenwich Hospital Caisson Analysis.lpo
Name of plot output file: Greenwich Hospital Caisson Analysis.lpp
Name of runtime file: Greenwich Hospital Caisson Analysis.lpr

Time and Date of Analysis

Date: December 15, 2014 Time: 17:31:44

Problem Title

14067.063 - Greenwich

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 3:
- Computation of Nonlinear Bending Stiffness and Ultimate Bending Moment Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- Analysis includes computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-04 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 8

Pile Structural Properties and Geometry

Pile Length = 336.00 in

Depth of ground surface below top of pile = 12.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point No.	Point Depth in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	108.00000	6678285.	9160.9000	3600000.
2	336.0000	108.00000	6678285.	9160.9000	3600000.

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of moment of inertia and modulus of are not used for any computations other than total stress due to combined axial loading and bending.

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 12.000 in
Distance from top of pile to bottom of layer = 48.000 in
p-y subgrade modulus k for top of soil layer = 20.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 20.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 48.000 in
Distance from top of pile to bottom of layer = 72.000 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 72.000 in
Distance from top of pile to bottom of layer = 132.000 in
p-y subgrade modulus k for top of soil layer = 150.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 150.000 lbs/in**3

Layer 4 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 132.000 in
Distance from top of pile to bottom of layer = 360.000 in
p-y subgrade modulus k for top of soil layer = 250.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 250.000 lbs/in**3

(Depth of lowest layer extends 24.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	12.00	0.05800
2	48.00	0.05800
3	48.00	0.06900
4	72.00	0.06900
5	72.00	0.06900
6	132.00	0.06900
7	132.00	0.07500
8	360.00	0.07500

Shear Strength of Soils

Shear strength parameters with depth defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	12.000	0.00000	20.00	------	------
2	48.000	0.00000	20.00	------	------
3	48.000	0.00000	30.00	------	------
4	72.000	0.00000	30.00	------	------
5	72.000	0.00000	35.00	------	------
6	132.000	0.00000	35.00	------	------
7	132.000	0.00000	42.00	------	------
8	360.000	0.00000	42.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 43000.000 lbs
Bending moment at pile head = 57492000.000 in-lbs
Axial load at pile head = 82000.000 lbs

Non-zero moment at pile head for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Number of sections = 1

Pile Section No. 1

The sectional shape is a circular drilled shaft (bored pile).

Outside Diameter = 108.0000 in

Material Properties:

Compressive Strength of Concrete	=	3.000 kip/in**2
Yield Stress of Reinforcement	=	60. kip/in**2
Modulus of Elasticity of Reinforcement	=	29000. kip/in**2
Number of Reinforcing Bars	=	33
Area of Single Bar	=	1.56000 in**2
Number of Rows of Reinforcing Bars	=	33
Area of Steel	=	51.480 in**2
Area of Shaft	=	9160.884 in**2
Percentage of Steel Reinforcement	=	0.562 percent
Cover Thickness (edge to bar center)	=	4.000 in

Unfactored Axial Squash Load Capacity = 26317.78 kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement in**2	Distance to Centroidal Axis in
1	1.560	49.943
2	1.560	49.491
3	1.560	48.591
4	1.560	47.250
5	1.560	45.482
6	1.560	43.301
7	1.560	40.729
8	1.560	37.787
9	1.560	34.504
10	1.560	30.908
11	1.560	27.032
12	1.560	22.911
13	1.560	18.583
14	1.560	14.087
15	1.560	9.463
16	1.560	4.753
17	1.560	0.000
18	1.560	-4.753

19	1.560	-9.463
20	1.560	-14.087
21	1.560	-18.583
22	1.560	-22.911
23	1.560	-27.032
24	1.560	-30.908
25	1.560	-34.504
26	1.560	-37.787
27	1.560	-40.729
28	1.560	-43.301
29	1.560	-45.482
30	1.560	-47.250
31	1.560	-48.591
32	1.560	-49.491
33	1.560	-49.943

Axial Thrust Force = 82000.00 lbs

Bending Moment in-lbs	Bending Stiffness lb-in2	Bending Curvature rad/in	Maximum Strain in/in	Neutral Axis Position inches	Max. Concrete Stress psi	Max. Steel Stress psi
11414231.	2.282846E+13	5.000000E-07	0.00002982	59.63957995	91.65855472	805.95273
22713346.	2.271335E+13	0.00000100	0.00005695	56.94726223	173.46083	1533.82825
33889228.	2.259282E+13	0.00000150	0.00008404	56.02467781	253.76626	2260.60995
44950013.	2.247501E+13	0.00000200	0.00011120	55.60135764	332.91450	2989.59403
55888709.	2.235548E+13	0.00000250	0.00013831	55.32455367	410.51012	3716.92425
55888709.	1.862957E+13	0.00000300	0.00008475	28.25072104	251.86855	6585.26020
55888709.	1.596820E+13	0.00000350	0.00009698	27.70787948	286.94015	7737.90198
55888709.	1.397218E+13	0.00000400	0.00010922	27.30433148	321.78427	8890.12812
55888709.	1.241971E+13	0.00000450	0.00012150	26.99999839	356.48342	10041.10960
55888709.	1.117774E+13	0.00000500	0.00013401	26.80165869	391.56411	11185.54770
55888709.	1.016158E+13	0.00000550	0.00014623	26.58701652	425.53418	12338.33789
55888709.	9.314785E+12	0.00000600	0.00015846	26.41074711	459.27928	13490.67585
55888709.	8.598263E+12	0.00000650	0.00017072	26.26400882	492.79859	14642.55901
55888709.	7.984101E+12	0.00000700	0.00018298	26.14049309	526.09142	15793.98339
55888709.	7.451828E+12	0.00000750	0.00019527	26.03556508	559.15687	16944.94691
55888709.	6.986089E+12	0.00000800	0.00020757	25.94575828	591.99425	18095.44521
55888709.	6.575142E+12	0.00000850	0.00021988	25.86841410	624.60270	19245.47588
55888709.	6.209857E+12	0.00000900	0.00023221	25.80146939	656.98144	20395.03527
55888709.	5.883022E+12	0.00000950	0.00024456	25.74329549	689.12967	21544.11969
55888709.	5.588871E+12	0.00001000	0.00025693	25.69258565	721.04650	22692.72658
55888709.	5.322734E+12	0.00001050	0.00026931	25.64828736	752.73117	23840.85174
55888709.	5.080792E+12	0.00001100	0.00028170	25.60953480	784.18276	24988.49246
55888709.	4.859888E+12	0.00001150	0.00029412	25.57561988	815.40057	26135.64365
55888709.	4.657392E+12	0.00001200	0.00030655	25.54594392	846.38360	27282.30322
55888709.	4.471097E+12	0.00001250	0.00031900	25.52000803	877.13098	28428.46761
55888709.	4.299131E+12	0.00001300	0.00033147	25.49739379	907.64196	29574.13189
55888709.	4.139904E+12	0.00001350	0.00034395	25.47773749	937.91549	30719.29394
56875893.	4.062564E+12	0.00001400	0.00035645	25.46073657	967.95086	31863.94794
58786948.	4.054272E+12	0.00001450	0.00036897	25.44612068	997.74700	33008.09206
60695811.	4.046387E+12	0.00001500	0.00038150	25.43366128	1027.30302	34151.72197
62602478.	4.038870E+12	0.00001550	0.00039406	25.42316204	1056.61816	35294.83211
64506932.	4.031683E+12	0.00001600	0.00040663	25.41444594	1085.69138	36437.41935
66409145.	4.024797E+12	0.00001650	0.00041922	25.40735525	1114.52159	37579.48160
68309125.	4.018184E+12	0.00001700	0.00043183	25.40176123	1143.10810	38721.01162
70206839.	4.011819E+12	0.00001750	0.00044446	25.39753836	1171.44970	39862.00801
72102285.	4.005682E+12	0.00001800	0.00045710	25.39458364	1199.54557	41002.46489
73995441.	3.999754E+12	0.00001850	0.00046977	25.39280051	1227.39463	42142.37890
75886308.	3.994016E+12	0.00001900	0.00048245	25.39210850	1254.99607	43281.74341
77774844.	3.988454E+12	0.00001950	0.00049515	25.39242393	1282.34854	44420.55828
81544940.	3.977802E+12	0.00002050	0.00052061	25.39583248	1336.30340	46696.50925
85305581.	3.967701E+12	0.00002150	0.00054615	25.40254980	1389.25057	48970.19950
89056656.	3.958074E+12	0.00002250	0.00057177	25.41219610	1441.18170	51241.58899
92798045.	3.948853E+12	0.00002350	0.00059747	25.42445594	1492.08815	53510.63786
96529602.	3.939984E+12	0.00002450	0.00062326	25.43906218	1541.96080	55777.30855
1.002512E+08	3.931420E+12	0.00002550	0.00064912	25.45579916	1590.79072	58041.55639
1.039252E+08	3.921707E+12	0.00002650	0.00067499	25.47129697	1638.40962	60000.00000
1.068280E+08	3.884653E+12	0.00002750	0.00069920	25.42557603	1681.78208	60000.00000
1.092595E+08	3.833668E+12	0.00002850	0.00072239	25.34706026	1722.25728	60000.00000
1.113800E+08	3.775595E+12	0.00002950	0.00074489	25.25046533	1760.55709	60000.00000
1.135610E+08	3.723312E+12	0.00003050	0.00076860	25.20000011	1800.02423	60000.00000
1.150016E+08	3.650844E+12	0.00003150	0.00079085	25.10622472	1836.03974	60000.00000
1.165715E+08	3.586814E+12	0.00003250	0.00081179	24.97807735	1869.04745	60000.00000
1.179405E+08	3.520611E+12	0.00003350	0.00083216	24.84045750	1900.36246	60000.00000
1.192686E+08	3.457062E+12	0.00003450	0.00085245	24.70859259	1930.82137	60000.00000
1.204244E+08	3.392236E+12	0.00003550	0.00087221	24.56940204	1959.75559	60000.00000
1.215767E+08	3.330868E+12	0.00003650	0.00089202	24.43896621	1988.05836	60000.00000
1.225621E+08	3.268322E+12	0.00003750	0.00091128	24.30086035	2014.87474	60000.00000
1.235350E+08	3.208702E+12	0.00003850	0.00093055	24.17004794	2041.04198	60000.00000
1.244538E+08	3.150728E+12	0.00003950	0.00094965	24.04180080	2066.33346	60000.00000
1.252674E+08	3.093022E+12	0.00004050	0.00096839	23.91095620	2090.49701	60000.00000
1.260782E+08	3.038029E+12	0.00004150	0.00098717	23.78728598	2114.08833	60000.00000
1.268617E+08	2.984982E+12	0.00004250	0.00100588	23.66784507	2136.97232	60000.00000
1.275335E+08	2.931805E+12	0.00004350	0.00102416	23.54402035	2158.70955	60000.00000
1.282027E+08	2.880959E+12	0.00004450	0.00104248	23.42652673	2179.90011	60000.00000
1.288288E+08	2.831402E+12	0.00004550	0.00106470	23.39999861	2205.03779	60000.00000

1.295860E+08	2.786796E+12	0.00004650	0.00108339	23.29865295	2225.33439	60000.00000
1.301197E+08	2.739362E+12	0.00004750	0.00110067	23.17198938	2243.48313	60000.00000
1.306512E+08	2.693840E+12	0.00004850	0.00111798	23.05120307	2261.14354	60000.00000
1.311807E+08	2.650114E+12	0.00004950	0.00113533	22.93593997	2278.31270	60000.00000
1.317079E+08	2.608078E+12	0.00005050	0.00115271	22.82587820	2294.98787	60000.00000
1.321707E+08	2.566421E+12	0.00005150	0.00116975	22.71357304	2310.81132	60000.00000
1.325956E+08	2.525631E+12	0.00005250	0.00118661	22.60209507	2325.95890	60000.00000
1.330187E+08	2.486330E+12	0.00005350	0.00120350	22.49534529	2340.63809	60000.00000
1.334397E+08	2.448435E+12	0.00005450	0.00122042	22.39306945	2354.84639	60000.00000
1.338588E+08	2.411870E+12	0.00005550	0.00123737	22.29503256	2368.58128	60000.00000
1.342759E+08	2.376564E+12	0.00005650	0.00125436	22.20101255	2381.84002	60000.00000
1.346177E+08	2.341177E+12	0.00005750	0.00127088	22.10225147	2394.23735	60000.00000
1.349504E+08	2.306844E+12	0.00005850	0.00128738	22.00652236	2406.14496	60000.00000
1.352813E+08	2.273635E+12	0.00005950	0.00130391	21.91450435	2417.60020	60000.00000
1.359376E+08	2.210367E+12	0.00006150	0.00133706	21.74087745	2439.14289	60000.00000
1.367504E+08	2.153550E+12	0.00006350	0.00137160	21.60000032	2459.59723	60000.00000
1.372406E+08	2.095277E+12	0.00006550	0.00141056	21.53523463	2480.28893	60000.00000
1.377220E+08	2.040326E+12	0.00006750	0.00144166	21.35798353	2494.71419	60000.00000
1.381974E+08	1.988452E+12	0.00006950	0.00147288	21.19253522	2507.51437	60000.00000
1.386668E+08	1.939396E+12	0.00007150	0.00150421	21.03792411	2518.67100	60000.00000
1.391068E+08	1.892610E+12	0.00007350	0.00153541	20.88996917	2528.09393	60000.00000
1.394605E+08	1.847159E+12	0.00007550	0.00156588	20.74014419	2535.66310	60000.00000
1.398086E+08	1.803982E+12	0.00007750	0.00159646	20.59945697	2541.65350	60000.00000
1.401511E+08	1.762906E+12	0.00007950	0.00162715	20.46723479	2546.04701	60000.00000
1.404878E+08	1.723776E+12	0.00008150	0.00165794	20.34287900	2548.82519	60000.00000
1.408186E+08	1.686451E+12	0.00008350	0.00168886	20.22584242	2549.96907	60000.00000
1.411115E+08	1.650427E+12	0.00008550	0.00171956	20.11183137	2545.92056	60000.00000
1.413481E+08	1.615407E+12	0.00008750	0.00174971	19.99673241	2540.94734	60000.00000
1.415822E+08	1.581924E+12	0.00008950	0.00177998	19.88801926	2543.61589	60000.00000
1.415822E+08	1.547347E+12	0.00009150	0.00181170	19.79999882	2547.09008	60000.00000
1.417490E+08	1.516032E+12	0.00009350	0.00185130	19.79999882	2549.59126	60000.00000
1.423932E+08	1.491028E+12	0.00009550	0.00188574	19.74594158	2548.50327	60000.00000
1.425996E+08	1.462560E+12	0.00009750	0.00191516	19.64267439	2544.28942	60000.00000
1.428046E+08	1.435222E+12	0.00009950	0.00194467	19.54444760	2540.06005	60000.00000
1.429989E+08	1.408856E+12	0.00010150	0.00197410	19.44922704	2539.88153	60000.00000
1.431431E+08	1.383026E+12	0.00010350	0.00200266	19.34940702	2543.39111	60000.00000
1.432862E+08	1.358163E+12	0.00010550	0.00203131	19.25416070	2546.16623	60000.00000
1.434280E+08	1.334214E+12	0.00010750	0.00206005	19.16324347	2548.19745	60000.00000
1.435686E+08	1.311129E+12	0.00010950	0.00208887	19.07643324	2549.47513	60000.00000
1.437079E+08	1.288860E+12	0.00011150	0.00211778	18.99351436	2549.98931	60000.00000
1.438438E+08	1.267346E+12	0.00011350	0.00214688	18.91523033	2547.05771	60000.00000
1.439784E+08	1.246567E+12	0.00011550	0.00217606	18.84038061	2543.51707	60000.00000
1.441123E+08	1.226488E+12	0.00011750	0.00220531	18.76859826	2539.96573	60000.00000
1.442455E+08	1.207075E+12	0.00011950	0.00223462	18.69973522	2536.40355	60000.00000
1.443779E+08	1.188295E+12	0.00012150	0.00226399	18.63364989	2535.80622	60000.00000
1.444985E+08	1.170028E+12	0.00012350	0.00229314	18.56794757	2539.42921	60000.00000
1.445901E+08	1.152112E+12	0.00012550	0.00232163	18.49907166	2542.40611	60000.00000
1.446811E+08	1.134754E+12	0.00012750	0.00235018	18.43281251	2544.90002	60000.00000
1.447714E+08	1.117926E+12	0.00012950	0.00237879	18.36905748	2546.90564	60000.00000
1.448611E+08	1.101606E+12	0.00013150	0.00240746	18.30769068	2548.41744	60000.00000
1.449502E+08	1.085769E+12	0.00013350	0.00243619	18.24861556	2549.42994	60000.00000
1.450386E+08	1.070395E+12	0.00013550	0.00246498	18.19173557	2549.93747	60000.00000
1.451252E+08	1.055456E+12	0.00013750	0.00249390	18.13746268	2548.54472	60000.00000
1.452105E+08	1.040935E+12	0.00013950	0.00252293	18.08554584	2545.66235	60000.00000
1.455127E+08	1.014026E+12	0.00014350	0.00258300	18.00000054	2539.54654	60000.00000
1.466286E+08	9.940921E+11	0.00014750	0.00265500	18.00000054	2531.33751	60000.00000
1.476109E+08	9.743296E+11	0.00015150	0.00272700	18.00000054	2536.11274	60000.00000
1.476109E+08	9.492664E+11	0.00015550	0.00279250	17.95818383	2542.73992	60000.00000
1.476109E+08	9.254604E+11	0.00015950	0.00284997	17.86811954	2546.34139	60000.00000
1.476109E+08	9.028191E+11	0.00016350	0.00290656	17.77710575	2548.65823	60000.00000
1.476109E+08	8.812593E+11	0.00016750	0.00296333	17.69154435	2549.84149	60000.00000
1.476109E+08	8.607051E+11	0.00017150	0.00302149	17.61803681	2547.72168	60000.00000
1.476109E+08	8.410879E+11	0.00017550	0.00308050	17.55268532	2543.05534	60000.00000
1.476109E+08	8.223450E+11	0.00017950	0.00313962	17.49090654	2538.36822	60000.00000
1.476109E+08	8.044192E+11	0.00018350	0.00319886	17.43248802	2533.65963	60000.00000
1.476109E+08	7.872583E+11	0.00018750	0.00325823	17.37722701	2528.92917	60000.00000
1.476109E+08	7.708143E+11	0.00019150	0.00331773	17.32494324	2524.17626	60000.00000
1.476109E+08	7.550431E+11	0.00019550	0.00337735	17.27546936	2519.40035	60000.00000
1.476109E+08	7.399044E+11	0.00019950	0.00343813	17.23374599	2526.25270	60000.00000
1.476109E+08	7.253608E+11	0.00020350	0.00349961	17.19710487	2532.43665	60000.00000
1.476109E+08	7.113780E+11	0.00020750	0.00356127	17.16274256	2537.72896	60000.00000
1.476109E+08	6.979240E+11	0.00021150	0.00362252	17.12773973	2542.00275	60000.00000
1.476109E+08	6.849695E+11	0.00021550	0.00368217	17.08663756	2545.14857	60000.00000
1.476109E+08	6.724872E+11	0.00021950	0.00374198	17.04774660	2547.52767	60000.00000
1.476109E+08	6.604516E+11	0.00022350	0.00380195	17.01097029	2549.12186	60000.00000

Unfactored (Nominal) Moment Capacity at Concrete Strain of 0.003 = 147610.93014 in-kip

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Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Moment (Pile-head Condition Type 1)
Specified shear force at pile head = 43000.000 lbs

Specified moment at pile head = 57492000.000 in-lbs
Specified axial load at pile head = 82000.000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res. p lbs/in	Es*h F/L
0.000	0.518355	5.75E+07	43000.	-0.003612	473.826	4.06E+12	0.000	0.000
26.880	0.426427	5.87E+07	42008.	-0.003227	483.194	4.05E+12	-126.905	999.936
53.760	0.344948	5.97E+07	33718.	-0.002834	491.790	4.05E+12	-844.444	8225.396
80.640	0.274112	6.02E+07	-799.068	-0.002436	495.920	4.05E+12	-1829.938	22431.
107.520	0.214005	5.94E+07	-61417.	-0.002038	489.550	4.05E+12	-2505.655	39340.
134.400	0.164470	5.69E+07	-1.32E+05	-0.001660	468.772	6.35E+12	-3466.233	70813.
161.280	0.121262	5.21E+07	-2.25E+05	-0.001574	429.965	2.24E+13	-3370.488	93392.
188.160	0.079761	4.49E+07	-3.08E+05	-0.001516	371.715	2.25E+13	-2752.971	1.16E+05
215.040	0.039698	3.57E+07	-3.68E+05	-0.001467	297.620	2.26E+13	-1636.962	1.39E+05
241.920	0.000775	2.54E+07	-3.92E+05	-0.001431	214.191	2.27E+13	-37.181	1.61E+05
268.800	-0.037338	1.51E+07	-3.66E+05	-0.001407	130.774	2.28E+13	2041.490	1.84E+05
295.680	-0.074970	6.25E+06	-2.78E+05	-0.001395	59.515	2.28E+13	4602.815	2.06E+05
322.560	-0.112395	7.95E+05	-1.14E+05	-0.001391	15.383	2.28E+13	7655.838	2.29E+05

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.51835504 in
Computed slope at pile head = -0.00361162
Maximum bending moment = 60224446. lbs-in
Maximum shear force = -392047.42429 lbs
Depth of maximum bending moment = 80.64000000 in
Depth of maximum shear force = 241.92000 in
Number of iterations = 71
Number of zero deflection points = 1

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1	V= 43000.	M= 5.75E+07	82000.0000	0.5183550	6.0224E+07	-392047.

Computed Pile-head Stiffness Matrix Members
K22, K23, K32, K33 for Superstructure

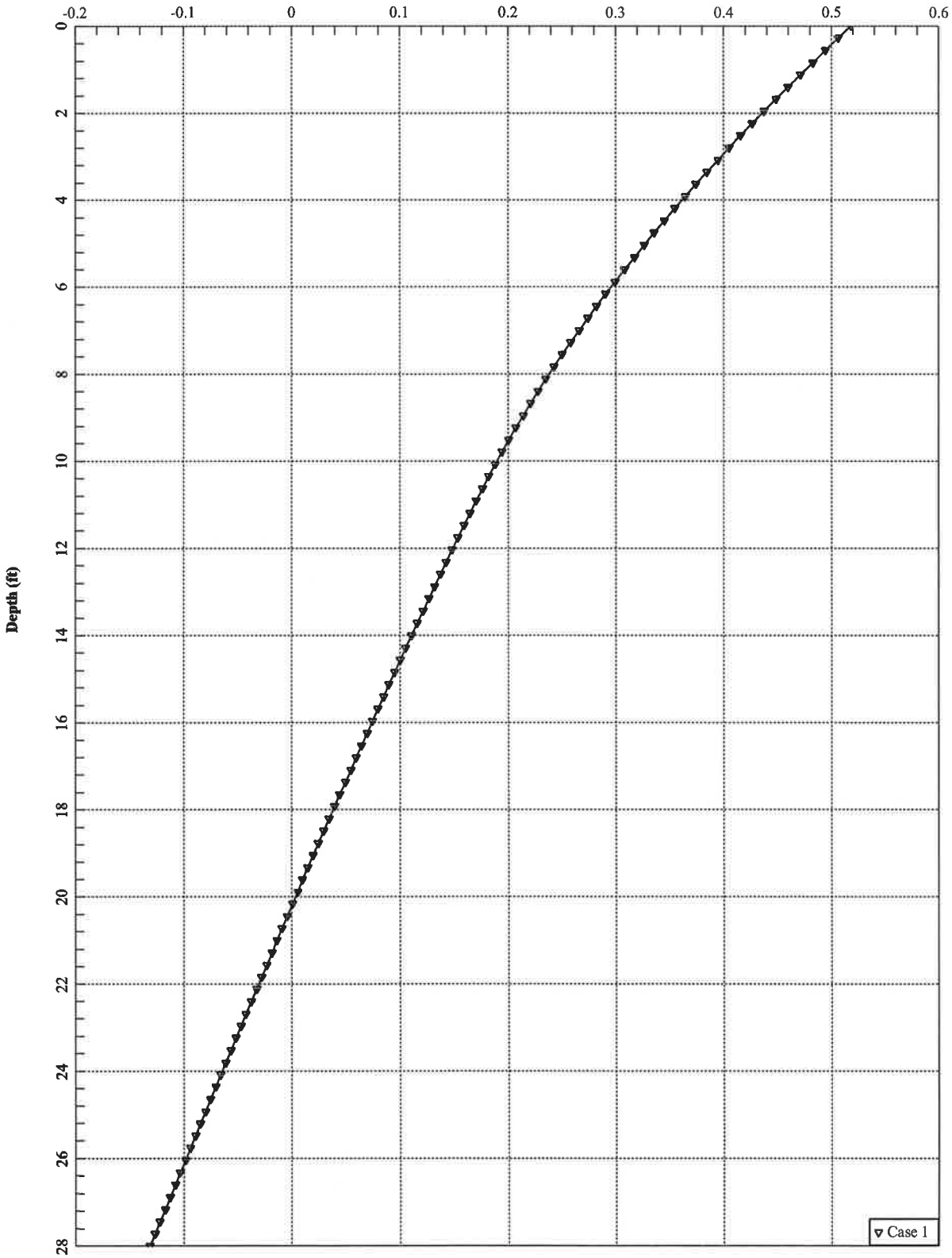
Top y in	Shear React. lbs	Mom. React. in-lbs	K22 lbs/in	K32 in-lbs/in
0.00111107	4300.00006	859614.18274	3870140.	7.736808E+08
0.00334466	12944.28981	2587696.	3870140.	7.736808E+08
0.00530116	20516.21395	4101402.	3870140.	7.736808E+08
0.00668931	25888.57963	5175393.	3870140.	7.736808E+08
0.00776605	30055.71019	6008445.	3870140.	7.736808E+08
0.00864581	33460.50377	6689098.	3870140.	7.736808E+08
0.00938964	36339.21572	7264583.	3870140.	7.736808E+08
0.01003397	38832.86944	7763089.	3870140.	7.736808E+08
0.01060231	41032.42791	8202804.	3870140.	7.736808E+08
0.01111071	43000.00000	8596142.	3870140.	7.736808E+08

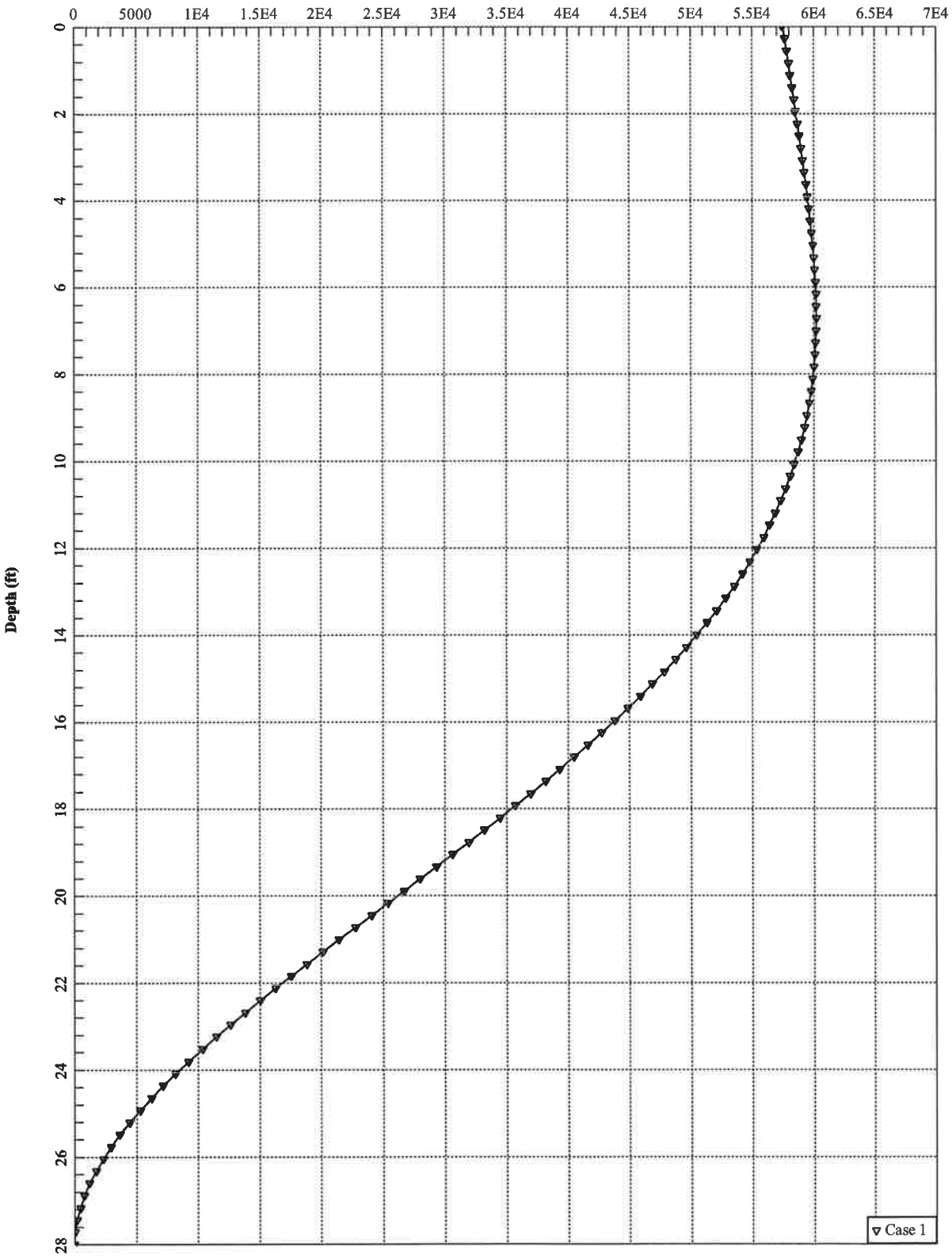
Top Rota. rad	Shear React. lbs	Mom. React. in-lbs	K23 lbs/rad	K33 in-lbs/rad

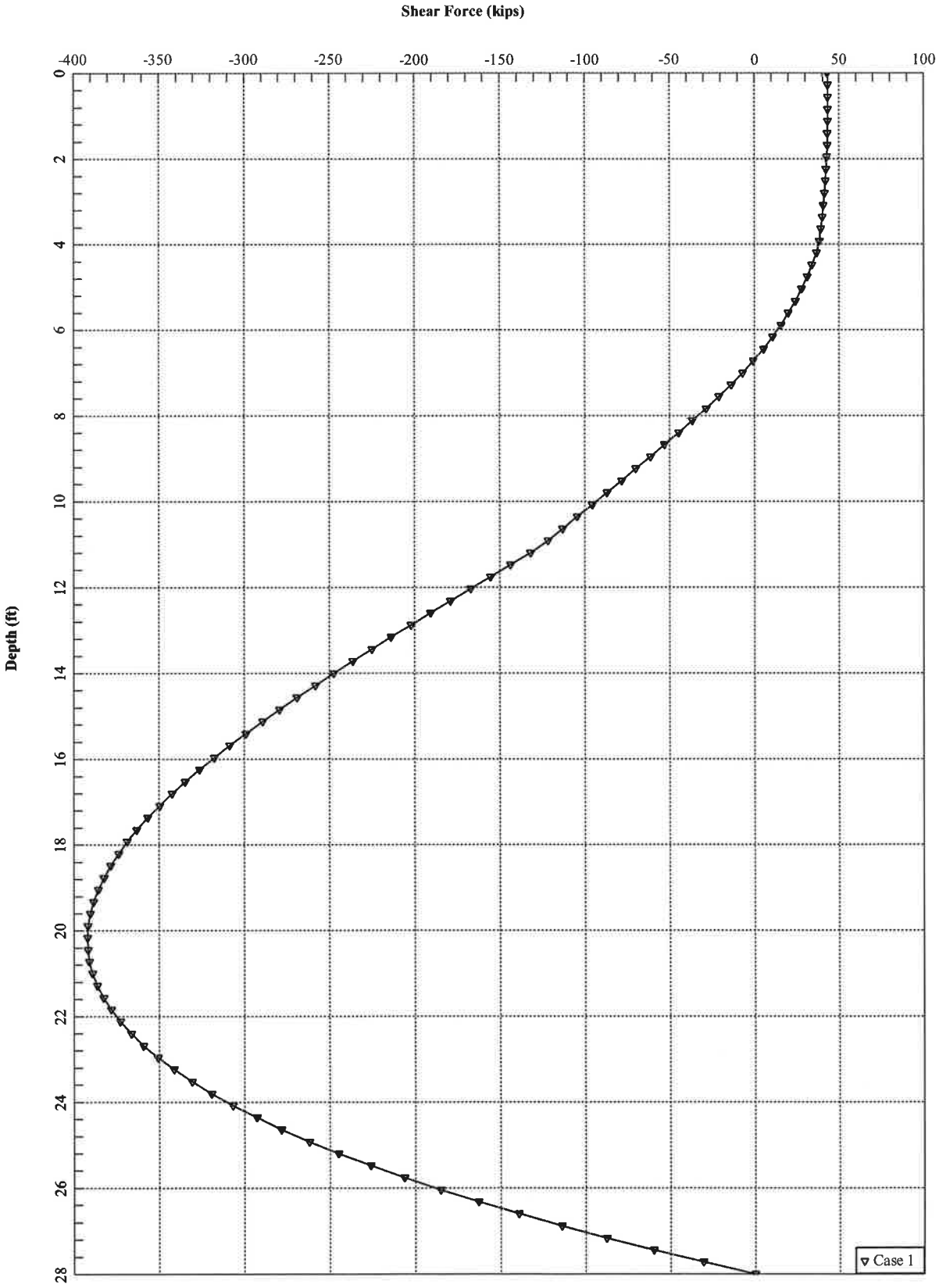
0.00003059	23667.06377	5749200.	7.736808E+08	1.879424E+11
0.00009218	71247.00747	17306817.	7.728921E+08	1.877455E+11
0.00014641	112937.03661	27430655.	7.713840E+08	1.873572E+11
0.00018505	142524.60358	34613633.	7.702079E+08	1.870533E+11
0.00021511	165479.09861	40185183.	7.692640E+08	1.868092E+11
0.00023974	184237.38823	44737472.	7.685011E+08	1.866114E+11
0.00026060	200099.37476	48586377.	7.678521E+08	1.864431E+11
0.00027870	213841.27354	51920450.	7.672714E+08	1.862927E+11
0.00029470	225963.74191	54861310.	7.667648E+08	1.861614E+11
0.00030993	236811.16505	57492000.	7.640874E+08	1.855019E+11

K22 = abs(Shear Reaction/Top y)
K23 = abs(Shear Reaction/Top Rotation)
K32 = abs(Moment Reaction/Top y)
K33 = abs(Moment Reaction/Top Rotation)

The analysis ended normally.


Lateral Deflection (in)
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Case 1


Bending Moment (in-kips)
0
5000
1E4
1.5E4
2E4
2.5E4
3E4
3.5E4
4E4
4.5E4
5E4
5.5E4
6E4
6.5E4
7E4
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Case 1


Shear Force (kips)
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Case 1

SITE NAME	065089_GREENWICH_CT	ECP - CELL #	0	5	89
LATITUDE	41.033936	LONGITUDE	-73.630832		
		SAVE BUTTON			
Additional Comments:		STRUCTURE TYPE	Roof Top		

AWS - LTE Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	ALU RRH_2X40-AWS	ALU RRH_2X40-AWS	ALU RRH_2X40-AWS
ANTENNA TYPE	MG D3-800T0	MG D3-800T0	MG D3-800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	124	124	124
TMA - INSTALLED	No	No	No
RRH - INSTALLED	Yes	Yes	Yes
AWS - LTE Future Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	ALU RRH_2X40-AWS	ALU RRH_2X40-AWS	ALU RRH_2X40-AWS
ANTENNA TYPE	HBXX-6517DS-A2M_2DT_2110	HBXX-6517DS-A2M_5DT_2110	HBXX-6517DS-A2M_4DT_2110
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	124	124	124
TMA - QTY / MODEL			
RRH - QTY/MODEL			
700 Mhz - LTE Current Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	ALU TRDU-2X40-700	ALU TRDU-2X40-700	ALU TRDU-2X40-700
ANTENNA TYPE	LNX-6514DS-T4M-750_4	LNX-6514DS-T4M-750_4	LNX-6514DS-T4M-750_4
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	160	270
DOWN TILT (MECH/DEG)	2	2	2
RAD CTR (FT AGL)	124	124	124
TMA - INSTALLED	No	No	No
RRH - INSTALLED	Yes	Yes	Yes
700 Mhz - LTE Future Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	ALU TRDU-2X40-700	ALU TRDU-2X40-700	ALU TRDU-2X40-700
ANTENNA TYPE	LNX6514DS-AIM-5DT-750MHZ	LNX6514DS-AIM-9DT-750MHZ	LNX6514DS-AIM-8DT-750MHZ
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	160	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	124	124	124
TMA - QTY / MODEL			
RRH - 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	DB844G65A-XY	DB844G65A-XY	DB844G65A-XY
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	124	124	124
TMA - INSTALLED	No	No	No
RRH - INSTALLED	No	No	No
850 Celluar - Future Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	CELLULAR MOD 4.0B	CELLULAR MOD 4.0B	CELLULAR MOD 4.0B
ANTENNA TYPE	DB844G65A-XY	DB844G65A-XY	DB844G65A-XY
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	124	124	124
TMA - QTY / MODEL			
RRH - QTY/MODEL			
1900 PCS - Current Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	PCS MOD 4.0B	PCS MOD 4.0B	PCS MOD 4.0B
ANTENNA TYPE	MG D3-800T0	MG D3-800T0	MG D3-800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	124	124	124
TMA - INSTALLED	No	No	No
RRH - INSTALLED	No	No	No
1900 PCS - Future Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	PCS MOD 4.0B	PCS MOD 4.0B	PCS MOD 4.0B
ANTENNA TYPE	MG D3-800T0	MG D3-800T0	MG D3-800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	124	124	124
TMA - QTY / MODEL			
RRH - QTY/MODEL			

TX / RX FREQUENCIES								TX POWER OUTPUT			
Cellular A-Band				PCS F / AWS-Band			700 Mhz C - Block	Cellular (Watts)			20
TX - 869-880,890-891.5 MHz				TX - 1970-1975 / 2145-2155			TX - 746-757	PCS (Watts)			16
RX - 824-835,845-846.5 MHz				RX - 1890-1895 / 1745-1755			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/	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/BROWN	F1-F	1700	Tx/Rx	GREEN/GREEN/BROWN
System Performance Engineer				Performance Manager				INITIALS			DATE
Prepared By:Chad Chisholm				Alex Restrepo				CC			10/31/2014

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6517DS-VTM

Andrew® Quad Port Teletilt® Antenna, 1710–2180 MHz, 65° horizontal beamwidth, RET compatible

- Superior azimuth tracking and pattern symmetry with excellent passive intermodulation suppression
- The values presented on this datasheet have been calculated based on N-P-BASTA White Paper version 9.6 by the NGMN Alliance

Electrical Specifications

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® single band, quad
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2180 MHz
Number of Ports, all types	4

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Low loss circuit board
Radome Material	PVC, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom

Product Specifications

HBXX-6517DS-VTM

RF Connector Quantity, total	4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	166.0 mm | 6.5 in
Length	1903.0 mm | 74.9 in
Width	305.0 mm | 12.0 in
Net Weight	19.5 kg | 43.0 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	HBXX-6517DS-R2M
Model with Factory Installed AISG 2.0 Actuator	HBXX-6517DS-A2M
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

600899A-2 — Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6514DS-VTM

Andrew® Antenna, 698–896 MHz, 65° horizontal beamwidth, RET compatible

- Great solution to maximize network coverage and capacity
- Excellent gain, VSWR, front-to-back ratio, and PIM specifications for robust network performance
- Ideal choice for site collocations and tough zoning restrictions
- Excellent solution for site sharing and maximizing capacity
- Fully compatible with Andrew remote electrical tilt system for greater OpEx savings
- The RF connectors are designed for IP67 rating and the radome for IP56 rating

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Gain, dBi	15.7	16.3
Beamwidth, Horizontal, degrees	65	65
Beamwidth, Horizontal Tolerance, degrees	±3	±3
Beamwidth, Vertical, degrees	12.5	11.2
Beam Tilt, degrees	0–10	0–10
USLS, typical, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	20	20
CPR at Sector, dB	10	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°
Impedance	50 ohm	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol®
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	698 – 896 MHz

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Bottom
Connector Quantity, total	2
Lightning Protection	dc Ground
Radiator Material	Aluminum
Radome Material	Fiberglass, UV resistant
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Product Specifications

LNX-6514DS-VTM

Dimensions

Depth	181.0 mm | 7.1 in
Length	1847.0 mm | 72.7 in
Width	301.0 mm | 11.9 in
Net Weight	17.6 kg | 38.8 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	LNX-6514DS-R2M
Model with Factory Installed AISG 2.0 Actuator	LNX-6514DS-A1M
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

DB380 — Pipe Mounting Kit for 2.4"-4.5" (60-115mm) OD round members on wide panel antennas. Includes 2 clamp sets and double nuts.

DB5083 — Downtilt Mounting Kit for 2.4"-4.5" (60 - 115 mm) OD round members. Includes a heavy-duty, galvanized steel downtilt mounting bracket assembly and associated hardware. This kit is compatible with the DB380 pipe mount kit for panel antennas that are equipped with two mounting brackets.