COHEN and WOLF P.C.
ATTORNEYS AT LAW

RACHEL A. SCHWARTZMAN

Please Reply To: Bridgeport
Writer's Direct Dial: (203) 337-4110
E-Mail: rschwartzman@cohenandwolf.com

May 14, 2015

Attorney Melanie Bachman
Acting Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06501

Re: Notice of Exempt Modification
Verizon Wireless/T-Mobile Equipment Upgrade
Site ID CT11508F
123 Palmer Road, Chaplin, CT (aka 121 Palmer Road, Chaplin, CT)

Dear Attorney Bachman:

This office represents T-Mobile Northeast LLC ("T-Mobile") and has been retained to file exempt modification filings with the Connecticut Siting Council on its behalf.

In this case, Verizon Wireless owns the existing monopole telecommunications tower and related facility at 123 Palmer Road, Chaplin, CT (-72.1355448/41.78461418). T-Mobile intends to add three new antennas mounted to a proposed mast pipe on a low-profile platform and related equipment at this existing telecommunications facility in Chaplin ("Chaplin Facility"). Please accept this letter as notification, pursuant to R.C.S.A. §16-50j-73, of construction which 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 the first selectman, William H. Rose IV and the property owner, Verizon Wireless.

The existing Chaplin Facility consists of a 147-foot monopole tower.[1] T-Mobile plans to add three (3) new antennas mounted to a proposed mast pipe on a low-profile platform, as well as a hand rail for the low-profile platform, at a centerline of 118 feet. T-Mobile will also install a BBU equipment cabinet on the existing concrete pad, install three (3) remote radio units (RRUs) mounted to a new equipment H-frame, and add coax cable (which will be routed with the existing coax cable) along the exterior of the monopole. (See the plans dated March 10, 2015 attached hereto as **Exhibit A**). The existing Chaplin Facility is structurally capable of supporting T-Mobile's proposed modifications, as indicated in the structural analysis dated April 21, 2015, and attached hereto as **Exhibit B**.

[1] While the online docket for the Connecticut Siting Council does not provide a docket or petition number for approval of this structure, it does reference this structure in connection with notices of intent captioned EM-CING-024-090213 and EM-AT&T-024-121217.

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

1. The proposed modification will not increase the height of the tower. T-Mobile's existing antennas are at a centerline of 118 feet; the additional antennas will be installed at the same 118-foot level. The enclosed tower drawing confirms that the proposed modification will not increase the height of the tower.

2. The proposed modifications will not require an extension on the site boundaries or lease area, as depicted on Sheet LE-1 of Exhibit A. T-Mobile's equipment will be located entirely within the existing compound area.

3. The proposed modification to the Facility will not increase the noise levels at the existing facility by six decibels or more.

4. The operation of the additional antennas and equipment will not increase the total radio frequency (RF) power density, measured at the base of the tower, to a level at or above the applicable standard. According to a Radio Frequency Emissions Analysis Report prepared by EBI dated April 27, 2015, T-Mobile's operations would add 11.24% of the FCC Standard. Therefore, the calculated "worst case" power density for the planned combined operation at the site including all of the proposed antennas would be 57.45% of the FCC Standard as calculated for a mixed frequency site as evidenced by the engineering exhibit attached hereto as **Exhibit C.**

For the foregoing reasons, T-Mobile respectfully submits that the proposed additional antennas and equipment at the Chaplin Facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2). Upon acknowledgement of this exempt modification, T-Mobile shall commence construction approximately sixty days from the receipt of the Council's decision.

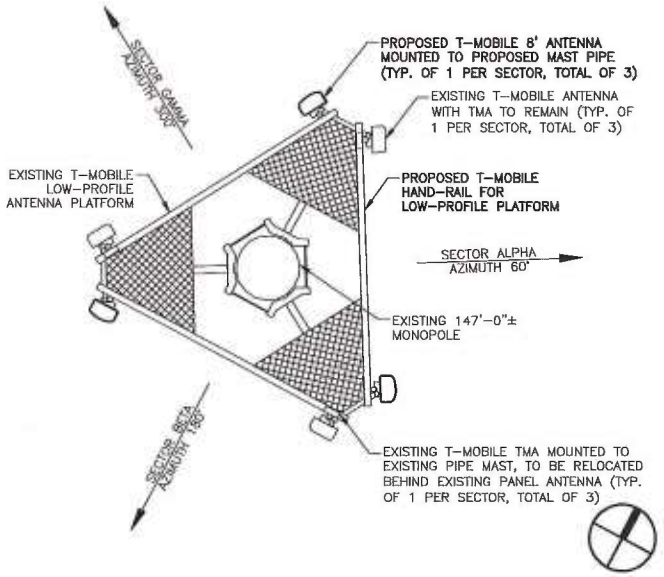
Sincerely,

Rachel Schwartzman

Rachel A. Schwartzman, Esq.

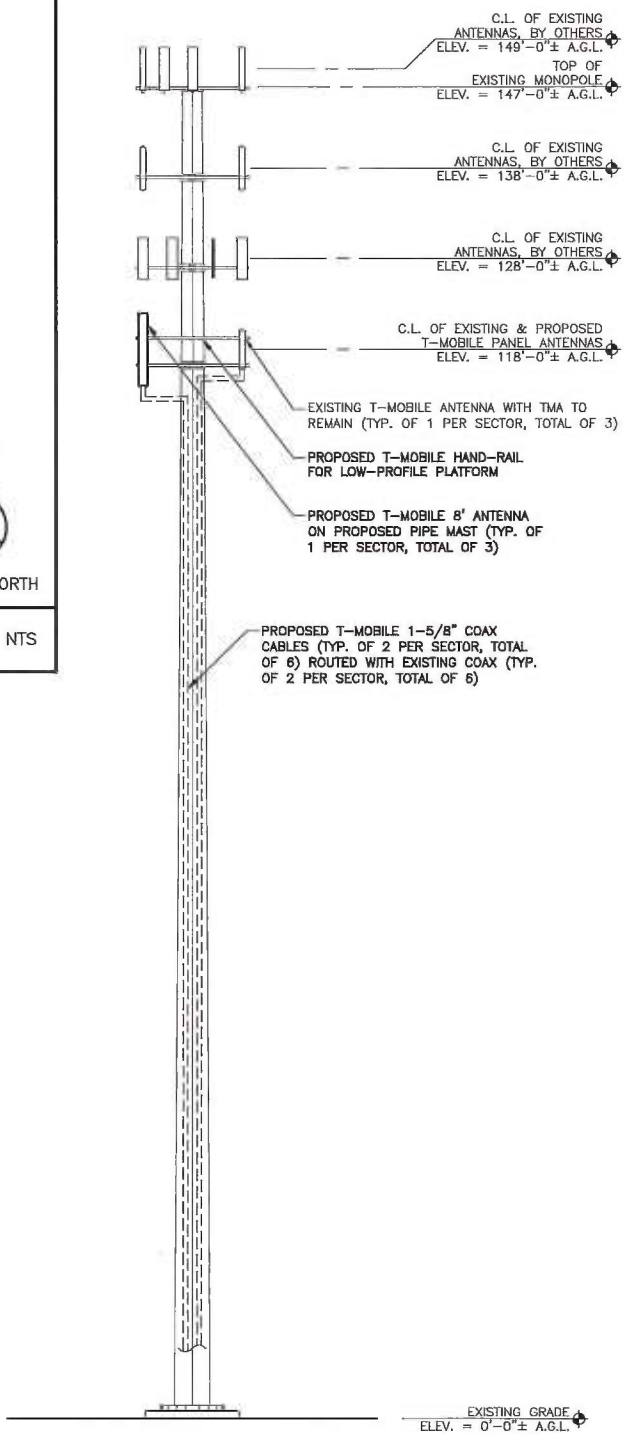
cc: First Selectman William H. Rose IV, Town of Chaplin
Verizon Wireless
Jamie Ford, EBI Consulting

EXHIBIT A



ANTENNA CONFIGURATION

NTS



CONFIGURATION

704G

NOTE:
ALL EQUIPMENT LOCATIONS ARE APPROXIMATE AND ARE SUBJECT TO APPROVAL BY LESSEE/LICENSEE STRUCTURAL AND RF ENGINEERS.

TOWER ELEVATION

SCALE: 1:20

PREPARED BY:
EBI Consulting
environmental | engineering | due diligence
21 B Street | Burlington, MA 01803
Tel: (781) 273-2500 | Fax: (781) 273-3311
www.ebiconsulting.com
EBI JOB NO.: 8115000122

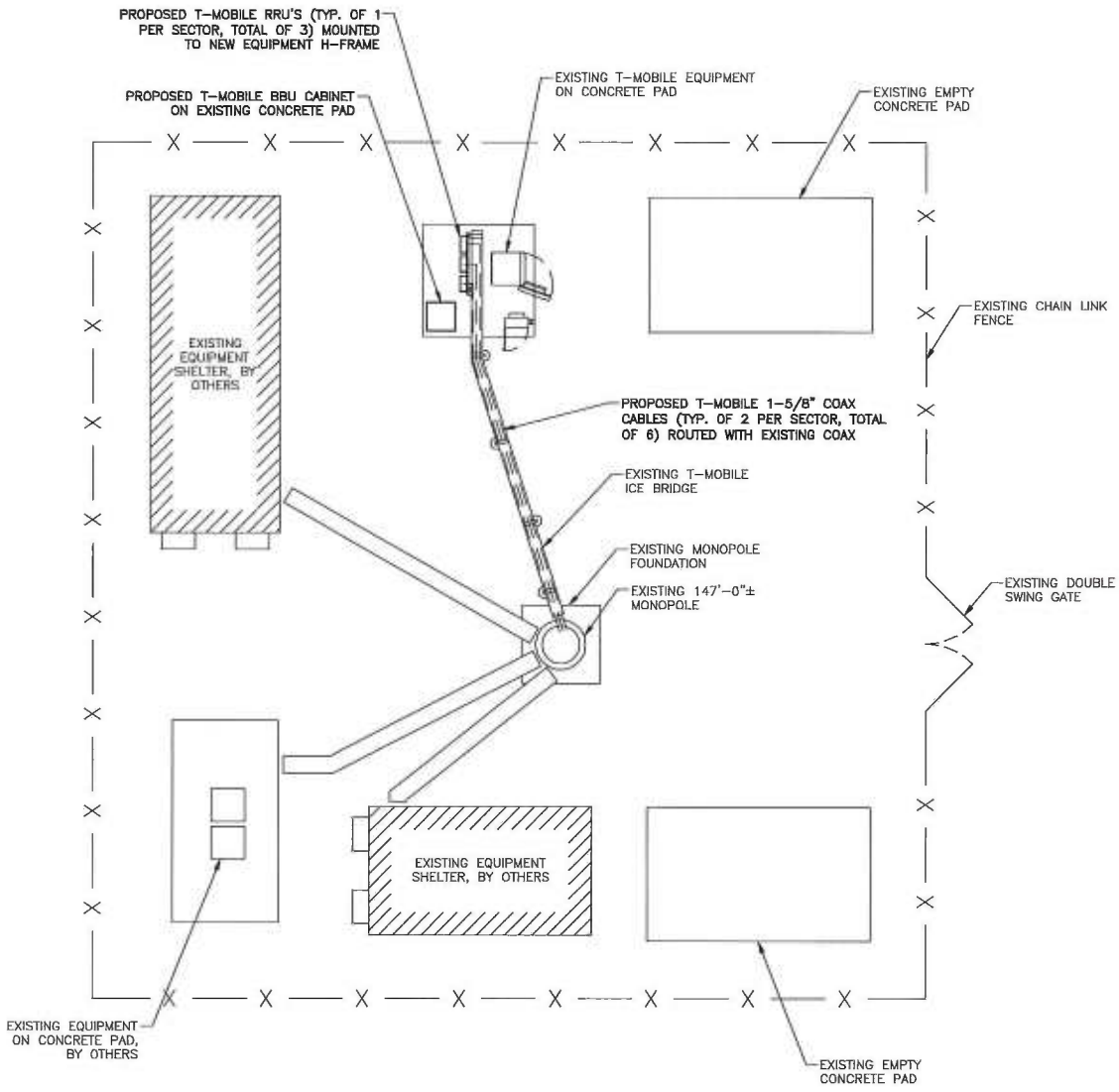
CLIENT:
T-Mobile Northeast, LLC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
860.692.7100

SITE INFO:
CT11508F
CT508/VERIZON
CHAPLIN
121 PALMER ROAD
CHAPLIN, CT 06256

SUBMITTALS			
NO.	DATE	DESCRIPTION	BY
A	03/10/15	FOR REVIEW	JM

DRAWN BY: JM
CHECKED BY: BB
DATE: 03/04/15

SHEET NO: LE-2



CONFIGURATION

704G

APPROX. NORTH

NOTE:
ALL EQUIPMENT LOCATIONS ARE APPROXIMATE AND ARE SUBJECT TO APPROVAL BY LESSEE/LICENSEE STRUCTURAL AND RF ENGINEERS.

SITE PLAN

SCALE: 1/16" = 1'-0"

PREPARED BY:

EBI Consulting
environmental | engineering | due diligence
21 B Street | Burlington, MA 01803
Tel: (781) 273-2500 | Fax: (781) 273-3311
www.ebiconsulting.com

EBI JOB NO.:
8115000122

CLIENT:

T-Mobile Northeast, LLC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
860.692.7100

SITE INFO:

CT11508F
CT508/VERIZON
CHAPLIN
121 PALMER ROAD
CHAPLIN, CT 06256

SUBMITTALS			
NO.	DATE	DESCRIPTION	BY
A	03/10/15	FOR REVIEW	JM

DRAWN BY: JM
CHECKED BY: BB
DATE: 03/04/15

SHEET NO:

LE-1

EXHIBIT B

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

147-ft Existing EEI Monopole

Proposed T-Mobile
Antenna Upgrade

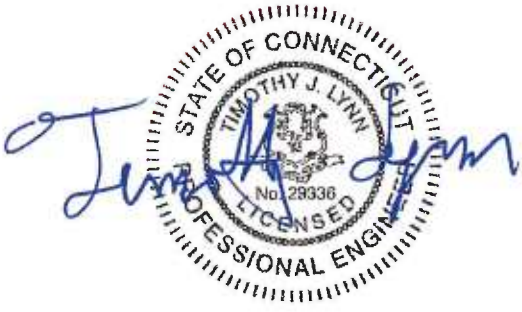
T-Mobile Site Ref: CT11508F

Verizon Site Ref: Chaplin South

123 Palmer Road
Chaplin, CT

Centek Project No. 15049.004

Date: April 21, 2015



Prepared for:
T-Mobile USA
35 Griffin Road
Bloomfield, CT 06002

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

Table of Contents

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna upgrade proposed by T-Mobile on the existing monopole (tower) located in Chaplin, CT.

The host tower is a 147-ft, three-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Inc (EEI)—job no: 12120, dated November 12, 2003. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned EEI design report.

Antenna and appurtenance information were obtained from a previous structural analysis report prepared by Centek project no. 12044.CO5 dated December 10, 2012, a tower mapping report prepared by Eastern Communications dated March 30, 2015 and a T-Mobile RF data sheet.

The tower is made up of three (3) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 23.50-in at the top and 54.50-in at the base.

T-Mobile proposes the installation of three (3) 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, proposed and future loads considered in this analysis consist of the following:

- VERIZON WIRELESS (Existing/Reserved):
  Antennas: Six (6) Antel LPA-80063-6CF panel antennas, six (6) Antel BXA-70063-6CF panel antennas, six (6) LPA-171063-12CF panel antennas, six (6) RFS FD9R6004/2C-3L diplexers, six (6) RRH's and two (2) main distribution boxes mounted on an existing low profile platform with a RAD center elevation of 149-ft above existing grade.
  Coax Cables: Eighteen (18) 1-5/8" ∅ coax cables running on the inside of the existing tower and two (2) 1-5/8" ∅ fiber cables running on the exterior of the existing tower.
- Sprint (Existing):
  Antennas: Two (2) Decibel DB950F65T2E-M and four (4) Decibel DB950F85E-M panel antennas mounted to one (1) low profile platform with a RAD center elevation of 138-ft above grade level.
  Coax Cables: Six (6) 1 5/8" ∅ coax cables running on the interior of monopole.
- AT&T (Existing):
  Antennas: Three (3) KWM AM-X-CD-17-65-00T-RET panel antennas, six (6) Powerwave 7770 panel antennas, six (6) Powerwave LGP21401 TMA's, six (6) Powerwave LGP21901 Diplexers, three (3) PolyPahser DAS-DFDM-06 Bias-T, six (6) Ericsson RRUS-11 and two (2) Raycap DC6-48-60-18-8F surge arrestors mounted on one (1) low profile platform at a RAD center elevation of 128-ft above grade level.
  Coax Cables: Twelve (12) 1 5/8" ∅ coax cables, one (1) fiber cable and two (2) dc control cables running on the interior of monopole.

- AT&T (Existing):
  GPS: One (1) GPS antenna mounted on a 4-ft standoff arm with a RAD center elevation of 74-ft above grade level.
  Coax Cables: One (1) 1/2" ∅ coax cable running on the exterior of monopole.
- Sprint (Existing):
  GPS: One (1) GPS antenna mounted on a 4-ft standoff arm with a RAD center elevation of 62-ft above grade level.
  Coax Cables: One (1) 1/2" ∅ coax cable running on the exterior of monopole.
- T-Mobile (Existing to Remain):
  Antennas: Three (3) RFS APXV18-206517 panel antennas and three (3) Ericsson KRY112 TMA's mounted to one (1) low profile platform with a RAD center elevation of 118-ft above grade level.
  Coax Cables: Six (6) 1 5/8" ∅ coax cables running on the interior of the monopole.
- **T-Mobile (Proposed):**
  Antennas: Three (3) Andrew LNX-6515DS panel antennas mounted to one (1) low profile platform with a RAD center elevation of 118-ft above grade level.
  Coax Cables: Six (6) 1 5/8" ∅ coax cables running on the exterior of the monopole.

Primary Assumptions Used in the Analysis

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

Analysis

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

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

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

Tower Loading

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

Basic Wind Speed:	Windham; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Chaplin; v = 105 mph (3 second gust) equivalent to v = 85 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA-222-F and Appendix K wind speeds are equal.	
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 **92.6%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L2)	47.92'-94.54'	92.6%	**PASS**

Foundation and Anchors

The existing foundation consists of an 7-ft ∅ x 1.5-ft long reinforced concrete pier on a 27.0-ft square x 4.5-ft thick reinforce concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; job no: 12120, dated November 12, 2003. The base of the tower is connected to the foundation by means of (16) 2.25" ∅, ASTM A615-75 anchor bolts embedded approximately 5-ft into the concrete foundation structure.

- 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	30 kips
	Compression	37 kips
	Moment	3306 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 (FS)[1]	Proposed Loading (FS)[1]	Result
Reinforced Concrete Pad and Pier	OTM[2]	2.0	2.45	**PASS**

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

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Combined Compression and Bending	82.0%	**PASS**
Base Plate	Bending	94.9%	**PASS**

Conclusion

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

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

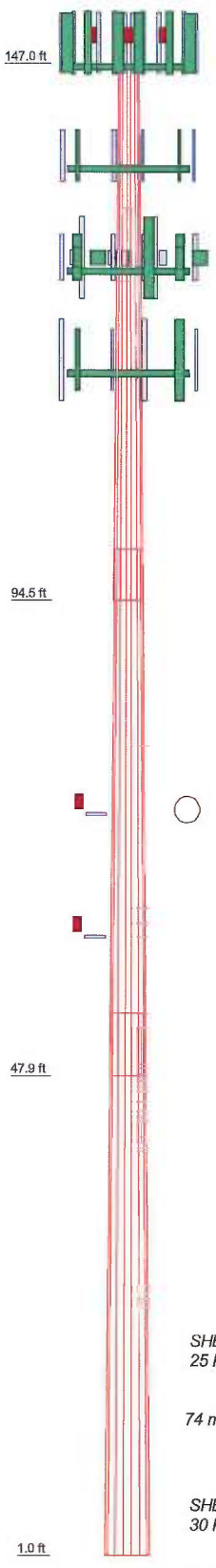
General Description of Structural Analysis Program

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

tnxTower Features:

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

Section	1	2	3
Length (ft)	52.460	51.540	53.084
Number of Sides	18	18	18
Thickness (in)	0.250	0.313	0.375
Socket Length (ft)	4.917	6.167	
Top Dia (in)	23.500	33.540	42.872
Bot Dia (in)	35.130	44.850	54.500
Grade		A572-65	
Weight (K)	4.1	6.8	10.4



AXIAL
45 K
SHEAR
25 K
MOMENT
2783 kip-ft
TORQUE 1 kip-ft
74 mph WIND - 0.500 in ICE
AXIAL
37 K
SHEAR
30 K
MOMENT
3306 kip-ft
TORQUE 1 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
LPA-80063/6CF (Verizon - Reserved)	149	(2) 7770.00 (ATI Existing)	128
LPA-171063-12CF (Verizon - Reserved)	149	(2) 7770.00 (ATI Existing)	128
		(2) 7770.00 (ATI Existing)	128
BXA-70063/6CF (Verizon - Reserved)	149	(2) LGP21401 TMA (ATI Existing)	128
BXA-70063/6CF (Verizon - Reserved)	149	(2) LGP21401 TMA (ATI Existing)	128
LPA-171063-12CF (Verizon - Reserved)	149	(2) LGP21401 TMA (ATI Existing)	128
		(2) LGP21901 Diplexer (ATI Existing)	128
LPA-80063/6CF (Verizon - Reserved)	149	(2) LGP21901 Diplexer (ATI Existing)	128
LPA-80063/6CF (Verizon - Reserved)	149	(2) LGP21901 Diplexer (ATI Existing)	128
LPA-171063-12CF (Verizon - Reserved)	149	DAS-HY-DFDM-06 BIAS-T (ATI Existing)	128
BXA-70063/6CF (Verizon - Reserved)	149	DAS-HY-DFDM-06 BIAS-T (ATI Existing)	128
BXA-70063/6CF (Verizon - Reserved)	149		
LPA-171063-12CF (Verizon - Reserved)	149	DAS-HY-DFDM-06 BIAS-T (ATI Existing)	128
LPA-80063/6CF (Verizon - Reserved)	149	AM-X-CD-17-65-00T-RET (ATI Existing)	128
LPA-80063/6CF (Verizon - Reserved)	149		
LPA-171063-12CF (Verizon - Reserved)	149	AM-X-CD-17-65-00T-RET (ATI Existing)	128
BXA-70063/6CF (Verizon - Reserved)	149	AM-X-CD-17-65-00T-RET (ATI Existing)	128
BXA-70063/6CF (Verizon - Reserved)	149		
LPA-171063-12CF (Verizon - Reserved)	149	(2) RRUS-11 (ATI Existing)	128
		(2) RRUS-11 (ATI Existing)	128
LPA-80063/6CF (Verizon - Reserved)	149	(2) RRUS-11 (ATI Existing)	128
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	149	(2) DC6-48-60-18-8F Surge Arrestor (ATI Existing)	128
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	149	EEI 12-ft Low Profile Platform (ATI Existing)	127
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	149	APXV18-206517S (T-Mobile Existing)	118
		APXV18-206517S (T-Mobile Existing)	118
RRH2x40-AWS (Verizon - Reserved)	149	APXV18-206517S (T-Mobile Existing)	118
RRH2x40-AWS (Verizon - Reserved)	149	TMA 10"x8"x5" (T-Mobile Existing)	118
RRH2x40-AWS (Verizon - Reserved)	149	TMA 10"x8"x5" (T-Mobile Existing)	118
RRH2x40-07-U (Verizon - Reserved)	149	TMA 10"x8"x5" (T-Mobile Existing)	118
RRH2x40-07-U (Verizon - Reserved)	149	LNX-6515DS (T-Mobile Proposed)	118
RRH2x40-07-U (Verizon - Reserved)	149	LNX-6515DS (T-Mobile Proposed)	118
(2) DB-T1-6Z-8AB-0Z (Verizon - Reserved)	149	LNX-6515DS (T-Mobile Proposed)	118
		Andrew 12'-6" Low Profile Platform (T-Mobile Existing)	117
EEI 14-ft Low Profile Platform (Verizon Existing)	147	GPS (ATI Existing)	74
(2) DB950F85T2E-M (Sprint Existing)	138	4-ft Standoff (ATI Existing)	73.5
(2) DB950F85E-M (Sprint Existing)	138	GPS (Sprint Existing)	62
(2) DB950F85E-M (Sprint Existing)	138	4-ft Standoff (Sprint Existing)	61.5
EEI 12-ft Low Profile Platform (Sprint Existing)	137		

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. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 92.6%

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

Job: **15049.004 - CT11508F**			
Project: **147' EEI Monopole - 123 Palmer Road Chaplin, CT**			
Client: T-Mobile	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 04/22/15	Scale: NTS	
Path: J:\Jobs\15049.004-CT11508F04_Structural\Backup Documents\tnx\CtCt11508F04 Rev147' Monopole_Chaplin_CT.eri		Dwg No. E-1	

tnxTower	Job	Page
	15049.004 - CT11508F	1 of 28
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project 147' EEI Monopole - 123 Palmer Road Chaplin, CT	Date 08:43:29 04/22/15
	Client T-Mobile	Designed by TJL

Tower Input Data

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

Basic wind speed of 85 mph.
Nominal ice thickness of 0.500 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.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	*Elevation*	*Section Length*	*Splice Length*	*Number of Sides*	*Top Diameter*	*Bottom Diameter*	*Wall Thickness*	*Bend Radius*	*Pole Grade*
	ft	*ft*	*ft*		*in*	*in*	*in*	*in*	
L1	147.000-94.540	52.460	4.917	18	23.500	35.130	0.250	1.000	A572-65 (65 ksi)
L2	94.540-47.917	51.540	6.167	18	33.540	44.850	0.313	1.250	A572-65 (65 ksi)
L3	47.917-1.000	53.084		18	42.872	54.500	0.375	1.500	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	23.863	18.449	1259.950	8.254	11.938	105.541	2521.558	9.226	3.696	14.784
	35.672	27.677	4254.160	12.382	17.846	238.381	8513.918	13.841	5.743	22.972
L2	35.153	32.957	4597.110	11.796	17.038	269.811	9200.270	16.482	5.353	17.13
	45.542	44.176	11070.619	15.811	22.784	485.899	22155.805	22.092	7.344	23.5
L3	44.905	50.582	11540.941	15.086	21.779	529.916	23097.068	25.296	6.885	18.361
	55.341	64.422	23843.465	19.214	27.686	861.210	47718.304	32.217	8.932	23.819

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 147.000-94.540				1	1	1		
L2 94.540-47.917				1	1	1		
L3 47.917-1.000				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
1 5/8	C	No	Inside Pole	147.000 - 2.000	18	No Ice	0.000	0.001
(Verizon Existing)						1/2" Ice	0.000	0.001
1 5/8	C	No	Inside Pole	138.000 - 2.000	6	No Ice	0.000	0.001
(Sprint Existing)						1/2" Ice	0.000	0.001
1 5/8	C	No	Inside Pole	128.000 - 2.000	12	No Ice	0.000	0.001
(AT&T Existing)						1/2" Ice	0.000	0.001
1 5/8	C	No	Inside Pole	118.000 - 2.000	6	No Ice	0.000	0.001
(T-Mobile Existing)						1/2" Ice	0.000	0.001
1/2	C	No	CaAa (Out Of	74.000 - 2.000	1	No Ice	0.058	0.000
(AT&T Existing)			Face)			1/2" Ice	0.158	0.001
1/2	C	No	CaAa (Out Of	62.000 - 2.000	1	No Ice	0.058	0.000
(Sprint Existing)			Face)			1/2" Ice	0.158	0.001
RG6-Fiber	C	No	Inside Pole	128.000 - 4.000	1	No Ice	0.000	0.001
(AT&T Existing)						1/2" Ice	0.000	0.001
#8 AWG Copper WIre	C	No	Inside Pole	128.000 - 4.000	2	No Ice	0.000	0.000
(AT&T Existing)						1/2" Ice	0.000	0.000
HYBRIFLEX 1-5/8"	C	No	CaAa (Out Of	147.000 - 1.000	1	No Ice	0.198	0.002
(Verizon - Reserved)			Face)			1/2" Ice	0.298	0.003
1 5/8	C	No	CaAa (Out Of	118.000 - 2.000	1	No Ice	0.198	0.001
(T-Mobile Proposed)			Face)			1/2" Ice	0.298	0.003
1 5/8	C	No	CaAa (Out Of	118.000 - 2.000	5	No Ice	0.000	0.001
(T-Mobile Proposed)			Face)			1/2" Ice	0.000	0.003
HYBRIFLEX 1-5/8"	C	No	CaAa (Out Of	147.000 - 1.000	1	No Ice	0.000	0.002
(Verizon - Reserved)			Face)			1/2" Ice	0.000	0.003

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	147.000-94.540	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	15.032	2.200
L2	94.540-47.917	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	20.792	2.566
L3	47.917-1.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	23.707	2.542

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	147.000-94.540	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	22.624	2.571
L2	94.540-47.917	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	34.133	3.156
L3	47.917-1.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	42.174	3.161

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
LPA-80063/6CF	A	From Face	3.000	0.000	149.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-171063-12CF	A	From Face	3.000	0.000	149.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
BXA-70063/6CF	A	From Face	3.000	0.000	149.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
BXA-70063/6CF	A	From Face	3.000	0.000	149.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			-1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
LPA-171063-12CF	A	From Face	3.000	0.000	149.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			-4.000			1/2" Ice	6.462	6.523	0.055
			0.000						

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
LPA-80063/6CF	A	From Face	3.000	0.000	149.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-80063/6CF	B	From Face	3.000	0.000	149.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-171063-12CF	B	From Face	3.000	0.000	149.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
BXA-70063/6CF	B	From Face	3.000	0.000	149.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
BXA-70063/6CF	B	From Face	3.000	0.000	149.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			-1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
LPA-171063-12CF	B	From Face	3.000	0.000	149.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			-4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
LPA-80063/6CF	B	From Face	3.000	0.000	149.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-80063/6CF	C	From Face	3.000	0.000	149.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-171063-12CF	C	From Face	3.000	0.000	149.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
BXA-70063/6CF	C	From Face	3.000	0.000	149.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
BXA-70063/6CF	C	From Face	3.000	0.000	149.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			-1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
LPA-171063-12CF	C	From Face	3.000	0.000	149.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			-4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
LPA-80063/6CF	C	From Face	3.000	0.000	149.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
(2) FD9R6004/2C-3L	A	From Face	3.000	0.000	149.000	No Ice	0.000	0.085	0.003
Diplexer			0.000			1/2" Ice	0.000	0.136	0.005
(Verizon - Reserved)			0.000						
(2) FD9R6004/2C-3L	B	From Face	3.000	0.000	149.000	No Ice	0.000	0.085	0.003
Diplexer			0.000			1/2" Ice	0.000	0.136	0.005
(Verizon - Reserved)			0.000						
(2) FD9R6004/2C-3L	C	From Face	3.000	0.000	149.000	No Ice	0.000	0.085	0.003
Diplexer			0.000			1/2" Ice	0.000	0.136	0.005
(Verizon - Reserved)			0.000						
RRH2x40-AWS	A	From Face	3.000	0.000	149.000	No Ice	0.000	1.589	0.044
(Verizon - Reserved)			0.000			1/2" Ice	0.000	1.795	0.061
			0.000						
RRH2x40-AWS	B	From Face	3.000	0.000	149.000	No Ice	0.000	1.589	0.044
(Verizon - Reserved)			0.000			1/2" Ice	0.000	1.795	0.061
			0.000						
RRH2x40-AWS	C	From Face	3.000	0.000	149.000	No Ice	0.000	1.589	0.044
(Verizon - Reserved)			0.000			1/2" Ice	0.000	1.795	0.061
			0.000						

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
RRH2x40-07-U	A	From Face	3.000	0.000	149.000	No Ice	0.000	1.228	0.050
(Verizon - Reserved)			0.000			1/2" Ice	0.000	1.385	0.067
			0.000						
RRH2x40-07-U	B	From Face	3.000	0.000	149.000	No Ice	0.000	1.228	0.050
(Verizon - Reserved)			0.000			1/2" Ice	0.000	1.385	0.067
			0.000						
RRH2x40-07-U	C	From Face	3.000	0.000	149.000	No Ice	0.000	1.228	0.050
(Verizon - Reserved)			0.000			1/2" Ice	0.000	1.385	0.067
			0.000						
(2) DB-T1-6Z-8AB-0Z	A	From Face	3.000	0.000	149.000	No Ice	5.600	2.333	0.044
(Verizon - Reserved)			0.000			1/2" Ice	5.915	2.558	0.080
			0.000						
EEI 14-ft Low Profile	C	None		0.000	147.000	No Ice	16.500	16.500	1.550
Platform						1/2" Ice	20.000	20.000	1.800
(Verizon Existing)									
(2) DB950F65T2E-M	A	From Face	3.500	0.000	138.000	No Ice	6.125	4.236	0.015
(Sprint Existing)			0.000			1/2" Ice	6.586	4.620	0.054
			0.000						
(2) DB950F85E-M	B	From Face	3.500	0.000	138.000	No Ice	2.778	4.236	0.012
(Sprint Existing)			0.000			1/2" Ice	3.146	4.620	0.036
			0.000						
(2) DB950F85E-M	C	From Face	3.500	0.000	138.000	No Ice	2.778	4.236	0.012
(Sprint Existing)			0.000			1/2" Ice	3.146	4.620	0.036
			0.000						
EEI 12-ft Low Profile	C	None		0.000	137.000	No Ice	15.000	15.000	1.500
Platform						1/2" Ice	18.400	18.400	1.750
(Sprint Existing)									
(2) 7770.00	A	From Face	3.500	0.000	128.000	No Ice	5.882	2.928	0.035
(AT&T Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
(2) 7770.00	B	From Face	3.500	0.000	128.000	No Ice	5.882	2.928	0.035
(AT&T Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
(2) 7770.00	C	From Face	3.500	0.000	128.000	No Ice	5.882	2.928	0.035
(AT&T Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
(2) LGP21401 TMA	A	From Face	3.500	0.000	128.000	No Ice	0.000	0.367	0.018
(AT&T Existing)			0.000			1/2" Ice	0.000	0.480	0.023
			0.000						
(2) LGP21401 TMA	B	From Face	3.500	0.000	128.000	No Ice	0.000	0.367	0.018
(AT&T Existing)			0.000			1/2" Ice	0.000	0.480	0.023
			0.000						
(2) LGP21401 TMA	C	From Face	3.500	0.000	128.000	No Ice	0.000	0.367	0.018
(AT&T Existing)			0.000			1/2" Ice	0.000	0.480	0.023
			0.000						
(2) LGP21901 Diplexer	A	From Face	3.500	0.000	128.000	No Ice	0.000	0.117	0.006
(AT&T Existing)			0.000			1/2" Ice	0.000	0.166	0.008
			0.000						
(2) LGP21901 Diplexer	B	From Face	3.500	0.000	128.000	No Ice	0.000	0.117	0.006
(AT&T Existing)			0.000			1/2" Ice	0.000	0.166	0.008
			0.000						
(2) LGP21901 Diplexer	C	From Face	3.500	0.000	128.000	No Ice	0.000	0.117	0.006
(AT&T Existing)			0.000			1/2" Ice	0.000	0.166	0.008
			0.000						
DAS-HY-DFDM-06 BIAS-T	A	From Face	3.500	0.000	128.000	No Ice	0.000	0.136	0.080
(AT&T Existing)			0.000			1/2" Ice	0.000	0.199	0.081
			0.000						

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
DAS-HY-DFDM-06 BIAS-T (AT&T Existing)	B	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.000 0.000	0.136 0.199	0.080 0.081
DAS-HY-DFDM-06 BIAS-T (AT&T Existing)	C	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.000 0.000	0.136 0.199	0.080 0.081
AM-X-CD-17-65-00T-RET (AT&T Existing)	A	From Face	3.000 -2.000 0.000	0.000	128.000	No Ice 1/2" Ice	11.311 11.927	6.800 7.384	0.060 0.121
AM-X-CD-17-65-00T-RET (AT&T Existing)	B	From Face	3.000 -2.000 0.000	0.000	128.000	No Ice 1/2" Ice	11.311 11.927	6.800 7.384	0.060 0.121
AM-X-CD-17-65-00T-RET (AT&T Existing)	C	From Face	3.000 -2.000 0.000	0.000	128.000	No Ice 1/2" Ice	11.311 11.927	6.800 7.384	0.060 0.121
(2) RRUS-11 (AT&T Existing)	A	From Face	1.000 -2.000 0.000	0.000	128.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
(2) RRUS-11 (AT&T Existing)	B	From Face	1.000 -2.000 0.000	0.000	128.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
(2) RRUS-11 (AT&T Existing)	C	From Face	1.000 -2.000 0.000	0.000	128.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
(2) DC6-48-60-18-8F Surge Arrestor (AT&T Existing)	C	From Face	0.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	2.228 2.447	2.228 2.447	0.020 0.039
EEI 12-ft Low Profile Platform (AT&T Existing)	C	None		0.000	127.000	No Ice 1/2" Ice	15.000 18.400	15.000 18.400	1.500 1.750
APXV18-206517S (T-Mobile Existing)	A	From Face	3.500 5.000 0.000	0.000	118.000	No Ice 1/2" Ice	5.167 5.618	3.038 3.469	0.027 0.054
APXV18-206517S (T-Mobile Existing)	B	From Face	3.500 5.000 0.000	0.000	118.000	No Ice 1/2" Ice	5.167 5.618	3.038 3.469	0.027 0.054
APXV18-206517S (T-Mobile Existing)	C	From Face	3.500 5.000 0.000	0.000	118.000	No Ice 1/2" Ice	5.167 5.618	3.038 3.469	0.027 0.054
TMA 10"x8"x5" (T-Mobile Existing)	A	From Face	3.500 5.000 0.000	0.000	118.000	No Ice 1/2" Ice	0.000 0.000	0.486 0.588	0.020 0.026
TMA 10"x8"x5" (T-Mobile Existing)	B	From Face	3.500 5.000 0.000	0.000	118.000	No Ice 1/2" Ice	0.000 0.000	0.486 0.588	0.020 0.026
TMA 10"x8"x5" (T-Mobile Existing)	C	From Face	3.500 5.000 0.000	0.000	118.000	No Ice 1/2" Ice	0.000 0.000	0.486 0.588	0.020 0.026
LNX-6515DS (T-Mobile Proposed)	A	From Face	3.500 -5.000 0.000	0.000	118.000	No Ice 1/2" Ice	11.445 12.064	7.696 8.289	0.055 0.121
LNX-6515DS (T-Mobile Proposed)	B	From Face	3.500 -5.000 0.000	0.000	118.000	No Ice 1/2" Ice	11.445 12.064	7.696 8.289	0.055 0.121
LNX-6515DS (T-Mobile Proposed)	C	From Face	3.500 -5.000 0.000	0.000	118.000	No Ice 1/2" Ice	11.445 12.064	7.696 8.289	0.055 0.121

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Andrew 12'-6" Low Profile Platform (T-Mobile Existing)	C	None			0.000	117.000	No Ice 1/2" Ice	14.450 19.000	14.450 19.000	1.300 1.690
GPS (AT&T Existing)	A	From Face	4.000 0.000 0.000		0.000	74.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
4-ft Standoff (AT&T Existing)	A	From Face	2.000 0.000 0.000		0.000	73.500	No Ice 1/2" Ice	1.400 1.735	0.087 0.131	0.030 0.041
GPS (Sprint Existing)	A	From Face	4.000 0.000 0.000		0.000	62.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
4-ft Standoff (Sprint Existing)	A	From Face	2.000 0.000 0.000		0.000	61.500	No Ice 1/2" Ice	1.400 1.735	0.087 0.131	0.030 0.041

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	119.440	1.444	0.027	128.155	A	0.000	128.155	128.155	100.00	0.000	0.000
147.000-94.54					B	0.000	128.155		100.00	0.000	0.000
0					C	0.000	128.155		100.00	0.000	15.032
L2	70.777	1.244	0.023	154.378	A	0.000	154.378	154.378	100.00	0.000	0.000
94.540-47.917					B	0.000	154.378		100.00	0.000	0.000
					C	0.000	154.378		100.00	0.000	20.792
L3	23.789	1	0.019	192.990	A	0.000	192.990	192.990	100.00	0.000	0.000
47.917-1.000					B	0.000	192.990		100.00	0.000	0.000
					C	0.000	192.990		100.00	0.000	23.707

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	119.440	1.444	0.020	0.500	132.527	A	0.000	132.527	132.527	100.00	0.000	0.000
147.000-94.540						B	0.000	132.527		100.00	0.000	0.000
						C	0.000	132.527		100.00	0.000	22.624
L2	70.777	1.244	0.017	0.500	158.264	A	0.000	158.264	158.264	100.00	0.000	0.000
94.540-47.917						B	0.000	158.264		100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z ksf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L3 47.917-1.000	23.789	1	0.014	0.500	196.900	C	0.000	158.264		100.00	0.000	34.133
						A	0.000	196.900	196.900	100.00	0.000	0.000
						B	0.000	196.900		100.00	0.000	0.000
						C	0.000	196.900		100.00	0.000	42.174

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	119.440	1.444	0.009	128.155	A	0.000	128.155	128.155	100.00	0.000	0.000
147.000-94.54					B	0.000	128.155		100.00	0.000	0.000
0					C	0.000	128.155		100.00	0.000	15.032
L2	70.777	1.244	0.008	154.378	A	0.000	154.378	154.378	100.00	0.000	0.000
94.540-47.917					B	0.000	154.378		100.00	0.000	0.000
					C	0.000	154.378		100.00	0.000	20.792
L3	23.789	1	0.006	192.990	A	0.000	192.990	192.990	100.00	0.000	0.000
47.917-1.000					B	0.000	192.990		100.00	0.000	0.000
					C	0.000	192.990		100.00	0.000	23.707

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.200	4.117	A	1	0.65	1	1	1	128.155	4.429	0.084	C
147.000-94.54			B	1	0.65	1	1	1	128.155			
0			C	1	0.65	1	1	1	128.155			
L2	2.566	6.764	A	1	0.65	1	1	1	154.378	4.685	0.100	C
94.540-47.917			B	1	0.65	1	1	1	154.378			
			C	1	0.65	1	1	1	154.378			
L3	2.542	10.387	A	1	0.65	1	1	1	192.990	4.717	0.101	C
47.917-1.000			B	1	0.65	1	1	1	192.990			
			C	1	0.65	1	1	1	192.990			
Sum Weight:	7.307	21.268						OTM	959.036 kip-ft	13.832		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.200	4.117	A	1	0.65	1	1	1	128.155	4.429	0.084	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 klf	Ctrl. Face
147.000-94.54			B	1	0.65	1	1	1	128.155			
0			C	1	0.65	1	1	1	128.155			
L2	2.566	6.764	A	1	0.65	1	1	1	154.378	4.685	0.100	C
94.540-47.917			B	1	0.65	1	1	1	154.378			
			C	1	0.65	1	1	1	154.378			
L3	2.542	10.387	A	1	0.65	1	1	1	192.990	4.717	0.101	C
47.917-1.000			B	1	0.65	1	1	1	192.990			
			C	1	0.65	1	1	1	192.990			
Sum Weight:	7.307	21.268						OTM	959.036 kip-ft	13.832		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.200	4.117	A	1	0.65	1	1	1	128.155	4.429	0.084	C
147.000-94.54			B	1	0.65	1	1	1	128.155			
0			C	1	0.65	1	1	1	128.155			
L2	2.566	6.764	A	1	0.65	1	1	1	154.378	4.685	0.100	C
94.540-47.917			B	1	0.65	1	1	1	154.378			
			C	1	0.65	1	1	1	154.378			
L3	2.542	10.387	A	1	0.65	1	1	1	192.990	4.717	0.101	C
47.917-1.000			B	1	0.65	1	1	1	192.990			
			C	1	0.65	1	1	1	192.990			
Sum Weight:	7.307	21.268						OTM	959.036 kip-ft	13.832		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.200	4.117	A	1	0.65	1	1	1	128.155	4.429	0.084	C
147.000-94.54			B	1	0.65	1	1	1	128.155			
0			C	1	0.65	1	1	1	128.155			
L2	2.566	6.764	A	1	0.65	1	1	1	154.378	4.685	0.100	C
94.540-47.917			B	1	0.65	1	1	1	154.378			
			C	1	0.65	1	1	1	154.378			
L3	2.542	10.387	A	1	0.65	1	1	1	192.990	4.717	0.101	C
47.917-1.000			B	1	0.65	1	1	1	192.990			
			C	1	0.65	1	1	1	192.990			
Sum Weight:	7.307	21.268						OTM	959.036 kip-ft	13.832		

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 klf	Ctrl. Face
L1	2.571	5.082	A	1	0.65	1	1	1	132.527	3.674	0.070	C
147.000-94.54			B	1	0.65	1	1	1	132.527			
0			C	1	0.65	1	1	1	132.527			
L2	3.156	7.922	A	1	0.65	1	1	1	158.264	3.974	0.085	C
94.540-47.917			B	1	0.65	1	1	1	158.264			
			C	1	0.65	1	1	1	158.264			
L3	3.161	11.831	A	1	0.65	1	1	1	196.900	4.036	0.086	C
47.917-1.000			B	1	0.65	1	1	1	196.900			
			C	1	0.65	1	1	1	196.900			
Sum Weight:	8.888	24.834						OTM	804.496 kip-ft	11.685		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.571	5.082	A	1	0.65	1	1	1	132.527	3.674	0.070	C
147.000-94.54			B	1	0.65	1	1	1	132.527			
0			C	1	0.65	1	1	1	132.527			
L2	3.156	7.922	A	1	0.65	1	1	1	158.264	3.974	0.085	C
94.540-47.917			B	1	0.65	1	1	1	158.264			
			C	1	0.65	1	1	1	158.264			
L3	3.161	11.831	A	1	0.65	1	1	1	196.900	4.036	0.086	C
47.917-1.000			B	1	0.65	1	1	1	196.900			
			C	1	0.65	1	1	1	196.900			
Sum Weight:	8.888	24.834						OTM	804.496 kip-ft	11.685		

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 klf	Ctrl. Face
L1	2.571	5.082	A	1	0.65	1	1	1	132.527	3.674	0.070	C
147.000-94.54			B	1	0.65	1	1	1	132.527			
0			C	1	0.65	1	1	1	132.527			
L2	3.156	7.922	A	1	0.65	1	1	1	158.264	3.974	0.085	C
94.540-47.917			B	1	0.65	1	1	1	158.264			
			C	1	0.65	1	1	1	158.264			
L3	3.161	11.831	A	1	0.65	1	1	1	196.900	4.036	0.086	C
47.917-1.000			B	1	0.65	1	1	1	196.900			
			C	1	0.65	1	1	1	196.900			
Sum Weight:	8.888	24.834						OTM	804.496 kip-ft	11.685		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.571	5.082	A	1	0.65	1	1	1	132.527	3.674	0.070	C
147.000-94.54			B	1	0.65	1	1	1	132.527			
0			C	1	0.65	1	1	1	132.527			
L2	3.156	7.922	A	1	0.65	1	1	1	158.264	3.974	0.085	C
94.540-47.917			B	1	0.65	1	1	1	158.264			
			C	1	0.65	1	1	1	158.264			
L3	3.161	11.831	A	1	0.65	1	1	1	196.900	4.036	0.086	C
47.917-1.000			B	1	0.65	1	1	1	196.900			
			C	1	0.65	1	1	1	196.900			
Sum Weight:	8.888	24.834						OTM	804.496 kip-ft	11.685		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.200	4.117	A	1	0.65	1	1	1	128.155	1.533	0.029	C
147.000-94.54			B	1	0.65	1	1	1	128.155			
0			C	1	0.65	1	1	1	128.155			
L2	2.566	6.764	A	1	0.65	1	1	1	154.378	1.621	0.035	C
94.540-47.917			B	1	0.65	1	1	1	154.378			
			C	1	0.65	1	1	1	154.378			
L3	2.542	10.387	A	1	0.65	1	1	1	192.990	1.632	0.035	C
47.917-1.000			B	1	0.65	1	1	1	192.990			
			C	1	0.65	1	1	1	192.990			
Sum Weight:	7.307	21.268						OTM	331.846 kip-ft	4.786		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.200	4.117	A	1	0.65	1	1	1	128.155	1.533	0.029	C
147.000-94.54			B	1	0.65	1	1	1	128.155			
0			C	1	0.65	1	1	1	128.155			
L2	2.566	6.764	A	1	0.65	1	1	1	154.378	1.621	0.035	C
94.540-47.917			B	1	0.65	1	1	1	154.378			
			C	1	0.65	1	1	1	154.378			
L3	2.542	10.387	A	1	0.65	1	1	1	192.990	1.632	0.035	C
47.917-1.000			B	1	0.65	1	1	1	192.990			
			C	1	0.65	1	1	1	192.990			
Sum Weight:	7.307	21.268						OTM	331.846 kip-ft	4.786		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	2.200	4.117	A	1	0.65	1	1	1	128.155	1.533	0.029	C
147.000-94.54			B	1	0.65	1	1	1	128.155			
0			C	1	0.65	1	1	1	128.155			
L2	2.566	6.764	A	1	0.65	1	1	1	154.378	1.621	0.035	C
94.540-47.917			B	1	0.65	1	1	1	154.378			
			C	1	0.65	1	1	1	154.378			
L3	2.542	10.387	A	1	0.65	1	1	1	192.990	1.632	0.035	C
47.917-1.000			B	1	0.65	1	1	1	192.990			
			C	1	0.65	1	1	1	192.990			
Sum Weight:	7.307	21.268						OTM	331.846 kip-ft	4.786		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	2.200	4.117	A	1	0.65	1	1	1	128.155	1.533	0.029	C
147.000-94.54			B	1	0.65	1	1	1	128.155			
0			C	1	0.65	1	1	1	128.155			
L2	2.566	6.764	A	1	0.65	1	1	1	154.378	1.621	0.035	C
94.540-47.917			B	1	0.65	1	1	1	154.378			
			C	1	0.65	1	1	1	154.378			
L3	2.542	10.387	A	1	0.65	1	1	1	192.990	1.632	0.035	C
47.917-1.000			B	1	0.65	1	1	1	192.990			
			C	1	0.65	1	1	1	192.990			
Sum Weight:	7.307	21.268						OTM	331.846 kip-ft	4.786		

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	21.268					
Bracing Weight	0.000					
Total Member Self-Weight	21.268			-0.290	0.617	
Total Weight	36.697			-0.290	0.617	
Wind 0 deg - No Ice		-0.316	-29.812	-3129.573	42.336	-1.173
Wind 30 deg - No Ice		14.815	-25.660	-2689.469	-1551.981	-1.184
Wind 45 deg - No Ice		21.115	-20.857	-2183.528	-2216.683	-1.068
Wind 60 deg - No Ice		25.976	-14.632	-1528.802	-2730.280	-0.879
Wind 90 deg - No Ice		30.177	0.316	41.428	-3176.838	-0.338
Wind 120 deg - No Ice		26.292	15.179	1600.481	-2771.999	0.294

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 135 deg - No Ice		21.561	21.303	2241.946	-2275.682	0.590
Wind 150 deg - No Ice		15.362	25.976	2730.607	-1624.240	0.847
Wind 180 deg - No Ice		0.316	29.812	3128.993	-41.101	1.173
Wind 210 deg - No Ice		-14.815	25.660	2688.889	1553.215	1.184
Wind 225 deg - No Ice		-21.115	20.857	2182.947	2217.918	1.068
Wind 240 deg - No Ice		-25.976	14.632	1528.222	2731.515	0.879
Wind 270 deg - No Ice		-30.177	-0.316	-42.009	3178.072	0.338
Wind 300 deg - No Ice		-26.292	-15.179	-1601.061	2773.233	-0.294
Wind 315 deg - No Ice		-21.561	-21.303	-2242.527	2276.917	-0.590
Wind 330 deg - No Ice		-15.362	-25.976	-2731.188	1625.474	-0.847
Member Ice	3.567					
Total Weight Ice	45.219			-0.508	1.105	
Wind 0 deg - Ice		-0.250	-25.002	-2608.934	33.689	-1.085
Wind 30 deg - Ice		12.429	-21.528	-2243.179	-1293.702	-1.113
Wind 45 deg - Ice		17.707	-17.503	-1821.904	-1846.894	-1.012
Wind 60 deg - Ice		21.778	-12.285	-1276.503	-2274.149	-0.843
Wind 90 deg - Ice		25.291	0.250	32.075	-2644.944	-0.347
Wind 120 deg - Ice		22.028	12.718	1331.923	-2306.732	0.242
Wind 135 deg - Ice		18.060	17.856	1866.967	-1892.974	0.522
Wind 150 deg - Ice		12.862	21.778	2274.747	-1350.137	0.766
Wind 180 deg - Ice		0.250	25.002	2607.918	-31.478	1.085
Wind 210 deg - Ice		-12.429	21.528	2242.163	1295.912	1.113
Wind 225 deg - Ice		-17.707	17.503	1820.888	1849.105	1.012
Wind 240 deg - Ice		-21.778	12.285	1275.487	2276.360	0.843
Wind 270 deg - Ice		-25.291	-0.250	-33.091	2647.155	0.347
Wind 300 deg - Ice		-22.028	-12.718	-1332.939	2308.943	-0.242
Wind 315 deg - Ice		-18.060	-17.856	-1867.983	1895.185	-0.522
Wind 330 deg - Ice		-12.862	-21.778	-2275.763	1352.348	-0.766
Total Weight	36.697			-0.290	0.617	
Wind 0 deg - Service		-0.109	-10.315	-1083.087	15.053	-0.406
Wind 30 deg - Service		5.126	-8.879	-930.802	-536.614	-0.410
Wind 45 deg - Service		7.306	-7.217	-755.736	-766.615	-0.370
Wind 60 deg - Service		8.988	-5.063	-529.187	-944.330	-0.304
Wind 90 deg - Service		10.442	0.109	14.145	-1098.848	-0.117
Wind 120 deg - Service		9.097	5.252	553.610	-958.766	0.102
Wind 135 deg - Service		7.461	7.371	775.570	-787.030	0.204
Wind 150 deg - Service		5.316	8.988	944.657	-561.617	0.293
Wind 180 deg - Service		0.109	10.315	1082.507	-13.818	0.406
Wind 210 deg - Service		-5.126	8.879	930.222	537.848	0.410
Wind 225 deg - Service		-7.306	7.217	755.155	767.849	0.370
Wind 240 deg - Service		-8.988	5.063	528.607	945.564	0.304
Wind 270 deg - Service		-10.442	-0.109	-14.726	1100.083	0.117
Wind 300 deg - Service		-9.097	-5.252	-554.190	960.000	-0.102
Wind 315 deg - Service		-7.461	-7.371	-776.151	788.264	-0.204
Wind 330 deg - Service		-5.316	-8.988	-945.237	562.851	-0.293

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice

Comb. No.	Description
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	147 - 94.54	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-18.234	0.697	0.272
			Max. Mx	14	-12.140	736.138	12.607
			Max. My	2	-12.190	12.800	721.656
			Max. Vy	14	-21.116	736.138	12.607
			Max. Vx	2	-20.788	12.800	721.656
			Max. Torque	11			-0.922
L2	94.54 - 47.917	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-28.727	1.108	0.509

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Mx	14	-21.566	1796.566	26.346
			Max. My	2	-21.595	26.683	1766.405
			Max. Vy	14	-25.637	1796.566	26.346
			Max. Vx	2	-25.261	26.683	1766.405
			Max. Torque	11			-1.205
L3	47.917 - 1	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-45.219	1.106	0.508
			Max. Mx	14	-36.671	3280.716	43.491
			Max. My	2	-36.672	43.835	3230.852
			Max. Vy	14	-30.206	3280.716	43.491
			Max. Vx	2	-29.842	43.835	3230.852
			Max. Torque	11			-1.204

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	45.219	-0.000	-0.000
	Max. H_x	14	36.697	30.174	0.316
	Max. H_z	2	36.697	0.316	29.811
	Max. M_x	2	3230.852	0.316	29.811
	Max. M_z	6	3279.424	-30.174	-0.316
	Max. Torsion	3	1.203	-14.815	25.660
	Min. Vert	14	36.697	30.174	0.316
	Min. H_x	6	36.697	-30.174	-0.316
	Min. H_z	10	36.697	-0.316	-29.810
	Min. M_x	10	-3230.065	-0.316	-29.810
	Min. M_z	14	-3280.716	30.174	0.316
	Min. Torsion	11	-1.203	14.815	-25.660

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	36.697	-0.000	-0.000	-0.290	0.617	0.000
Dead+Wind 0 deg - No Ice	36.697	-0.316	-29.811	-3230.852	43.834	-1.192
Dead+Wind 30 deg - No Ice	36.697	14.815	-25.660	-2776.578	-1602.242	-1.203
Dead+Wind 45 deg - No Ice	36.697	21.115	-20.857	-2254.197	-2288.521	-1.084
Dead+Wind 60 deg - No Ice	36.697	25.976	-14.632	-1578.206	-2818.755	-0.891
Dead+Wind 90 deg - No Ice	36.697	30.174	0.316	42.885	-3279.424	-0.345
Dead+Wind 120 deg - No Ice	36.697	26.292	15.179	1652.285	-2861.725	0.288
Dead+Wind 135 deg - No Ice	36.697	21.561	21.303	2314.469	-2349.395	0.585
Dead+Wind 150 deg - No Ice	36.697	15.362	25.976	2818.947	-1676.927	0.844
Dead+Wind 180 deg - No Ice	36.697	0.316	29.810	3230.065	-42.549	1.179
Dead+Wind 210 deg - No Ice	36.697	-14.815	25.660	2775.976	1603.527	1.203
Dead+Wind 225 deg - No Ice	36.697	-21.115	20.857	2253.595	2289.808	1.091
Dead+Wind 240 deg - No Ice	36.697	-25.976	14.632	1577.604	2820.044	0.904
Dead+Wind 270 deg - No Ice	36.697	-30.174	-0.316	-43.491	3280.716	0.358
Dead+Wind 300 deg - No Ice	36.697	-26.292	-15.179	-1652.895	2863.014	-0.288
Dead+Wind 315 deg - No Ice	36.697	-21.561	-21.303	-2315.079	2350.682	-0.593
Dead+Wind 330 deg - No Ice	36.697	-15.362	-25.976	-2819.557	1678.212	-0.857

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+Ice+Temp	45.219	0.000	0.000	-0.508	1.106	-0.000
Dead+Wind 0 deg+Ice+Temp	45.219	-0.250	-25.002	-2723.098	35.320	-1.118
Dead+Wind 30 deg+Ice+Temp	45.219	12.429	-21.528	-2341.399	-1350.315	-1.149
Dead+Wind 45 deg+Ice+Temp	45.219	17.707	-17.503	-1901.630	-1927.787	-1.046
Dead+Wind 60 deg+Ice+Temp	45.219	21.778	-12.285	-1332.300	-2373.778	-0.873
Dead+Wind 90 deg+Ice+Temp	45.219	25.290	0.250	33.597	-2760.700	-0.366
Dead+Wind 120 deg+Ice+Temp	45.219	22.028	12.718	1390.279	-2407.794	0.236
Dead+Wind 135 deg+Ice+Temp	45.219	18.060	17.856	1948.713	-1975.952	0.523
Dead+Wind 150 deg+Ice+Temp	45.219	12.862	21.778	2374.333	-1409.378	0.774
Dead+Wind 180 deg+Ice+Temp	45.219	0.250	25.002	2722.013	-32.962	1.109
Dead+Wind 210 deg+Ice+Temp	45.219	-12.429	21.528	2340.317	1352.675	1.149
Dead+Wind 225 deg+Ice+Temp	45.219	-17.707	17.503	1900.549	1930.148	1.051
Dead+Wind 240 deg+Ice+Temp	45.219	-21.778	12.285	1331.219	2376.140	0.882
Dead+Wind 270 deg+Ice+Temp	45.219	-25.290	-0.250	-34.681	2763.063	0.375
Dead+Wind 300 deg+Ice+Temp	45.219	-22.028	-12.718	-1391.366	2410.156	-0.236
Dead+Wind 315 deg+Ice+Temp	45.219	-18.060	-17.856	-1949.801	1978.313	-0.528
Dead+Wind 330 deg+Ice+Temp	45.219	-12.862	-21.778	-2375.420	1411.738	-0.783
Dead+Wind 0 deg - Service	36.697	-0.109	-10.315	-1119.533	15.616	-0.415
Dead+Wind 30 deg - Service	36.697	5.126	-8.878	-962.104	-554.647	-0.420
Dead+Wind 45 deg - Service	36.697	7.306	-7.216	-781.137	-792.405	-0.379
Dead+Wind 60 deg - Service	36.697	8.987	-5.063	-546.956	-976.115	-0.312
Dead+Wind 90 deg - Service	36.697	10.441	0.109	14.663	-1135.855	-0.122
Dead+Wind 120 deg - Service	36.697	9.097	5.252	572.267	-991.073	0.101
Dead+Wind 135 deg - Service	36.697	7.460	7.371	801.686	-813.563	0.205
Dead+Wind 150 deg - Service	36.697	5.315	8.987	976.453	-580.566	0.296
Dead+Wind 180 deg - Service	36.697	0.109	10.315	1118.924	-14.319	0.413
Dead+Wind 210 deg - Service	36.697	-5.126	8.878	961.495	555.944	0.420
Dead+Wind 225 deg - Service	36.697	-7.306	7.216	780.528	793.702	0.380
Dead+Wind 240 deg - Service	36.697	-8.987	5.063	546.348	977.413	0.314
Dead+Wind 270 deg - Service	36.697	-10.441	-0.109	-15.272	1137.154	0.123
Dead+Wind 300 deg - Service	36.697	-9.097	-5.252	-572.876	992.371	-0.101
Dead+Wind 315 deg - Service	36.697	-7.460	-7.371	-802.296	814.861	-0.206
Dead+Wind 330 deg - Service	36.697	-5.315	-8.987	-977.063	581.863	-0.298

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	0.000	-36.697	0.000	0.000	36.697	0.000	0.000%
2	-0.316	-36.697	-29.812	0.316	36.697	29.811	0.001%
3	14.815	-36.697	-25.660	-14.815	36.697	25.660	0.000%
4	21.115	-36.697	-20.857	-21.115	36.697	20.857	0.000%
5	25.976	-36.697	-14.632	-25.976	36.697	14.632	0.000%
6	30.177	-36.697	0.316	-30.174	36.697	-0.316	0.005%
7	26.292	-36.697	15.179	-26.292	36.697	-15.179	0.000%
8	21.561	-36.697	21.303	-21.561	36.697	-21.303	0.000%
9	15.362	-36.697	25.976	-15.362	36.697	-25.976	0.000%
10	0.316	-36.697	29.812	-0.316	36.697	-29.810	0.005%
11	-14.815	-36.697	25.660	14.815	36.697	-25.660	0.000%
12	-21.115	-36.697	20.857	21.115	36.697	-20.857	0.000%
13	-25.976	-36.697	14.632	25.976	36.697	-14.632	0.000%
14	-30.177	-36.697	-0.316	30.174	36.697	0.316	0.005%
15	-26.292	-36.697	-15.179	26.292	36.697	15.179	0.000%
16	-21.561	-36.697	-21.303	21.561	36.697	21.303	0.000%
17	-15.362	-36.697	-25.976	15.362	36.697	25.976	0.000%
18	0.000	-45.219	0.000	-0.000	45.219	-0.000	0.000%
19	-0.250	-45.219	-25.002	0.250	45.219	25.002	0.001%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
20	12.429	-45.219	-21.528	-12.429	45.219	21.528	0.000%
21	17.707	-45.219	-17.503	-17.707	45.219	17.503	0.000%
22	21.778	-45.219	-12.285	-21.778	45.219	12.285	0.000%
23	25.291	-45.219	0.250	-25.290	45.219	-0.250	0.001%
24	22.028	-45.219	12.718	-22.028	45.219	-12.718	0.000%
25	18.060	-45.219	17.856	-18.060	45.219	-17.856	0.000%
26	12.862	-45.219	21.778	-12.862	45.219	-21.778	0.000%
27	0.250	-45.219	25.002	-0.250	45.219	-25.002	0.001%
28	-12.429	-45.219	21.528	12.429	45.219	-21.528	0.000%
29	-17.707	-45.219	17.503	17.707	45.219	-17.503	0.000%
30	-21.778	-45.219	12.285	21.778	45.219	-12.285	0.000%
31	-25.291	-45.219	-0.250	25.290	45.219	0.250	0.001%
32	-22.028	-45.219	-12.718	22.028	45.219	12.718	0.000%
33	-18.060	-45.219	-17.856	18.060	45.219	17.856	0.000%
34	-12.862	-45.219	-21.778	12.862	45.219	21.778	0.000%
35	-0.109	-36.697	-10.315	0.109	36.697	10.315	0.002%
36	5.126	-36.697	-8.879	-5.126	36.697	8.878	0.002%
37	7.306	-36.697	-7.217	-7.306	36.697	7.216	0.002%
38	8.988	-36.697	-5.063	-8.987	36.697	5.063	0.002%
39	10.442	-36.697	0.109	-10.441	36.697	-0.109	0.002%
40	9.097	-36.697	5.252	-9.097	36.697	-5.252	0.002%
41	7.461	-36.697	7.371	-7.460	36.697	-7.371	0.002%
42	5.316	-36.697	8.988	-5.315	36.697	-8.987	0.002%
43	0.109	-36.697	10.315	-0.109	36.697	-10.315	0.002%
44	-5.126	-36.697	8.879	5.126	36.697	-8.878	0.002%
45	-7.306	-36.697	7.217	7.306	36.697	-7.216	0.002%
46	-8.988	-36.697	5.063	8.987	36.697	-5.063	0.002%
47	-10.442	-36.697	-0.109	10.441	36.697	0.109	0.002%
48	-9.097	-36.697	-5.252	9.097	36.697	5.252	0.002%
49	-7.461	-36.697	-7.371	7.460	36.697	7.371	0.002%
50	-5.316	-36.697	-8.988	5.315	36.697	8.987	0.002%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	13	0.00000001	0.00005737
3	Yes	15	0.00000001	0.00007386
4	Yes	15	0.00000001	0.00008623
5	Yes	15	0.00000001	0.00007637
6	Yes	12	0.00005411	0.00011877
7	Yes	15	0.00000001	0.00008166
8	Yes	15	0.00000001	0.00009231
9	Yes	15	0.00000001	0.00008005
10	Yes	12	0.00005425	0.00010692
11	Yes	15	0.00000001	0.00007637
12	Yes	15	0.00000001	0.00008621
13	Yes	15	0.00000001	0.00007455
14	Yes	12	0.00005411	0.00013407
15	Yes	15	0.00000001	0.00008112
16	Yes	15	0.00000001	0.00009244
17	Yes	15	0.00000001	0.00008196
18	Yes	6	0.00000001	0.00000001
19	Yes	13	0.00000001	0.00014512
20	Yes	15	0.00000001	0.00007980

21	Yes	15	0.00000001	0.00009296
22	Yes	15	0.00000001	0.00008206
23	Yes	13	0.00000001	0.00014099
24	Yes	15	0.00000001	0.00008710
25	Yes	15	0.00000001	0.00009878
26	Yes	15	0.00000001	0.00008572
27	Yes	13	0.00000001	0.00013914
28	Yes	15	0.00000001	0.00008217
29	Yes	15	0.00000001	0.00009304
30	Yes	15	0.00000001	0.00008044
31	Yes	13	0.00000001	0.00014297
32	Yes	15	0.00000001	0.00008687
33	Yes	15	0.00000001	0.00009914
34	Yes	15	0.00000001	0.00008765
35	Yes	12	0.00000001	0.00005419
36	Yes	12	0.00000001	0.00008568
37	Yes	12	0.00000001	0.00010184
38	Yes	12	0.00000001	0.00009686
39	Yes	12	0.00000001	0.00005323
40	Yes	12	0.00000001	0.00010250
41	Yes	12	0.00000001	0.00011151
42	Yes	12	0.00000001	0.00009546
43	Yes	12	0.00000001	0.00005279
44	Yes	12	0.00000001	0.00009716
45	Yes	12	0.00000001	0.00010173
46	Yes	12	0.00000001	0.00008851
47	Yes	12	0.00000001	0.00005369
48	Yes	12	0.00000001	0.00009987
49	Yes	12	0.00000001	0.00011203
50	Yes	12	0.00000001	0.00010427

Maximum Tower Deflections - Service Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load Comb.*	*Tilt*	*Twist*
	ft	*in*		°	°
L1	147 - 94.54	33.203	48	2.027	0.003
L2	99.457 - 47.917	14.985	48	1.489	0.001
L3	54.084 - 1	4.211	48	0.735	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation	*Appurtenance*	*Gov. Load Comb.*	*Deflection*	*Tilt*	*Twist*	*Radius of Curvature*
ft			*in*	°	°	*ft*
149.000	LPA-80063/6CF	48	33.203	2.027	0.003	30562
147.000	EEI 14-ft Low Profile Platform	48	33.203	2.027	0.003	30562
138.000	(2) DB950F65T2E-M	48	29.497	1.939	0.003	16979
137.000	EEI 12-ft Low Profile Platform	48	29.088	1.929	0.003	15281
128.000	(2) 7770.00	48	25.449	1.838	0.002	8042
127.000	EEI 12-ft Low Profile Platform	48	25.051	1.827	0.002	7640
118.000	APXV18-206517S	48	21.551	1.728	0.002	5268
117.000	Andrew 12'-6" Low Profile Platform	48	21.172	1.716	0.002	5092
74.000	GPS	48	7.963	1.073	0.001	3110
73.500	4-ft Standoff	48	7.850	1.064	0.001	3108
62.000	GPS	48	5.517	0.866	0.001	3064

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
61.500	4-ft Standoff	48	5.427	0.858	0.001	3062

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	147 - 94.54	95.521	15	5.837	0.010
L2	99.457 - 47.917	43.165	15	4.289	0.003
L3	54.084 - 1	12.142	15	2.118	0.001

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
149.000	LPA-80063/6CF	15	95.521	5.837	0.010	10823
147.000	EEI 14-ft Low Profile Platform	15	95.521	5.837	0.010	10823
138.000	(2) DB950F65T2E-M	15	84.875	5.584	0.009	6012
137.000	EEI 12-ft Low Profile Platform	15	83.699	5.556	0.009	5411
128.000	(2) 7770.00	15	73.245	5.293	0.007	2846
127.000	EEI 12-ft Low Profile Platform	15	72.101	5.262	0.007	2703
118.000	APXV18-206517S	15	62.042	4.977	0.006	1862
117.000	Andrew 12'-6" Low Profile Platform	15	60.954	4.944	0.006	1800
74.000	GPS	15	22.955	3.093	0.002	1087
73.500	4-ft Standoff	15	22.630	3.068	0.002	1086
62.000	GPS	15	15.906	2.497	0.002	1067
61.500	4-ft Standoff	15	15.647	2.473	0.002	1066

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	147 - 144.498	TP35.13x23.5x0.25	52.460	0.000	0.0	39.000	18.889	-1.686	736.673	0.002
	144.498 - 141.995					39.000	19.329	-1.936	753.840	0.003
	141.995 - 139.493					39.000	19.769	-2.191	771.007	0.003
	139.493 - 136.991					39.000	20.210	-3.820	788.174	0.005
	136.991 - 134.489					39.000	20.650	-4.086	805.341	0.005
	134.489 -					39.000	21.090	-4.358	822.509	0.005

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 $\frac{P}{P_a}$
	131.986									
	131.986 - 129.484					39.000	21.530	-4.636	839.676	0.006
	129.484 - 126.982					39.000	21.970	-7.132	856.843	0.008
	126.982 - 124.48					39.000	22.410	-7.426	874.010	0.008
	124.48 - 121.977					39.000	22.851	-7.726	891.177	0.009
	121.977 - 119.475					39.000	23.291	-8.032	908.344	0.009
	119.475 - 116.973					39.000	23.731	-9.715	925.511	0.010
	116.973 - 114.471					39.000	24.171	-10.038	942.678	0.011
	114.471 - 111.968					39.000	24.611	-10.369	959.845	0.011
	111.968 - 109.466					39.000	25.052	-10.705	977.012	0.011
	109.466 - 106.964					39.000	25.492	-11.048	994.179	0.011
	106.964 - 104.462					39.000	25.932	-11.398	1011.350	0.011
	104.462 - 101.959					39.000	26.372	-11.753	1028.510	0.011
	101.959 - 99.457					39.000	26.812	-12.115	1045.680	0.012
	99.457 - 94.54					39.000	27.677	-6.034	1079.410	0.006
L2	99.457 - 94.54	TP44.85x33.54x0.313	51.540	0.000	0.0	39.000	34.028	-7.313	1327.080	0.006
	94.54 - 92.2924					39.000	34.517	-13.761	1346.160	0.010
	92.2924 - 90.0449					39.000	35.006	-14.177	1365.240	0.010
	90.0449 - 87.7973					39.000	35.495	-14.597	1384.320	0.011
	87.7973 - 85.5498					39.000	35.985	-15.023	1403.400	0.011
	85.5498 - 83.3022					39.000	36.474	-15.453	1422.470	0.011
	83.3022 - 81.0547					39.000	36.963	-15.888	1441.550	0.011
	81.0547 - 78.8071					39.000	37.452	-16.328	1460.630	0.011
	78.8071 - 76.5596					39.000	37.941	-16.773	1479.710	0.011
	76.5596 - 74.312					39.000	38.431	-17.222	1498.790	0.011
	74.312 - 72.0644					39.000	38.920	-17.712	1517.870	0.012
	72.0644 - 69.8169					39.000	39.409	-18.171	1536.950	0.012
	69.8169 - 67.5693					39.000	39.898	-18.635	1556.030	0.012
	67.5693 - 65.3218					39.000	40.387	-19.103	1575.110	0.012
	65.3218 - 63.0742					39.000	40.876	-19.576	1594.180	0.012
	63.0742 - 60.8267					39.000	41.366	-20.090	1613.260	0.012
	60.8267 - 58.5791					39.000	41.855	-20.572	1632.340	0.013

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 $\frac{P}{P_a}$
	58.5791 - 56.3316					39.000	42.344	-21.060	1651.420	0.013
	56.3316 - 54.084					39.000	42.833	-21.551	1670.500	0.013
	54.084 - 47.917					39.000	44.176	-11.050	1722.850	0.006
L3	54.084 - 47.917	TP54.5x42.872x0.375	53.084	0.000	0.0	39.000	52.190	-12.865	2035.400	0.006
	47.917 - 45.4477					39.000	52.833	-24.542	2060.500	0.012
	45.4477 - 42.9784					39.000	53.477	-25.165	2085.610	0.012
	42.9784 - 40.5091					39.000	54.121	-25.795	2110.720	0.012
	40.5091 - 38.0397					39.000	54.765	-26.430	2135.830	0.012
	38.0397 - 35.5704					39.000	55.409	-27.072	2160.940	0.013
	35.5704 - 33.1011					39.000	56.053	-27.719	2186.050	0.013
	33.1011 - 30.6318					39.000	56.696	-28.372	2211.160	0.013
	30.6318 - 28.1625					39.000	57.340	-29.032	2236.270	0.013
	28.1625 - 25.6932					39.000	57.984	-29.697	2261.380	0.013
	25.6932 - 23.2238					39.000	58.628	-30.368	2286.490	0.013
	23.2238 - 20.7545					39.000	59.272	-31.045	2311.600	0.013
	20.7545 - 18.2852					39.000	59.916	-31.727	2336.710	0.014
	18.2852 - 15.8159					39.000	60.559	-32.416	2361.810	0.014
	15.8159 - 13.3466					39.000	61.203	-33.111	2386.920	0.014
	13.3466 - 10.8773					39.000	61.847	-33.811	2412.030	0.014
	10.8773 - 8.40795					39.000	62.491	-34.517	2437.140	0.014
	8.40795 - 5.93863					39.000	63.135	-35.229	2462.250	0.014
	5.93863 - 3.46932					39.000	63.778	-35.947	2487.360	0.014
	3.46932 - 1					39.000	64.422	-36.671	2512.470	0.015

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	147 - 144.498	TP35.13x23.5x0.25	34.541	3.745	39.000	0.096	0.000	0.000	39.000	0.000
	144.498 - 141.995		55.264	5.721	39.000	0.147	0.000	0.000	39.000	0.000
	141.995 - 139.493		76.515	7.571	39.000	0.194	0.000	0.000	39.000	0.000
	139.493 - 136.991		99.653	9.433	39.000	0.242	0.000	0.000	39.000	0.000

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
	136.991 - 134.489		127.373	11.547	39.000	0.296	0.000	0.000	39.000	0.000
	134.489 - 131.986		155.638	13.523	39.000	0.347	0.000	0.000	39.000	0.000
	131.986 - 129.484		184.454	15.376	39.000	0.394	0.000	0.000	39.000	0.000
	129.484 - 126.982		217.298	17.392	39.000	0.446	0.000	0.000	39.000	0.000
	126.982 - 124.48		257.878	19.833	39.000	0.509	0.000	0.000	39.000	0.000
	124.48 - 121.977		299.015	22.116	39.000	0.567	0.000	0.000	39.000	0.000
	121.977 - 119.475		340.714	24.253	39.000	0.622	0.000	0.000	39.000	0.000
	119.475 - 116.973		384.952	26.390	39.000	0.677	0.000	0.000	39.000	0.000
	116.973 - 114.471		434.441	28.704	39.000	0.736	0.000	0.000	39.000	0.000
	114.471 - 111.968		484.496	30.872	39.000	0.792	0.000	0.000	39.000	0.000
	111.968 - 109.466		535.120	32.905	39.000	0.844	0.000	0.000	39.000	0.000
	109.466 - 106.964		586.315	34.814	39.000	0.893	0.000	0.000	39.000	0.000
	106.964 - 104.462		638.085	36.608	39.000	0.939	0.000	0.000	39.000	0.000
	104.462 - 101.959		690.432	38.295	39.000	0.982	0.000	0.000	39.000	0.000
	101.959 - 99.457		743.357	39.883	39.000	1.023	0.000	0.000	39.000	0.000
	99.457 - 94.54		388.064	19.535	39.000	0.501	0.000	0.000	39.000	0.000
L2	99.457 - 94.54	TP44.85x33.54x0.313	461.175	19.235	39.000	0.493	0.000	0.000	39.000	0.000
	94.54 - 92.2924		898.475	36.416	39.000	0.934	0.000	0.000	39.000	0.000
	92.2924 - 90.0449		948.200	37.360	39.000	0.958	0.000	0.000	39.000	0.000
	90.0449 - 87.7973		998.408	38.257	39.000	0.981	0.000	0.000	39.000	0.000
	87.7973 - 85.5498		1049.092	39.108	39.000	1.003	0.000	0.000	39.000	0.000
	85.5498 - 83.3022		1100.258	39.919	39.000	1.024	0.000	0.000	39.000	0.000
	83.3022 - 81.0547		1151.900	40.689	39.000	1.043	0.000	0.000	39.000	0.000
	81.0547 - 78.8071		1204.025	41.422	39.000	1.062	0.000	0.000	39.000	0.000
	78.8071 - 76.5596		1256.633	42.119	39.000	1.080	0.000	0.000	39.000	0.000
	76.5596 - 74.312		1309.717	42.784	39.000	1.097	0.000	0.000	39.000	0.000
	74.312 - 72.0644		1363.592	43.427	39.000	1.113	0.000	0.000	39.000	0.000
	72.0644 - 69.8169		1417.850	44.036	39.000	1.129	0.000	0.000	39.000	0.000
	69.8169 - 67.5693		1472.575	44.617	39.000	1.144	0.000	0.000	39.000	0.000
	67.5693 - 65.3218		1527.775	45.170	39.000	1.158	0.000	0.000	39.000	0.000
	65.3218 - 63.0742		1583.450	45.698	39.000	1.172	0.000	0.000	39.000	0.000

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
	63.0742 - 60.8267		1639.842	46.209	39.000	1.185	0.000	0.000	39.000	0.000
	60.8267 - 58.5791		1696.667	46.695	39.000	1.197	0.000	0.000	39.000	0.000
	58.5791 - 56.3316		1753.967	47.159	39.000	1.209	0.000	0.000	39.000	0.000
	56.3316 - 54.084		1811.725	47.602	39.000	1.221	0.000	0.000	39.000	0.000
	54.084 - 47.917		920.242	22.727	39.000	0.583	0.000	0.000	39.000	0.000
L3	54.084 - 47.917	TP54.5x42.872x0.375	1052.725	22.387	39.000	0.574	0.000	0.000	39.000	0.000
	47.917 - 45.4477		2038.600	42.297	39.000	1.085	0.000	0.000	39.000	0.000
	45.4477 - 42.9784		2104.733	42.620	39.000	1.093	0.000	0.000	39.000	0.000
	42.9784 - 40.5091		2171.375	42.925	39.000	1.101	0.000	0.000	39.000	0.000
	40.5091 - 38.0397		2238.500	43.214	39.000	1.108	0.000	0.000	39.000	0.000
	38.0397 - 35.5704		2306.133	43.487	39.000	1.115	0.000	0.000	39.000	0.000
	35.5704 - 33.1011		2374.267	43.745	39.000	1.122	0.000	0.000	39.000	0.000
	33.1011 - 30.6318		2442.900	43.989	39.000	1.128	0.000	0.000	39.000	0.000
	30.6318 - 28.1625		2512.033	44.220	39.000	1.134	0.000	0.000	39.000	0.000
	28.1625 - 25.6932		2581.675	44.439	39.000	1.139	0.000	0.000	39.000	0.000
	25.6932 - 23.2238		2651.817	44.645	39.000	1.145	0.000	0.000	39.000	0.000
	23.2238 - 20.7545		2722.467	44.841	39.000	1.150	0.000	0.000	39.000	0.000
	20.7545 - 18.2852		2793.617	45.025	39.000	1.155	0.000	0.000	39.000	0.000
	18.2852 - 15.8159		2865.275	45.200	39.000	1.159	0.000	0.000	39.000	0.000
	15.8159 - 13.3466		2937.433	45.365	39.000	1.163	0.000	0.000	39.000	0.000
	13.3466 - 10.8773		3010.108	45.521	39.000	1.167	0.000	0.000	39.000	0.000
	10.8773 - 8.40795		3083.292	45.669	39.000	1.171	0.000	0.000	39.000	0.000
	8.40795 - 5.93863		3156.983	45.808	39.000	1.175	0.000	0.000	39.000	0.000
	5.93863 - 3.46932		3231.183	45.940	39.000	1.178	0.000	0.000	39.000	0.000
	3.46932 - 1		3305.892	46.064	39.000	1.181	0.000	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	147 - 144.498	TP35.13x23.5x0.25	8.179	0.433	26.000	0.033	0.000	0.000	26.000	0.000
	144.498 - 141.995		8.388	0.434	26.000	0.033	0.000	0.000	26.000	0.000
	141.995 - 139.493		8.600	0.435	26.000	0.033	0.000	0.000	26.000	0.000
	139.493 - 136.991		10.973	0.543	26.000	0.042	0.000	0.000	26.000	0.000
	136.991 - 134.489		11.189	0.542	26.000	0.042	0.000	0.000	26.000	0.000
	134.489 - 131.986		11.409	0.541	26.000	0.042	0.000	0.000	26.000	0.000
	131.986 - 129.484		11.630	0.540	26.000	0.042	0.000	0.000	26.000	0.000
	129.484 - 126.982		16.111	0.733	26.000	0.056	0.290	0.011	26.000	0.000
	126.982 - 124.48		16.335	0.729	26.000	0.056	0.290	0.011	26.000	0.000
	124.48 - 121.977		16.559	0.725	26.000	0.056	0.290	0.010	26.000	0.000
	121.977 - 119.475		16.785	0.721	26.000	0.055	0.290	0.010	26.000	0.000
	119.475 - 116.973		19.675	0.829	26.000	0.064	0.290	0.010	26.000	0.000
	116.973 - 114.471		19.901	0.823	26.000	0.063	0.290	0.009	26.000	0.000
	114.471 - 111.968		20.129	0.818	26.000	0.063	0.290	0.009	26.000	0.000
	111.968 - 109.466		20.358	0.813	26.000	0.062	0.290	0.009	26.000	0.000
	109.466 - 106.964		20.587	0.808	26.000	0.062	0.290	0.008	26.000	0.000
	106.964 - 104.462		20.818	0.803	26.000	0.062	0.290	0.008	26.000	0.000
	104.462 - 101.959		21.050	0.798	26.000	0.061	0.289	0.008	26.000	0.000
	101.959 - 99.457		21.283	0.794	26.000	0.061	0.289	0.008	26.000	0.000
	99.457 - 94.54		10.099	0.365	26.000	0.028	0.132	0.003	26.000	0.000
L2	99.457 - 94.54	TP44.85x33.54x0.313	11.717	0.344	26.000	0.026	0.157	0.003	26.000	0.000
	94.54 - 92.2924		22.030	0.638	26.000	0.049	0.289	0.006	26.000	0.000
	92.2924 - 90.0449		22.245	0.635	26.000	0.049	0.289	0.006	26.000	0.000
	90.0449 - 87.7973		22.460	0.633	26.000	0.049	0.289	0.005	26.000	0.000
	87.7973 - 85.5498		22.675	0.630	26.000	0.048	0.289	0.005	26.000	0.000
	85.5498 - 83.3022		22.889	0.628	26.000	0.048	0.289	0.005	26.000	0.000
	83.3022 - 81.0547		23.102	0.625	26.000	0.048	0.289	0.005	26.000	0.000
	81.0547 - 78.8071		23.316	0.623	26.000	0.048	0.289	0.005	26.000	0.000
	78.8071 - 76.5596		23.529	0.620	26.000	0.048	0.289	0.005	26.000	0.000
	76.5596 - 74.312		23.742	0.618	26.000	0.048	0.289	0.005	26.000	0.000
	74.312 - 72.0644		24.051	0.618	26.000	0.048	0.289	0.004	26.000	0.000
	72.0644 -		24.263	0.616	26.000	0.047	0.289	0.004	26.000	0.000

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
	69.8169									
	69.8169 - 67.5693		24.474	0.613	26.000	0.047	0.289	0.004	26.000	0.000
	67.5693 - 65.3218		24.686	0.611	26.000	0.047	0.289	0.004	26.000	0.000
	65.3218 - 63.0742		24.897	0.609	26.000	0.047	0.288	0.004	26.000	0.000
	63.0742 - 60.8267		25.199	0.609	26.000	0.047	0.288	0.004	26.000	0.000
	60.8267 - 58.5791		25.409	0.607	26.000	0.047	0.288	0.004	26.000	0.000
	58.5791 - 56.3316		25.619	0.605	26.000	0.047	0.288	0.004	26.000	0.000
	56.3316 - 54.084		25.828	0.603	26.000	0.046	0.288	0.004	26.000	0.000
	54.084 - 47.917		12.541	0.284	26.000	0.022	0.134	0.002	26.000	0.000
L3	54.084 - 47.917	TP54.5x42.872x0.375	13.972	0.268	26.000	0.021	0.154	0.002	26.000	0.000
	47.917 - 45.4477		26.706	0.505	26.000	0.039	0.288	0.003	26.000	0.000
	45.4477 - 42.9784		26.908	0.503	26.000	0.039	0.288	0.003	26.000	0.000
	42.9784 - 40.5091		27.110	0.501	26.000	0.039	0.288	0.003	26.000	0.000
	40.5091 - 38.0397		27.313	0.499	26.000	0.038	0.288	0.003	26.000	0.000
	38.0397 - 35.5704		27.516	0.497	26.000	0.038	0.288	0.003	26.000	0.000
	35.5704 - 33.1011		27.719	0.495	26.000	0.038	0.288	0.003	26.000	0.000
	33.1011 - 30.6318		27.922	0.492	26.000	0.038	0.288	0.003	26.000	0.000
	30.6318 - 28.1625		28.126	0.491	26.000	0.038	0.288	0.002	26.000	0.000
	28.1625 - 25.6932		28.331	0.489	26.000	0.038	0.288	0.002	26.000	0.000
	25.6932 - 23.2238		28.535	0.487	26.000	0.037	0.288	0.002	26.000	0.000
	23.2238 - 20.7545		28.740	0.485	26.000	0.037	0.288	0.002	26.000	0.000
	20.7545 - 18.2852		28.945	0.483	26.000	0.037	0.288	0.002	26.000	0.000
	18.2852 - 15.8159		29.151	0.481	26.000	0.037	0.288	0.002	26.000	0.000
	15.8159 - 13.3466		29.356	0.480	26.000	0.037	0.288	0.002	26.000	0.000
	13.3466 - 10.8773		29.563	0.478	26.000	0.037	0.288	0.002	26.000	0.000
	10.8773 - 8.40795		29.769	0.476	26.000	0.037	0.288	0.002	26.000	0.000
	8.40795 - 5.93863		29.976	0.475	26.000	0.037	0.288	0.002	26.000	0.000
	5.93863 - 3.46932		30.183	0.473	26.000	0.036	0.288	0.002	26.000	0.000
	3.46932 - 1		30.390	0.472	26.000	0.036	0.288	0.002	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	147 - 144.498	0.002	0.096	0.000	0.033	0.000	0.099 ✔	1.333	H1-3+VT ✔
	144.498 - 141.995	0.003	0.147	0.000	0.033	0.000	0.150 ✔	1.333	H1-3+VT ✔
	141.995 - 139.493	0.003	0.194	0.000	0.033	0.000	0.197 ✔	1.333	H1-3+VT ✔
	139.493 - 136.991	0.005	0.242	0.000	0.042	0.000	0.247 ✔	1.333	H1-3+VT ✔
	136.991 - 134.489	0.005	0.296	0.000	0.042	0.000	0.302 ✔	1.333	H1-3+VT ✔
	134.489 - 131.986	0.005	0.347	0.000	0.042	0.000	0.352 ✔	1.333	H1-3+VT ✔
	131.986 - 129.484	0.006	0.394	0.000	0.042	0.000	0.400 ✔	1.333	H1-3+VT ✔
	129.484 - 126.982	0.008	0.446	0.000	0.056	0.000	0.455 ✔	1.333	H1-3+VT ✔
	126.982 - 124.48	0.008	0.509	0.000	0.056	0.000	0.518 ✔	1.333	H1-3+VT ✔
	124.48 - 121.977	0.009	0.567	0.000	0.056	0.000	0.577 ✔	1.333	H1-3+VT ✔
	121.977 - 119.475	0.009	0.622	0.000	0.055	0.000	0.631 ✔	1.333	H1-3+VT ✔
	119.475 - 116.973	0.010	0.677	0.000	0.064	0.000	0.688 ✔	1.333	H1-3+VT ✔
	116.973 - 114.471	0.011	0.736	0.000	0.063	0.000	0.748 ✔	1.333	H1-3+VT ✔
	114.471 - 111.968	0.011	0.792	0.000	0.063	0.000	0.803 ✔	1.333	H1-3+VT ✔
	111.968 - 109.466	0.011	0.844	0.000	0.062	0.000	0.856 ✔	1.333	H1-3+VT ✔
	109.466 - 106.964	0.011	0.893	0.000	0.062	0.000	0.905 ✔	1.333	H1-3+VT ✔
	106.964 - 104.462	0.011	0.939	0.000	0.062	0.000	0.951 ✔	1.333	H1-3+VT ✔
	104.462 - 101.959	0.011	0.982	0.000	0.061	0.000	0.994 ✔	1.333	H1-3+VT ✔
	101.959 - 99.457	0.012	1.023	0.000	0.061	0.000	1.035 ✔	1.333	H1-3+VT ✔
	99.457 - 94.54	0.006	0.501	0.000	0.028	0.000	0.507 ✔	1.333	H1-3+VT ✔
L2	99.457 - 94.54	0.006	0.493	0.000	0.026	0.000	0.499 ✔	1.333	H1-3+VT ✔
	94.54 - 92.2924	0.010	0.934	0.000	0.049	0.000	0.945 ✔	1.333	H1-3+VT ✔
	92.2924 - 90.0449	0.010	0.958	0.000	0.049	0.000	0.969 ✔	1.333	H1-3+VT ✔
	90.0449 - 87.7973	0.011	0.981	0.000	0.049	0.000	0.992 ✔	1.333	H1-3+VT ✔

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	87.7973 - 85.5498	0.011	1.003	0.000	0.048	0.000	1.014 ✔	1.333	H1-3+VT ✔
	85.5498 - 83.3022	0.011	1.024	0.000	0.048	0.000	1.035 ✔	1.333	H1-3+VT ✔
	83.3022 - 81.0547	0.011	1.043	0.000	0.048	0.000	1.055 ✔	1.333	H1-3+VT ✔
	81.0547 - 78.8071	0.011	1.062	0.000	0.048	0.000	1.074 ✔	1.333	H1-3+VT ✔
	78.8071 - 76.5596	0.011	1.080	0.000	0.048	0.000	1.092 ✔	1.333	H1-3+VT ✔
	76.5596 - 74.312	0.011	1.097	0.000	0.048	0.000	1.109 ✔	1.333	H1-3+VT ✔
	74.312 - 72.0644	0.012	1.113	0.000	0.048	0.000	1.126 ✔	1.333	H1-3+VT ✔
	72.0644 - 69.8169	0.012	1.129	0.000	0.047	0.000	1.142 ✔	1.333	H1-3+VT ✔
	69.8169 - 67.5693	0.012	1.144	0.000	0.047	0.000	1.157 ✔	1.333	H1-3+VT ✔
	67.5693 - 65.3218	0.012	1.158	0.000	0.047	0.000	1.171 ✔	1.333	H1-3+VT ✔
	65.3218 - 63.0742	0.012	1.172	0.000	0.047	0.000	1.185 ✔	1.333	H1-3+VT ✔
	63.0742 - 60.8267	0.012	1.185	0.000	0.047	0.000	1.198 ✔	1.333	H1-3+VT ✔
	60.8267 - 58.5791	0.013	1.197	0.000	0.047	0.000	1.210 ✔	1.333	H1-3+VT ✔
	58.5791 - 56.3316	0.013	1.209	0.000	0.047	0.000	1.223 ✔	1.333	H1-3+VT ✔
	56.3316 - 54.084	0.013	1.221	0.000	0.046	0.000	1.234 ✔	1.333	H1-3+VT ✔
	54.084 - 47.917	0.006	0.583	0.000	0.022	0.000	0.589 ✔	1.333	H1-3+VT ✔
L3	54.084 - 47.917	0.006	0.574	0.000	0.021	0.000	0.580 ✔	1.333	H1-3+VT ✔
	47.917 - 45.4477	0.012	1.085	0.000	0.039	0.000	1.097 ✔	1.333	H1-3+VT ✔
	45.4477 - 42.9784	0.012	1.093	0.000	0.039	0.000	1.105 ✔	1.333	H1-3+VT ✔
	42.9784 - 40.5091	0.012	1.101	0.000	0.039	0.000	1.113 ✔	1.333	H1-3+VT ✔
	40.5091 - 38.0397	0.012	1.108	0.000	0.038	0.000	1.121 ✔	1.333	H1-3+VT ✔
	38.0397 - 35.5704	0.013	1.115	0.000	0.038	0.000	1.128 ✔	1.333	H1-3+VT ✔
	35.5704 - 33.1011	0.013	1.122	0.000	0.038	0.000	1.135 ✔	1.333	H1-3+VT ✔
	33.1011 - 30.6318	0.013	1.128	0.000	0.038	0.000	1.141 ✔	1.333	H1-3+VT ✔
	30.6318 - 28.1625	0.013	1.134	0.000	0.038	0.000	1.147 ✔	1.333	H1-3+VT ✔
	28.1625 - 25.6932	0.013	1.139	0.000	0.038	0.000	1.153 ✔	1.333	H1-3+VT ✔

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	25.6932 - 23.2238	0.013	1.145	0.000	0.037	0.000	1.158 ✔	1.333	H1-3+VT ✔
	23.2238 - 20.7545	0.013	1.150	0.000	0.037	0.000	1.164 ✔	1.333	H1-3+VT ✔
	20.7545 - 18.2852	0.014	1.155	0.000	0.037	0.000	1.168 ✔	1.333	H1-3+VT ✔
	18.2852 - 15.8159	0.014	1.159	0.000	0.037	0.000	1.173 ✔	1.333	H1-3+VT ✔
	15.8159 - 13.3466	0.014	1.163	0.000	0.037	0.000	1.177 ✔	1.333	H1-3+VT ✔
	13.3466 - 10.8773	0.014	1.167	0.000	0.037	0.000	1.182 ✔	1.333	H1-3+VT ✔
	10.8773 - 8.40795	0.014	1.171	0.000	0.037	0.000	1.185 ✔	1.333	H1-3+VT ✔
	8.40795 - 5.93863	0.014	1.175	0.000	0.037	0.000	1.189 ✔	1.333	H1-3+VT ✔
	5.93863 - 3.46932	0.014	1.178	0.000	0.036	0.000	1.193 ✔	1.333	H1-3+VT ✔
	3.46932 - 1	0.015	1.181	0.000	0.036	0.000	1.196 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	147 - 94.54	Pole	TP35.13x23.5x0.25	1	-12.115	1393.891	77.7	Pass
L2	94.54 - 47.917	Pole	TP44.85x33.54x0.313	2	-21.551	2226.776	92.6	Pass
L3	47.917 - 1	Pole	TP54.5x42.872x0.375	3	-36.671	3349.122	89.7	Pass
							Summary	
						Pole (L2)	92.6	Pass
						RATING =	**92.6**	**Pass**

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Subject:		Anchor Bolt and Base Plate Anlaysis
Location:		147-ft EEI Monopole Chaplin, CT
Rev. 0: 4/21/15		Prepared by: T.J.L. Checked by: C.F.C. Job No. 15049.004

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 3306·ft·kips	(Input From tnxTower)
Shear Force =	Shear := 30·kips	(Input From tnxTower)
Axial Force =	Axial := 37·kips	(Input From tnxTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 16	(User Input)
Diameter of Bolt Circle =	D_{bc} := 63.0·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strength =	F_u := 100·ksi	(User Input)
Bolt Yield Strength =	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 60

Plate Yield Strength =	Fy_{bp} := 60·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 1.75·in	(User Input)
Base Plate Diameter =	D_{bp} := 69.0·in	(User Input)
Outer Pole Diameter =	D_{pole} := 54.5·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 31.5 \cdot in$

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

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

$d_1 = 12.05 \cdot in$ $d_7 = 12.05 \cdot in$

$d_2 = 22.27 \cdot in$ $d_8 = 0.00 \cdot in$

$d_3 = 29.10 \cdot in$ $d_9 = -12.05 \cdot in$

$d_4 = 31.50 \cdot in$ $d_{10} = -22.27 \cdot in$

$d_5 = 29.10 \cdot in$ $d_{11} = -29.10 \cdot in$

$d_6 = 22.27 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 27.3 \cdot in$

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

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

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

$MA_3 = 1.85 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 4.25 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_5 = 1.85 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_6 = 0.00 \cdot in$ etc

Effective Width of Baseplate for Bending = $B_{eff} := 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 42.3 \cdot in$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 7.938 \times 10^3 \cdot in^2$

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

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

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

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

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 155.1 \cdot kips$

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

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} \cdot 100 = 80$ 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 = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.469 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 6.8 \cdot ksi$

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 =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 159.7 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 49.2 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) \cdot 100 = 82$$

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

$C_1 = 62.6 \cdot kips$ $C_7 = 62.6 \cdot kips$

$C_2 = 113.6 \cdot kips$ $C_8 = 2.3 \cdot kips$

$C_3 = 147.8 \cdot kips$ $C_9 = -57.9 \cdot kips$

$C_4 = 159.7 \cdot kips$ $C_{10} = -109.0 \cdot kips$

$C_5 = 147.8 \cdot kips$ $C_{11} = -143.1 \cdot kips$

$C_6 = 113.6 \cdot kips$ etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 56.8 \cdot ksi$

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

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} \cdot 100 = 94.9$

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

Condition3 = "Ok"

Units:

Angular

$rad \equiv 1$ $\quad deg \equiv \pi \cdot \frac{rad}{180}$

Weight

$lb \equiv lbf$

$kips \equiv 1000 \cdot lb$ $\quad k \equiv kips$

$tons \equiv 2000 \cdot lb$

Unit Weight

$plf \equiv \frac{lb}{ft}$ $\quad klf \equiv \frac{kips}{ft}$

Pressure

$psf \equiv \frac{lb}{ft^2}$ $\quad psi \equiv \frac{lb}{in^2}$

$ksf \equiv \frac{kips}{ft^2}$ $\quad ksi \equiv \frac{kips}{in^2}$

Density

$pcf \equiv \frac{lb}{ft^3}$

d =

	0
0	0
1	12.05
2	22.27
3	29.1
4	31.5
5	29.1
6	22.27
7	12.05
8	$3.86 \cdot 10^{-15}$
9	-12.05
10	-22.27
11	-29.1
12	-31.5
13	-29.1
14	-22.27
15	...

·in

MA =

	0
0	0
1	0
2	0
3	1.85
4	4.25
5	1.85
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	...

·in

C =

	0
0	0
1	62.56
2	113.63
3	147.76
4	159.74
5	147.76
6	113.63
7	62.56
8	2.31
9	-57.93
10	-109.01
11	-143.13
12	-155.12
13	-143.13
14	-109.01
15	...

kips

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Subject:	Foundation Analysis
Location:	147-ft Monopole Chaplin, CT
Rev. 0: 4/21/15	Prepared by: T.J.L. Checked by: C.F.C. Job No. 15049.004

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 3306 \cdot ft \cdot kips$	(User Input from tnxTower)	
Shear Force =	$Shear := 30 \cdot kip$	(User Input from tnxTower)	
Axial Force =	$Axial := 37 \cdot kip$	(User Input from tnxTower)	
Tower Height =	$H_t := 147 \cdot ft$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 5.5 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 1.5 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 0.5 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 7.0 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 4.5 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 27.0 \cdot ft$	(User Input)	

Anchor Bolt Data:

Length of Anchor Bolts =	$L_{st} := 72 \cdot in$	(User Input)	
Projection of Anchor Bolts Above Pier =	$A_{BP} := 12.0 \cdot in$	(User Input)	
Anchor Bolt Diameter =	$d_{anchor} := 2.25 \cdot in$	(User Input)	
Base Plate Bolt Circle =	$MP := 63.0 \cdot in$	(User Input)	

Material Properties:

Concrete Compressive Strength =	$f_c := 4000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Anchor Bolt Yield Strength =	$f_{ya} := 75000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 10 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 6000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 100 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 0 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.0 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 44$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 5.5 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 0.5 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.0 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 40$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.0 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 40$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =

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

Pad Top Reinforcement Bar Area =

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

Pad Bottom Reinforcement Bar Area =

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

Coefficient of Lateral Soil Pressure =

$$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 1.42$$

Load Factor =

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

Stability of Footing:

Adjusted Concrete Unit Weight =

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

Adjusted Soil Unit Weight =

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

Passive Pressure =

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

$$P_{pt} := K_p \cdot \gamma_s \cdot \left(D_f - T_f\right) + c \cdot 2 \cdot \sqrt{K_p} = 0.142 \cdot ksf$$

$$P_{top} := if\left[n < \left(D_f - T_f\right), P_{pt}, P_{pn}\right] = 0.142 \cdot ksf$$

$$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 0.781 \cdot ksf$$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 0.462 \cdot ksf$$

$$T_p := if\left[n < \left(D_f - T_f\right), T_f, \left(D_f - n\right)\right] = 4.5$$

$$A_p := W_f \cdot T_p = 121.5$$

Ultimate Shear =

$$S_u := P_{ave} \cdot A_p = 56.083 \cdot kip$$

Weight of Concrete Pad =

$$WT_c := \left[\left(W_f^{\,2} \cdot T_f\right) + d_p^{\,2} \cdot L_p\right] \cdot \gamma_c = 503.1 \cdot kip$$

Weight of Soil Above Footing =

$$WT_{s1} := \left[\left(W_f^{\,2} - d_p^{\,2}\right) \cdot \begin{cases} \left(L_p - L_{pag} - n\right) & \text{if } \left(L_p - L_{pag} - n\right) \geq 0 \\ 0 & \text{if } \left(L_p - L_{pag} - n\right) \leq 0 \end{cases}\right] \cdot \gamma_s = 68 \cdot kip$$

Weight of Soil Wedge at Back Face =

$$WT_{s2} := \left(\frac{D_f^{\,2} \cdot \tan\left(\Phi_s\right)}{2} \cdot W_f\right) \cdot \gamma_s = 7.201 \cdot kip$$

Weight of Soil Wedge at back face Corners =

$$WT_{s3} := 2 \cdot \left[\left(D_f\right)^3 \cdot \frac{\tan\left(\Phi_s\right)}{3}\right] \cdot \gamma_s = 1.956 \cdot kips$$

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + Axial = 608.1 \cdot kip$$

Resisting Moment =

$$M_r := \left(WT_{tot}\right) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[\left(WT_{s2} + WT_{s3}\right) \cdot \left(W_f + \frac{D_f \cdot \tan\left(\Phi_s\right)}{3}\right)\right] = 8544 \cdot kip \cdot ft$$

Overturning Moment =

$$M_{ot} := OM + Shear \cdot \left(L_p + T_f\right) = 3486 \cdot kip \cdot ft$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.45$$

Factor of Safety Required =

$$FS_{req} := 2$$

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

$$OverTurning\_Moment\_Check = "Okay"$$

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 136.823 \cdot kips$

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

$Shear\_Check = "Okay"$

Bearing Pressure Caused by Footing:

Area of the Mat = $A_{mat} := W_f^{\,2} = 729$

Section Modulus of Mat = $S := \frac{W_f^{\,3}}{6} = 3280.5 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.897 \cdot ksf$

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

$Max\_Pressure\_Check = "Okay"$

Minimum Pressure in Mat = $P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.228 \cdot ksf$

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

$Min\_Pressure\_Check = "No Good"$

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 8.032$

Distance to Kern = $X_k := \frac{W_f}{6} = 4.5$

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

Eccentricity = $e := \frac{M_{ot}}{WT_{tot}} = 5.733$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \left(\frac{W_f}{2} - e \right)} = 1.933 \cdot ksf$

$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.933 \cdot ksf$

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

$Pressure\_Check = "Okay"$

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Subject:	Foundation Analysis
Location:	147-ft Monopole Chaplin, CT
Rev. 0: 4/21/15	Prepared by: T.J.L. Checked by: C.F.C. Job No. 15049.004

Concrete Bearing Capacity:

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

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.225 \times 10^4 \cdot kips$ (ACI-2008 10.14)

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

Bearing_Check = "Okay"

Shear Strength of Concrete:

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

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 50 \cdot in$

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

$d_2 := d_1 - d$

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

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

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

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

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

Beam_Shear_Check = "Okay"

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

Critical Perimeter of Punching Shear = $b_o := \left(d_p + d\right) \cdot \pi = 35.1$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 97.9$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 631.1$

Guess Value = $v_u := 1ksf$

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

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

$v_u := Find(v_u) = 4.2 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 468 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 623.9 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 4526.2 \cdot kip$ (ACI-2008 11.11.2.1)

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

$Punching\_Shear\_Check = "Okay"$

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

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

$q_b := q_{adj} - d_1 \cdot Slope = 1.103 \cdot ksf$

Maximum Bending at Face of Pier = $M_u := LF \cdot \left[\left(q_{adj} - q_b \right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 2981 \cdot kip \cdot ft$

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

(ACI-200810.2.7.3)

$R_n := \frac{M_u}{\phi_m \cdot W_f \cdot d^2} = 49.1 \cdot psi$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) = 0.0008$

$\rho_{min} := \rho = 0.00082$

Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

$$As := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \frac{d}{2} & \text{otherwise} \end{cases} = 14.58 \cdot in^2$$

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

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

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$$As := \rho_{sh} \cdot \left(W_f \cdot \frac{d}{2}\right) = 14.6 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 31.4 \cdot in^2$$

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

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 7.13 \cdot in$$

Spacing or Cover Dimension =

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

Transverse Reinforcement Index =

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

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

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 117 \cdot in$$

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

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier =

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

$$A_{smin} := 0.0033 \cdot A_p = 18.29 \cdot in^2$$

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

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

Steel_Area_Check = "Okay"

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 4.998 \cdot in$$

Diameter of Reinforcement Cage =

$$Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 73 \cdot in$$

Maximum Moment in Pier =

$$M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2}\right)\right] \cdot LF = 53842.5 \cdot in \cdot kips$$

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

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

$$\left(D\ \ N\ \ n\ \ P_u\ \ M_{xu}\right) = \left(84\ \ 44\ \ 8\ \ 49.321\ \ 5.384 \times 10^4\right)$$

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

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

$$\left(\phi P_n\ \ \phi M_{xn}\ \ f_{sp}\ \ \rho\right) = \left(61.287\ \ 6.691 \times 10^4\ \ -60\ \ 6.272 \times 10^{-3}\right)$$

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

Axial_Load_Check = "Okay"

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

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 12.5 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 51 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 2.499 \cdot in$

Transverse Reinforcement =

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

$L_{dbt} := \frac{3 \cdot f_y \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 28.47 \cdot in$

Minimum Development Length =

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

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

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

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

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

Compression: (ACI-2008 12.3.2)

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

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

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

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

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

Tie Size and Spacing in Column:

Minimum Tie Size =

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

Used #4 Ties

Seismic Factor =

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

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

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

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

$s_{lim4} := 18in$

Maximum Spacing =

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

Number of Ties Required =

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 1.594$$

Check Anchor Steel Embedment:

Depth Available =

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

Length of Anchor Bolt =

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

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

Depth_Check = "No Good"

Note: Anchor plate is provided

Network Modernization RFDS v3.0

Site ID	**CT11508F**	**Latitude**	41.78461
		Longitude	-72.13554
Site Name	CT508//Verizon Chaplin	**Site Type**	Structure (Non-Building)
Address	121 Palmer Road,Chaplin	**Site Class**	Monopole
Market	CONNECTICUT	**Landlord**	Verizon

Configuration

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Approvals	
Market RF	
Market Development	

RFDS Revision		**Date**	07/29/2014
RFDS Final			
Work Order #		**NOC#**	877-611-5868

Site Information

Existing Configuration					Proposed Configuration			
1	2	3	4	Cabinet #	1	2	3	4
GSM/LTE				Technology	GSM/LTE			
6201 ODE				Cabinet type	6201 ODE			
				CBU				
				DUW30				
1				DUL20				
1				DUG20	1			
				DUS41	1			
				RBS6601				
				dTRU/TRX				
				RU22 B4				
6				RUS02 B2	6			
				RUS01 B4				

- [ ] Relocate cabinet
- [ ] Add cabinet
- [ ] Swap cabinet
- [ ] Remove cabinet
- [ ] Make cabinet dark

Scope of Work

Swap DUL with DUS41

ALPHA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [x] Add antenna
- [ ] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [ ] Remove TMA
- [x] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [ ] Consolidate coax cables
- [x] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Add LTE 700 passive antenna. Add coax. Add RRUS on ground. Add smart Bias-T

BETA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [x] Add antenna
- [ ] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [ ] Remove TMA
- [x] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [ ] Consolidate coax cables
- [x] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Add LTE 700 passive antenna. Add coax. Add RRUS on ground. Add smart Bias-T

GAMMA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [x] Add antenna
- [ ] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [ ] Remove TMA
- [x] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [ ] Consolidate coax cables
- [x] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Add LTE 700 passive antenna. Add coax. Add RRUS on ground. Add smart Bias-T

DELTA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [ ] Add antenna
- [ ] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [ ] Remove TMA
- [ ] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [ ] Consolidate coax cables
- [ ] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Network Modernization RFDS v3.0

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RFDS Revision	
RFDS Final	

Date 07/29/2014

ALPHA (view from behind)

Existing Configuration	Mount	Proposed Configuration
x		x
GSM/LTE	Technology	GSM/LTE
B2	Band	B2
P	Active/Passive	P
Dual pole	Ant. Type	Dual pole
RR90_17_02DP	Ant. Model	RR90_17_02DP
EMS	Ant. Vendor	EMS
117	Ant. Height	117
60	Azimuth	60
No	RET deployed	No
2	E-Tilt	2
0	M-Tilt	0
1	TMA #	1
d B2	TMA Type	d B2
	RRU #	
	RRU Type	
2	Used Coax #	2
1-5/8"	Coax Type	1-5/8"
145	Coax Length (ft)	145
	Fiber (CPRI) #	
	Splitter #	
	Combiner #	
	Combiner Type	

Existing Configuration	Proposed Configuration
x	x
LTE	
B12	
P	
Dual pole	
LNX-6515DS-VTM	
Commscope	
117	
60	
Yes	
2	
0	
1	
RUS11_B	
2	
1-5/8"	
145	

	Add new mount	x	Add RRU
	Relocate antenna		Swap existing RRU
x	Add antenna		Remove RRU
	Swap antenna		Consolidate coax cables
	Remove antenna	x	Add coax cables
	Add TMA		Add fiber cables
	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Scope of work

Add LTE 700 passive antenna. Add coax. Add RRUS on ground. Add smart Bias-T

BETA (view from behind)

Existing Configuration	Mount	Proposed Configuration
x		x
GSM/LTE	Technology	GSM/LTE
B2	Band	B2
P	Active/Passive	P
Dual pole	Ant. Type	Dual pole
RR90_17_02DP	Ant. Model	RR90_17_02DP
EMS	Ant. Vendor	EMS
117	Ant. Height	117
180	Azimuth	180
No	RET deployed	No
2	E-Tilt	2
0	M-Tilt	0
1	TMA #	1
d B2	TMA Type	d B2
	RRU #	
	RRU Type	
2	Used Coax #	2
1-5/8"	Coax Type	1-5/8"
145	Coax Length (ft)	145
	Fiber (CPRI) #	
	Splitter #	
	Combiner #	
	Combiner Type	

Existing Configuration	Proposed Configuration
x	x
LTE	
B12	
P	
Dual pole	
LNX-6515DS-VTM	
Commscope	
117	
180	
Yes	
2	
0	
1	
RUS11_B	
2	
1-5/8"	
145	

	Add new mount	x	Add RRU
	Relocate antenna		Swap existing RRU
x	Add antenna		Remove RRU
	Swap antenna		Consolidate coax cables
	Remove antenna	x	Add coax cables
	Add TMA		Add fiber cables
	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Scope of work

Add LTE 700 passive antenna. Add coax. Add RRUS on ground. Add smart Bias-T

Network Modernization RFDS v3.0

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Approvals	
Market RF	
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RFDS Revision	
RFDS Final	

Date 07/29/2014

GAMMA (view from behind)

Existing Configuration					Proposed Configuration			
x			x		x			x
GSM/LTE				Technology	GSM/LTE			LTE
B2				Band	B2			B12
P				Active/Passive	P			P
Dual pole				Ant. Type	Dual pole			Dual pole
RR90_17_02DP				Ant. Model	RR90_17_02DP			LNX-6515DS-VTM
EMS				Ant. Vendor	EMS			Commscope
117				Ant. Height	117			117
300				Azimuth	300			300
No				RET deployed	No			Yes
2				E-Tilt	2			2
0				M-Tilt	0			0
1				TMA #	1			
d B2				TMA Type	d B2			
				RRU #				1
				RRU Type				RUS11_B
2				Used Coax #	2			2
1-5/8"				Coax Type	1-5/8"			1-5/8"
145				Coax Length (ft)	145			145
				Fiber (CPRI) #				
				Splitter #				
				Combiner #				
				Combiner Type				

	Add new mount	x	Add RRU
	Relocate antenna		Swap existing RRU
x	Add antenna		Remove RRU
	Swap antenna		Consolidate coax cables
	Remove antenna	x	Add coax cables
	Add TMA		Add fiber cables
	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Scope of work

Add LTE 700 passive antenna. Add coax. Add RRUS on ground. Add smart Bias-T

DELTA (view from behind)

Existing Configuration					Proposed Configuration			
				Technology				
				Band				
				Active/Passive				
				Ant. Type				
				Ant. Model				
				Ant. Vendor				
				Ant. Height				
				Azimuth				
				RET deployed				
				E-Tilt				
				M-Tilt				
				TMA #				
				TMA Type				
				RRU #				
				RRU Type				
				Used Coax #				
				Coax Type				
				Coax Length (ft)				
				Fiber (CPRI) #				
				Splitter #				
				Combiner #				
				Combiner Type				

	Add new mount		Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
	Swap antenna		Consolidate coax cables
	Remove antenna		Add coax cables
	Add TMA		Add fiber cables
	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Scope of work

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6515DS-VTM

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

- Excellent choice to maximize both coverage and capacity in suburban and rural applications
- Fully compatible with Andrew remote electrical tilt system for greater OpEx savings
- Exceptional horizontal pattern roll-off and strong front-to-back ratio
- Extended bandwidth allows one antenna to serve multiple frequency allocations
- Great solution to maximize network coverage and capacity
- The RF connectors are designed for IP67 rating and the radome for IP56 rating
- 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	**698–806**	**806–896**
Gain by all Beam Tilts, average, dBi	16.6	16.9
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3
Gain by Beam Tilt, average, dBi	0 ° | 16.6 4 ° | 16.6 8 ° | 16.4	0 ° | 17.0 4 ° | 17.0 8 ° | 16.8
Beamwidth, Horizontal, degrees	65	64
Beamwidth, Horizontal Tolerance, degrees	±1	±0.9
Beamwidth, Vertical, degrees	9.7	8.6
Beamwidth, Vertical Tolerance, degrees	±0.6	±0.4
Beam Tilt, degrees	0–8	0–8
USLS, dB	18	18
Front-to-Back Total Power at 180° ± 30°, dB	25	23
CPR at Boresight, dB	24	27
CPR at Sector, dB	15	13
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
Number of Ports, all types	2

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum

Product Specifications

LNX-6515DS-VTM

Radome Material	Fiberglass, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	2
Wind Loading, maximum	878.0 N @ 150 km/h 197.4 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	181.0 mm | 7.1 in
Length	2449.0 mm | 96.4 in
Width	301.0 mm | 11.9 in
Net Weight	22.8 kg | 50.3 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	LNX-6515DS-R2M
Model with Factory Installed AISG 2.0 Actuator	LNX-6515DS-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

DB380-3 — Pipe Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Used for wide panel antennas. Includes three clamp sets.

DB5083D — Downtilt Mounting Kit for 2.4"-4.5" (60-115 mm) OD round members. Consists of two DB5083 heavy-duty, galvanized steel downtilt mounting brackets. This kit is compatible with the DB380-3 pipe mount for panel antennas with three mounting points.

EXHIBIT C

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RADIO FREQUENCY EMISSIONS ANALYSIS REPORT
EVALUATION OF HUMAN EXPOSURE POTENTIAL TO NON-IONIZING EMISSIONS

T-Mobile Existing Facility

Site ID: CT11508F

Verizon Chaplin
123 Palmer Road
Chaplin, CT 06256

April 27, 2015

EBI Project Number: 6215002779

Site Compliance Summary	
Compliance Status:	COMPLIANT
Site total MPE% of FCC general public allowable limit:	57.45 %

21 B Street Burlington, MA 01803 Tel: (781) 273.2500 Fax: (781) 273.3311

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April 27, 2015

T-Mobile USA
Attn: Jason Overbey, RF Manager
35 Griffin Road South
Bloomfield, CT 06002

Emissions Analysis for Site: **CT11508F – Verizon Chaplin**

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **123 Palmer Road, Chaplin, CT**, for the purpose of determining whether the emissions from the Proposed T-Mobile Antenna Installation located on this property are within specified federal limits.

All information used in this report was analyzed as a percentage of current Maximum Permissible Exposure (% MPE) as listed in the FCC OET Bulletin 65 Edition 97-01and ANSI/IEEE Std C95.1. The FCC regulates Maximum Permissible Exposure in units of microwatts per square centimeter (μW/cm2). The number of $\mu W/cm^2$ calculated at each sample point is called the power density. The exposure limit for power density varies depending upon the frequencies being utilized. Wireless Carriers and Paging Services use different frequency bands each with different exposure limits, therefore it is necessary to report results and limits in terms of percent MPE rather than power density.

All results were compared to the FCC (Federal Communications Commission) radio frequency exposure rules, 47 CFR 1.1307(b)(1) – (b)(3), to determine compliance with the Maximum Permissible Exposure (MPE) limits for General Population/Uncontrolled environments as defined below.

General population/uncontrolled exposure limits apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general public would always be considered under this category when exposure is not employment related, for example, in the case of a telecommunications tower that exposes persons in a nearby residential area.

Public exposure to radio frequencies is regulated and enforced in units of microwatts per square centimeter ($\mu W/cm^2$). The general population exposure limit for the 700 MHz Band is 467 $\mu W/cm^2$, and the general population exposure limit for the PCS band is 1000 $\mu W/cm^2$. Because each carrier will be using different frequency bands, and each frequency band has different exposure limits, it is necessary to report percent of MPE rather than power density.

Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Additional details can be found in FCC OET 65.

CALCULATIONS

Calculations were done for the proposed T-Mobile Wireless antenna facility located at **123 Palmer Road, Chaplin, CT**, using the equipment information listed below. All calculations were performed per the specifications under FCC OET 65. Since T-Mobile is proposing highly focused directional panel antennas, which project most of the emitted energy out toward the horizon, all calculations were performed assuming a lobe representing the maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was focused at the base of the tower. For this report the sample point is the top of a 6 foot person standing at the base of the tower.

For all calculations, all equipment was calculated using the following assumptions:

1) 2 GSM channels (PCS Band - 1900 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel

2) 2 UMTS channels (AWS Band – 2100 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

3) 2 LTE channels (AWS Band – 2100 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 60 Watts per Channel.

4) 1 LTE channel (700 MHz Band) was considered for each sector of the proposed installation. This channel has a transmit power of 30 Watts.

5) All radios at the proposed installation were considered to be running at full power and were uncombined in their RF transmissions paths per carrier prescribed configuration. Per FCC OET Bulletin No. 65 - Edition 97-01 recommendations to achieve the maximum anticipated value at each sample point, all power levels emitting from the proposed antenna installation are increased by a factor of 2.56 to account for possible in-phase reflections from the surrounding environment. This is rarely the case, and if so, is never continuous.

6) For the following calculations the sample point was the top of a six foot person standing at the base of the tower. The maximum gain of the antenna per the antenna manufactures supplied specifications minus 10 dB was used in this direction. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

7) The antennas used in this modeling are the **RFS APXV18-206517S-C-A20** for 1900 MHz (PCS) channels and the **Commscope LNX-6515DS-VTM** for 700 MHz channels. This is based on feedback from the carrier with regards to anticipated antenna selection. The **RFS APXV18-206517S-C-A20** has a maximum gain of **16.7 dBd** at its main lobe. The **Commscope LNX-6515DS-VTM** has a maximum gain of **14.6 dBd** at its main lobe. The maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was used for all calculations. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

8) The antenna mounting height centerline of the proposed antennas is **118 feet** above ground level (AGL).

9) Emissions values for additional carriers were taken from the Connecticut Siting Council active database. Values in this database are provided by the individual carriers themselves.

All calculations were done with respect to uncontrolled / general public threshold limits.

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T-Mobile Site Inventory and Power Data

Sector:	A	Sector:	B	Sector:	C
Antenna #:	1	Antenna #:	1	Antenna #:	1
Make / Model:	RFS APXV18-206517S-C-A20	Make / Model:	RFS APXV18-206517S-C-A20	Make / Model:	RFS APXV18-206517S-C-A20
Gain:	16.7 dBd	Gain:	16.7 dBd	Gain:	16.7 dBd
Height (AGL):	118	Height (AGL):	118	Height (AGL):	118
Frequency Bands	1900 MHz(PCS)	Frequency Bands	1900 MHz(PCS)	Frequency Bands	1900 MHz(PCS)
Channel Count	6	Channel Count	6	# PCS Channels:	6
Total TX Power:	240	Total TX Power:	240	# AWS Channels:	240
ERP (W):	11,225.64	ERP (W):	11,225.64	ERP (W):	11,225.64
Antenna A1 MPE%	3.22	Antenna B1 MPE%	3.22	Antenna C1 MPE%	3.22
Antenna #:	2	Antenna #:	2	Antenna #:	2
Make / Model:	Commscope LNX-6515DS-VTM	Make / Model:	Commscope LNX-6515DS-VTM	Make / Model:	Commscope LNX-6515DS-VTM
Gain:	14.6 dBd	Gain:	14.6 dBd	Gain:	14.6 dBd
Height (AGL):	118	Height (AGL):	118	Height (AGL):	118
Frequency Bands	700 MHz	Frequency Bands	700 MHz	Frequency Bands	700 MHz
Channel Count	1	Channel Count	1	Channel Count	1
Total TX Power:	30	Total TX Power:	30	Total TX Power:	30
ERP (W):	865.21	ERP (W):	865.21	ERP (W):	865.21
Antenna A2 MPE%	0.53	Antenna B2 MPE%	0.53	Antenna C2 MPE%	0.53

Site Composite MPE%	
Carrier	**MPE%**
T-Mobile	**11.24**
Verizon Wireless	17.31 %
AT&T	21.68 %
Sprint	7.22 %
Site Total MPE %:	**57.45 %**

T-Mobile Sector 1 Total:	3.75 %
T-Mobile Sector 2 Total:	3.75 %
T-Mobile Sector 3 Total:	3.75 %
Site Total:	57.45 %

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Summary

All calculations performed for this analysis yielded results that were **within** the allowable limits for general public exposure to RF Emissions.

The anticipated maximum composite contributions from the T-Mobile facility as well as the site composite emissions value with regards to compliance with FCC's allowable limits for general public exposure to RF Emissions are shown here:

T-Mobile Sector	Power Density Value (%)
Sector 1:	3.75 %
Sector 2:	3.75 %
Sector 3 :	3.75 %
T-Mobile Total:	11.24 %
Site Total:	57.45 %
Site Compliance Status:	**COMPLIANT**

The anticipated composite MPE value for this site assuming all carriers present is **57.45%** of the allowable FCC established general public limit sampled at the ground level. This is based upon values listed in the Connecticut Siting Council database for existing carrier emissions.

FCC guidelines state that if a site is found to be out of compliance (over allowable thresholds), that carriers over a 5% contribution to the composite value will require measures to bring the site into compliance. For this facility, the composite values calculated were well within the allowable 100% threshold standard per the federal government.

Scott Heffernan
RF Engineering Director

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