COHEN and WOLF P.C.
ATTORNEYS AT LAW

JULIE D. KOHLER

PLEASE REPLY TO: Bridgeport
WRITER'S DIRECT DIAL: (203) 337-4157
E-Mail Address: jkohler@cohenandwolf.com

March 17, 2014

Attorney Melanie Bachman
Acting Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

Re: Notice of Exempt Modification
Verizon Wireless/T-Mobile co-location
Site ID CTNL802A
125 Mile Creek Rd, Old Lyme, Connecticut

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 located at 125 Mile Creek Rd, Old Lyme, Connecticut (Latitude: 41.30561128 Longitude: -72.2970949). T-Mobile intends to replace three antennas and related equipment at this existing telecommunications facility in Old Lyme ("Old Lyme 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 also being sent to the First Selectwoman, Bonnie Reemsnyder, and the property owners, Todd & Rebecca L Machnik.

The existing Old Lyme Facility consists of a 160 foot tall monopole tower with a 10 foot extension approved by the Council in Docket No. 202.[1] T-Mobile plans to replace three antennas and six TMAs with six antennas and three TMAs at a centerline of 170 feet (See the plans revised to March 11, 2014 attached hereto as Exhibit A). T-Mobile will also install fiber cable and reuse existing cable. The existing Old Lyme Facility is structurally capable of supporting T-Mobile's proposed modifications, as indicated in the structural analysis dated March 4, 2014 and attached hereto as Exhibit B.

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

[1] The Decision and Order in this docket (dated September 12. 2001) contains no relevant requirements or limitations on the configuration of the Old Lyme Facility.

1. The proposed modification will not increase the height of the tower. T-Mobile's replacement antennas will be installed at a centerline of 170 feet, merely replacing existing antennas located at the same 170 foot elevation. 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 of the site boundaries. T-Mobile's equipment will be located entirely within the existing compound and leased area as shown on Page 2 of Exhibit A.

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

4. The operation of the replacement antennas 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 March 14, 2014, T-Mobile's operations would add 0.558% 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 19.178% of the FCC Standard as calculated for a mixed frequency site as evidenced by the engineering exhibit attached hereto as Exhibit C.

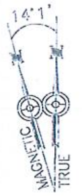
For the foregoing reasons, T-Mobile respectfully submits that the proposed replacement antennas and equipment at the Old Lyme Facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2). Upon acknowledgement by the Council of this proposed exempt modification, T-Mobile shall commence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

Sincerely,

Julie D. Kohler, Esq.

cc: Town of Old Lyme, First Selectwoman Bonnie Reemsnyder
Verizon Wireless
Todd & Rebecca L Manchnik
Northeast Site Solutions, Sheldon J. Freincle

EXHIBIT A

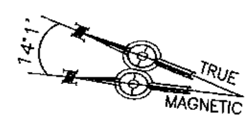


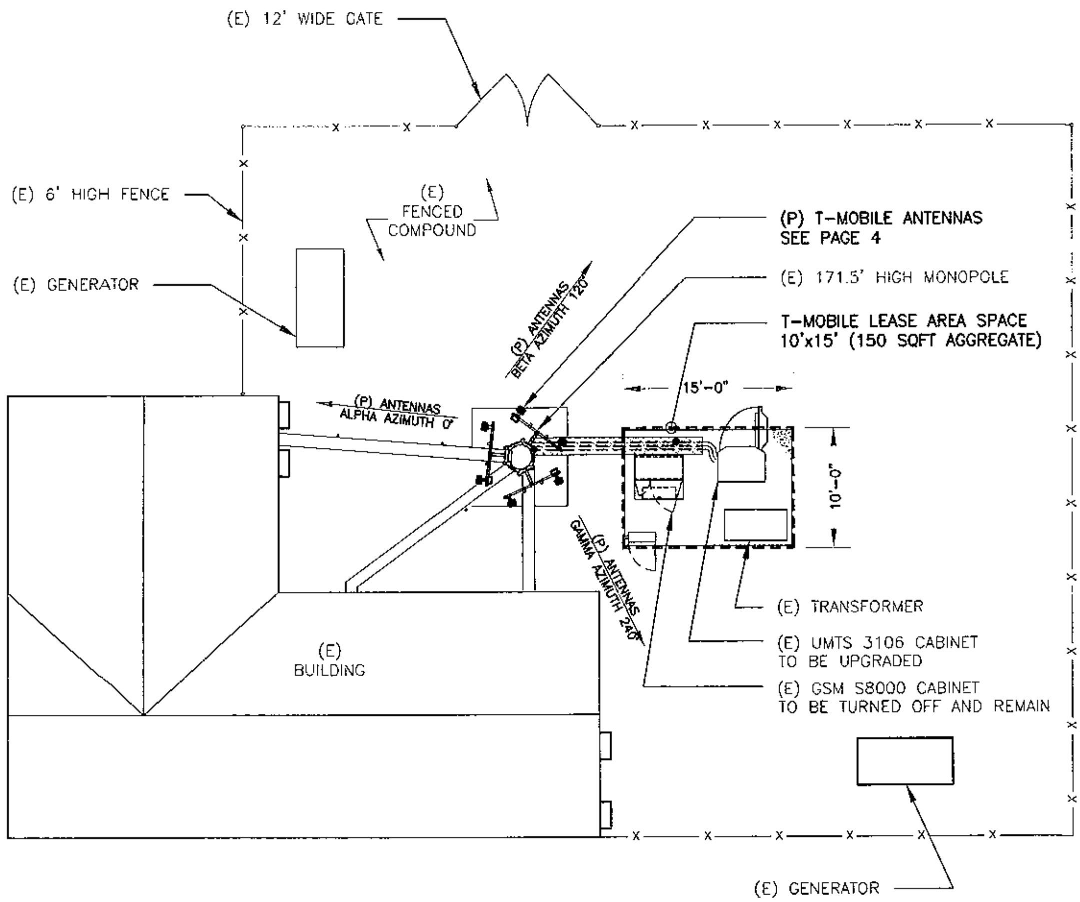
ALL EQUIPMENT LOCATIONS ARE APPROXIMATE AND ARE SUBJECT TO APPROVAL BY LESSEE/LICENSEE'S STRUCTURAL & RF ENGINEERS. LOCATIONS OF POWER & TELEPHONE FACILITIES ARE SUBJECT TO APPROVAL BY UTILITY COMPANIES.

KEY MAP 1 / LE-1
N.T.S.

CONFIGURATION
2C

SUBMITTALS				
LE REV A	02.06.14	ATLANTIS GROUP 1340 Centre Street Suite 212 Newton, MA 02459 Office: 617-965-0789 Fax: 617-213-5056	**LEASE EXHIBIT** SITE NUMBER: CTNL802A SITE NAME: AMTRAK OLD LYME VERIZON SITE ADDRESS: 125 MILE CREEK ROAD OLD LYME, CT 06371	NORTHEAST SITE SOLUTIONS 54 MAIN STREET, UNIT 3 STURBRIDGE, MA 01566 (508) 434-5237 FOR T-MOBILE NORTHEAST, LLC 35 GRIFFIN ROAD SOUTH BLOOMFIELD, CT 06002 OFFICE: (860) 692-7100 FAX: (860) 692-7159
LE REV 0	03.11.14			
			DRAWN BY: EB / CHECKED BY: SM	PAGE 1 OF 4





ALL EQUIPMENT LOCATIONS ARE APPROXIMATE AND ARE SUBJECT TO APPROVAL BY LESSEE/LICENSEE'S STRUCTURAL & RF ENGINEERS. LOCATIONS OF POWER & TELEPHONE FACILITIES ARE SUBJECT TO APPROVAL BY UTILITY COMPANIES.

SITE PLAN

N.T.S.

1 LE-2   1 LE-3

CONFIGURATION

2C

SUBMITTALS	
LE REV A	02.06.14
LE REV 0	03.11.14

ATLANTIS GROUP
1340 Centre Street
Suite 212
Newton, MA 02459
Office: 617-965-0789
Fax: 617-213-5056

LEASE EXHIBIT

SITE NUMBER:
CTNL802A

SITE NAME:
AMTRAK OLD LYME VERIZON

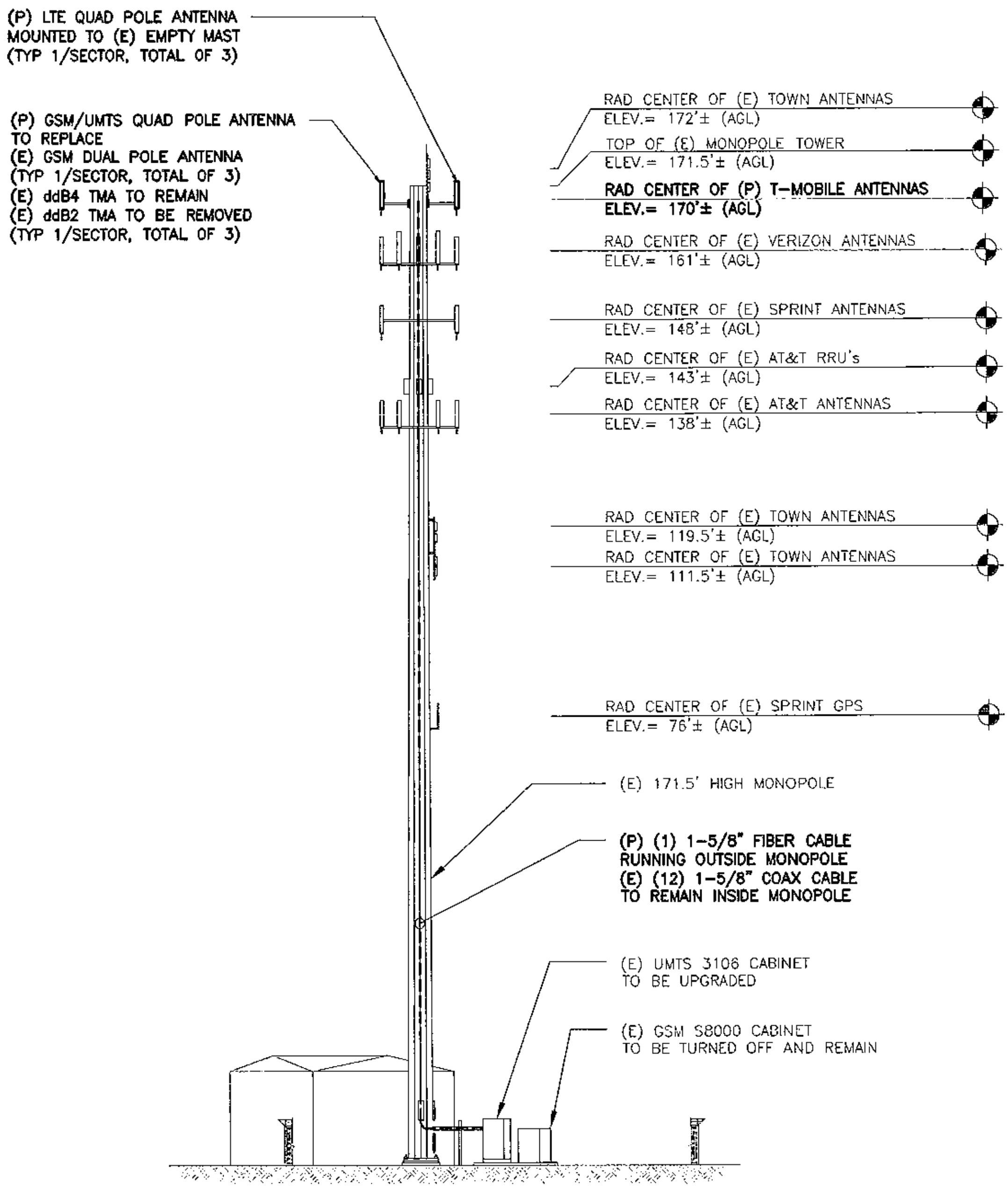
SITE ADDRESS:
125 MILE CREEK ROAD
OLD LYME, CT 06371

NORTHEAST SITE SOLUTIONS
54 MAIN STREET, UNIT 3
STURBRIDGE, MA 01566
(508) 434-5237

FOR

T-MOBILE NORTHEAST, LLC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
OFFICE: (860) 692-7100
FAX: (860) 692-7159

DRAWN BY: EB | **CHECKED BY: SM**



ELEVATION
N.T.S.

1
LE-3

CONFIGURATION
2C

SUBMITTALS	
LE REV A	02.06.14
LE REV 0	03.11.14

ATLANTIS GROUP
1340 Centre Street
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Fax: 617-213-5056

LEASE EXHIBIT

SITE NUMBER:
CTNL802A
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OLD LYME, CT 06371

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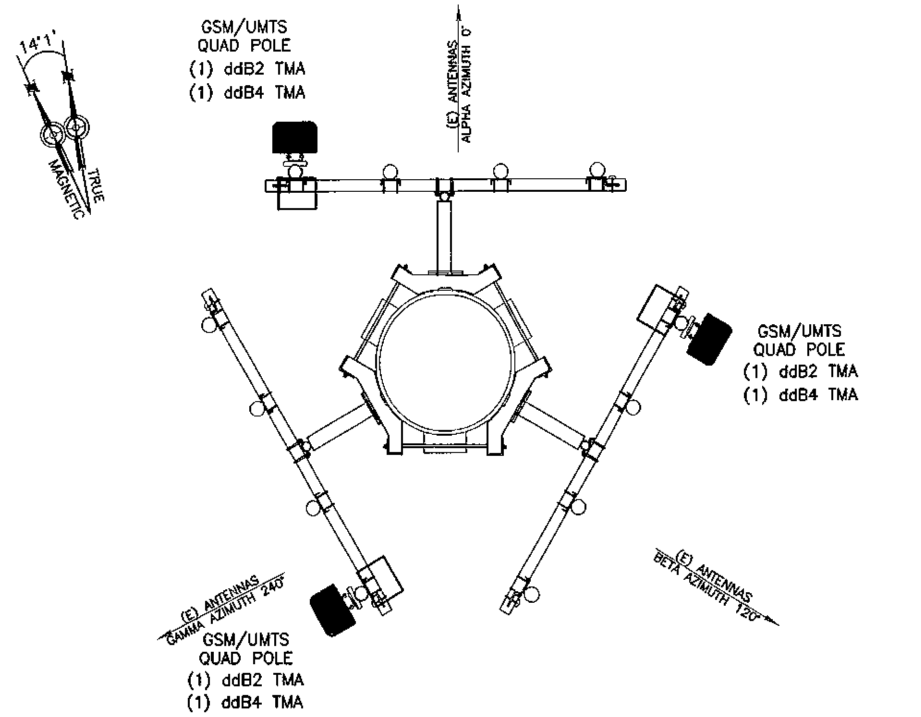
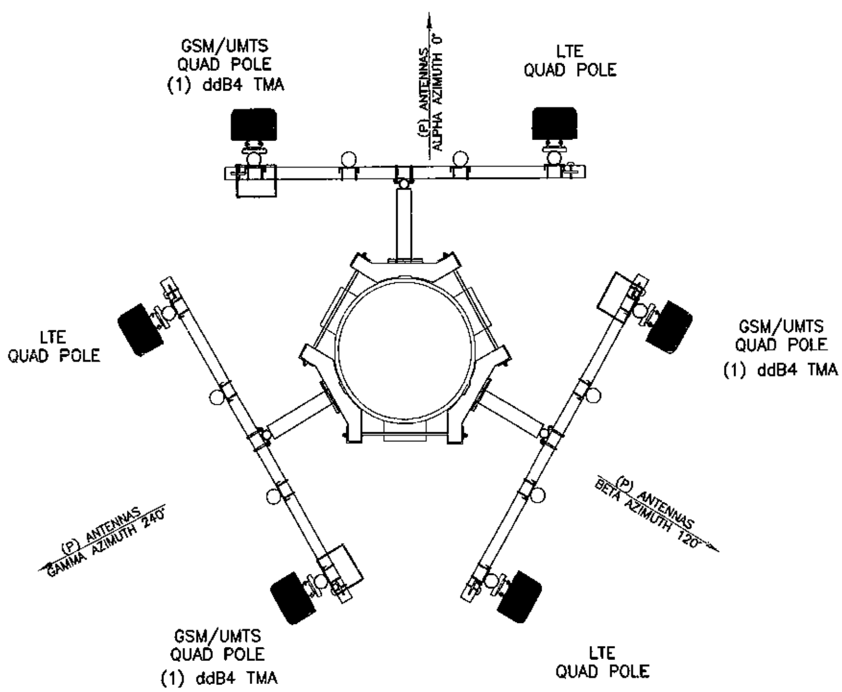


EXISTING ANTENNA CONFIGURATION



PROPOSED ANTENNA CONFIGURATION

CONFIGURATION

2C

SUBMITTALS	
LE REV A	02.06.14
LE REV 0	03.11.14

ATLANTIS GROUP
1340 Centre Street
Suite 212
Newton, MA 02459
Office: 617-965-0789
Fax: 617-213-5056

LEASE EXHIBIT

SITE NUMBER:
CTNL802A

SITE NAME:
AMTRAK OLD LYME VERIZON

SITE ADDRESS:
125 MILE CREEK ROAD
OLD LYME, CT 06371

NORTHEAST SITE SOLUTIONS
54 MAIN STREET, UNIT 3
STURBRIDGE, MA 01566
(508) 434-5237

FOR

T-MOBILE NORTHEAST, LLC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
OFFICE: (860) 692-7100
FAX: (860) 692-7159

DRAWN BY: EB | CHECKED BY:SM

EXHIBIT B

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

160-ft Existing EEI Monopole-
With 10-ft Extension

Proposed T-Mobile
Antenna Upgrade

T-Mobile Site Ref: CTNL802A

Verizon Site Ref: Old Lyme South

125 Mile Creek Road
Old Lyme, CT

CENTEK Project No. 14033.001

Date: March 4, 2014

STATE OF CONNECTICUT
CARLO F. CENTORE
No.16694
LICENSED
PROFESSIONAL ENGINEER

Prepared for:
T-Mobile Towers
4 Sylvan Way
Parsippany, NJ 07054

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 installation proposed by T-Mobile on the existing monopole (tower) owned and operated by Verizon Wireless, located in Old Lyme, CT.

The host tower is a 160-ft, four-section, eighteen sided, tapered monopole originally designed and manufactured by Engineered Endeavors Inc (EEI)—job no: 11723, dated September 19, 2003 with a 10-ft extension designed by Valmont job no: 31057 dated March 11, 2009. The tower geometry, structure member sizes and foundation system information were taken from aforementioned EEI's and Valmont's design drawings.

Antenna and appurtenance information were obtained from a previous structural analysis report prepared by Centek job no. 11001.CO71 rev. 1 dated December 8, 2011, a tower mapping report prepared by CSB Communications, LLC dated February 28, 2014 and a T-Mobile RF data sheet.

The tower consists of four (4) tapered vertical steel sections conforming to ASTM A572-65 (65ksi). The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 29.01-in at the top and 69.00-in at the base. The 10-ft tapered pole extension is flange connected to the top of the monopole. The diameter of the extension is (flat-flat) 25.73-in at the top and 27.89-in at the base

T-Mobile proposes the removal of three (3) panel antennas and six (6) TMA's and the installation of six (6) panel antennas and three (3) TMA's mounted to the existing three (3) T-Arms. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

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

- TOWN (Existing):
  Antennas: One (1) Comprod 4-Bay dipole antenna and one (1) Andrew ground plane antenna mounted to the existing T-Mobile T-Arms with an elevation of 167.5-ft above grade level.
  Coax Cables: Three (3) 1/2" ∅ coax cables running on the inside of the existing tower.
- 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 one (1) main distribution box mounted on a low profile platform with a RAD center elevation of 161-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower and six (6) 1-5/8" ∅ coax cables and two (2) 1-5/8" ∅ fiber cables running on the exterior of the existing tower.

- SPRINT (Existing):
  Antennas: Six (6) Decibel DB980F90E-M panel antennas mounted to an existing low profile platform with a RAD center elevation of 148-ft above grade level.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- AT&T (Existing/Reserved):
  Antennas: Six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted to one (1) universal ring mount with a RAD center elevation of 143-ft above grade level.
  Coax Cables: One (1) fiber cable and two (2) dc control cables within a 3" dia. flex conduit running inside of the existing tower.

- AT&T (Existing):
  Antennas: Six (6) KMW AM-X-CD-14-65-00T panel antennas, three (3) Powerwave 7770 panel antennas and six (6) Powerwave TT19-08BP111-001 TMA's mounted to an existing low profile platform with a RAD center elevation of 138-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- TOWN (Existing):
  Antennas: One (1) Comprod 4-Bay dipole antenna on a side arm with a RAD center elevation of 113.5-ft above grade level.
  Coax Cables: Two (2) 1/2" ∅ coax cables running on the exterior of the existing tower.

- SPRINT (Existing):
  Antennas: One (1) GPS antenna mounted on a 3-ft standoff with a RAD center elevation of 76-ft above grade level.
  Coax Cables: One (1) 1/2" ∅ coax cable running on the exterior of the existing tower.

- T-MOBILE (Existing to Remain):
  Coax Cable: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- T-MOBILE (Existing to Remove):
  Antenna: Three (3) RFS APX16DWV-16DWVS-E-A20 panel antennas, three (3) RFS AMAA1412D-1A20 TMA's and three (3) Andrew E15509P9403 TMA's mounted to three (3) T-Arms with a RAD center elevation of 170-ft above grade level.

- **T-MOBILE (Proposed):**
  Antennas: Six (6) Ericsson AIR 21 panel antennas and three (3) Ericsson KRY 112 TMA's mounted to three (3) T-Arms with a RAD center elevation of 170-ft above grade level.
  Coax Cables: One (1) 1-5/8" ∅ fiber cable running on the exterior of the existing tower.

Primary Assumptions Used in the Analysis

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

Analysis

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

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

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix K of the CSBC[1] and the wind speed data available in the TIA/EIA-222-F-96 Standard. The higher of the two wind speeds is utilized in preparation of 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:	New London; v = 85 mph (fastest mile) Old Lyme; v = 120 mph (3 second gust) equivalent to v = 100 mph (fastest mile) *Appendix-K wind speed controls.*	*[Section 16 of TIA/EIA-222-F-96]* *[Appendix K of the 2005 CT Building Code Supplement]*
Load Cases:	<u>Load Case 1</u>; 100 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]*
	<u>Load Case 2</u>; 87 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 87 mph wind speed velocity represents 75% of the wind pressure generated by the 100 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	<u>Load Case 3</u>; 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", the maximum tower steel usage was found to be at **89.0%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L1)	161.50'-171.50'	8.1%	**PASS**
Pole Shaft (L2)	127.46'-161.50'	59.6%	**PASS**
Pole Shaft (L3)	83.77'-127.46'	74.5%	**PASS**
Pole Shaft (L4)	41.12'-83.77'	78.6%	**PASS**
Pole Shaft (L5)	1.0'-41.12'	89.0%	**PASS**

Foundation and Anchors

The existing foundation consists of a 8.5-ft square x 4.5-ft long reinforced concrete pier on a 31.0-ft square x 3.5-ft thick reinforced concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; job no. 11723, dated September 19, 2003. The base of the tower is connected to the foundation by means of (24) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 7-ft into the concrete foundation structure.

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

Location	Vector	Proposed Reactions
Base	Shear	51 kips
	Compression	56 kips
	Moment	6023 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	2.54	**PASS**

Note 1: FS denotes Factor of Safety.

Note 2: OTM denotes Overturning Moment

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Flange Bolts	Tension	11.0%	**PASS**
Flange Plate	Bending	3.4%	**PASS**

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Combined Axial and Bending	79.5%	**PASS**
Base Plate	Bending	93.1%	**PASS**

Conclusion

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

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

Carlo F. Centore, PE
Principal ~ Structural Engineer

STATE OF CONNECTICUT
CARLO F. CENTORE
No. 15684
LICENSED
PROFESSIONAL ENGINEER

Prepared by:

Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

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

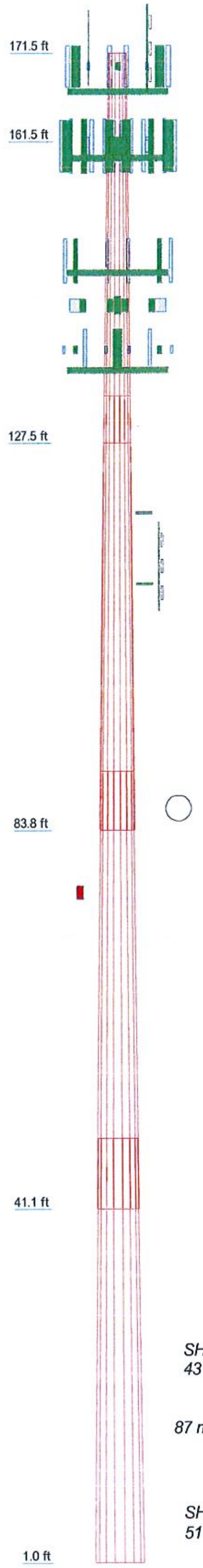
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

tnxTower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, tnxTower, formerly RISATower, 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	5	4	3	2	1
Length (ft)	48.05	49.28	48.94	34.04	10.00
Number of Sides	18	18	18	18	18
Thickness (in)	0.4375	0.4375	0.3750	0.2500	0.1875
Socket Length (ft)		7.93	6.63	5.26	
Top Dia (in)	56.4741	46.4841	35.9715	27.8900	25.7300
Bot Dia (in)	69.0000	59.4330	48.9974	38.0379	27.8900
Grade	A572-65				
Weight (K) 38.3	14.1	12.2	8.3	3.0	0.5



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION
DB201-A (Town - Existing)	172
779-70 (Town - Existing)	172
(2) AIR21 (T-Mobile - Proposed)	170
(2) AIR21 (T-Mobile - Proposed)	170
(2) AIR21 (T-Mobile - Proposed)	170
KRY 112 TMA (T-Mobile - Proposed)	170
KRY 112 TMA (T-Mobile - Proposed)	170
KRY 112 TMA (T-Mobile - Proposed)	170
Valmont T-Arm (3) (T-Mobile - Existing)	167.5
LPA-80063/6CF (Verizon - Reserved)	161
LPA-171063-12CF (Verizon - Reserved)	161
BXA-70063/6CF (Verizon - Reserved)	161
BXA-70063/6CF (Verizon - Reserved)	161
LPA-171063-12CF (Verizon - Reserved)	161
LPA-80063/6CF (Verizon - Reserved)	161
LPA-80063/6CF (Verizon - Reserved)	161
LPA-171063-12CF (Verizon - Reserved)	161
BXA-70063/6CF (Verizon - Reserved)	161
BXA-70063/6CF (Verizon - Reserved)	161
LPA-171063-12CF (Verizon - Reserved)	161
LPA-80063/6CF (Verizon - Reserved)	161
LPA-80063/6CF (Verizon - Reserved)	161
LPA-171063-12CF (Verizon - Reserved)	161
BXA-70063/6CF (Verizon - Reserved)	161
BXA-70063/6CF (Verizon - Reserved)	161
LPA-171063-12CF (Verizon - Reserved)	161
LPA-80063/6CF (Verizon - Reserved)	161
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	161
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	161
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	161
RRH2x40-AWS (Verizon - Reserved)	161
RRH2x40-AWS (Verizon - Reserved)	161

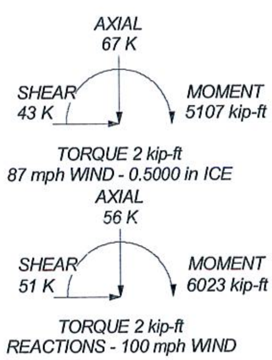
TYPE	ELEVATION
RRH2x40-AWS (Verizon - Reserved)	161
RRH2x40-07-U (Verizon - Reserved)	161
RRH2x40-07-U (Verizon - Reserved)	161
RRH2x40-07-U (Verizon - Reserved)	161
DB-T1-6Z-8AB-0Z (Verizon - Reserved)	161
EEI Low Profile Platform (Verizon - Existing)	160
(2) DB980F90E-M (Sprint - Existing)	148
(2) DB980F90E-M (Sprint - Existing)	148
(2) DB980F90E-M (Sprint - Existing)	148
EEI Low Profile Platform (Sprint - Existing)	147
(2) RRUS-11 (ATT - Existing)	143
(2) RRUS-11 (ATT - Existing)	143
(2) RRUS-11 (ATT - Existing)	143
DC6-48-60-18-8F Surge Arrestor (ATT - Existing)	143
Valmont Uni-Tri Bracket (ATT - Existing)	143
7770.00 (ATT - Existing)	138
(2) TT19-08BP111-001 TMA (ATT - Existing)	138
(2) TT19-08BP111-001 TMA (ATT - Existing)	138
(2) TT19-08BP111-001 TMA (ATT - Existing)	138
(2) AM-X-CD-14-65-00TT-RET (ATT - Existing)	138
(2) AM-X-CD-14-65-00TT-RET (ATT - Existing)	138
(2) AM-X-CD-14-65-00TT-RET (ATT - Existing)	138
7770.00 (ATT - Existing)	138
7770.00 (ATT - Existing)	138
EEI Low Profile Platform (ATT - Existing)	136
4-ft Standoff (Town - Existing)	119.5
779-70 (Town - Existing)	113.5
4-ft Standoff (Town - Existing)	111.5
GPS (Sprint - Existing)	76
3' GPS Stand-off Mount (Sprint - Existing)	76

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 100 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 87 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. TOWER RATING: 89%



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

Job: **14033.001 - CTNL802A**		
Project: **160' EEI Monopole w/ 10' Ext. 125 Mile Creek Road - Old Lyme, CT**		
Client: T-Mobile	Drawn by: TJL	App'd:
Code: TIA/EIA-222-F	Date: 03/04/14	Scale: NTS
Path:		Dwg No. E-1

Tower Input Data

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

- Basic wind speed of 100 mph.
- Nominal ice thickness of 0.5000 in.
- Ice density of 56 pcf.
- A wind speed of 87 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 50 mph.
- 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
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
√ Use Code Stress Ratios
Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
Include Bolts In Member Capacity
Leg Bolts Are At Top Of Section
Secondary Horizontal Braces Leg
Use Diamond Inner Bracing (4 Sided)
Add IBC .6D+W Combination

Distribute Leg Loads As Uniform
Assume Legs Pinned
√ Assume Rigid Index Plate
Use Clear Spans For Wind Area
Use Clear Spans For KL/r
Retension Guys To Initial Tension
√ Bypass Mast Stability Checks
Use Azimuth Dish Coefficients
√ Project Wind Area of Appurt.
Autocalc Torque Arm Areas
SR Members Have Cut Ends
√ Sort Capacity Reports By Component
Triangulate Diamond Inner Bracing

Treat Feedline Bundles As Cylinder
Use ASCE 10 X-Brace Ly Rules
Calculate Redundant Bracing Forces
Ignore Redundant Members in FEA
SR Leg Bolts Resist Compression
All Leg Panels Have Same Allowable
Offset Girt At Foundation
Consider Feedline Torque
Include Angle Block Shear Check

Poles

√ Include Shear-Torsion Interaction
Always Use Sub-Critical Flow
Use Top Mounted Sockets

Tapered Pole Section Geometry

Section	*Elevation* *ft*	*Section Length* *ft*	*Splice Length* *ft*	*Number of Sides*	*Top Diameter* *in*	*Bottom Diameter* *in*	*Wall Thickness* *in*	*Bend Radius* *in*	*Pole Grade*
L1	171.50-161.50	10.00	0.00	18	25.7300	27.8900	0.1875	0.7500	A572-65 (65 ksi)
L2	161.50-127.46	34.04	5.26	18	27.8900	38.0379	0.2500	1.0000	A572-65 (65 ksi)
L3	127.46-83.77	48.94	6.63	18	35.9715	48.9974	0.3750	1.5000	A572-65 (65 ksi)
L4	83.77-41.12	49.28	7.93	18	46.4841	59.4330	0.4375	1.7500	A572-65 (65 ksi)
L5	41.12-1.00	48.05		18	56.4741	69.0000	0.4375	1.7500	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	26.1269	15.2010	1252.9561	9.0676	13.0708	95.8589	2507.5608	7.6019	4.1985	22.392
	28.3202	16.4865	1598.4628	9.8344	14.1681	112.8211	3199.0289	8.2448	4.5786	24.419
L2	28.3202	21.9323	2116.8910	9.8122	14.1681	149.4123	4236.5675	10.9683	4.4686	17.875
	38.6247	29.9847	5409.3197	13.4147	19.3233	279.9384	10825.7572	14.9952	6.2547	25.019
L3	37.9467	42.3687	6782.6093	12.6368	18.2735	371.1716	13574.1434	21.1884	5.6710	15.123
	49.7533	57.8728	17285.6142	17.2610	24.8907	694.4613	34593.9733	28.9419	7.9635	21.236
L4	48.9690	63.9414	17128.3155	16.3465	23.6139	725.3484	34279.1688	31.9768	7.4112	16.94
	60.3498	81.9226	36022.9345	20.9434	30.1920	1193.1299	72093.2689	40.9691	9.6902	22.149
L5	59.4444	77.8139	30870.1250	19.8930	28.6889	1076.0319	61780.8697	38.9143	9.1694	20.959
	70.0644	95.2076	56543.4580	24.3397	35.0520	1613.1307	113161.317 3	47.6128	11.3740	25.998

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 171.50-161.50				1	1	1		
L2 161.50-127.46				1	1	1		
L3 127.46-83.77				1	1	1		
L4 83.77-41.12				1	1	1		
L5 41.12-1.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1/2 (Town - Existing)	C	No	Inside Pole	171.00 - 4.00	3	No Ice 1/2" Ice	0.00 0.00	0.25 0.25
1 5/8 (T-Mobile - Existing)	A	No	Inside Pole	170.00 - 4.00	12	No Ice 1/2" Ice	0.00 0.00	1.04 1.04
1 5/8 (Verizon - Existing)	B	No	Inside Pole	158.00 - 8.00	12	No Ice 1/2" Ice	0.00 0.00	1.04 1.04
1 5/8 (Verizon - Existing)	B	No	CaAa (Out Of Face)	158.00 - 8.00	1	No Ice 1/2" Ice	0.20 0.30	1.04 2.55
1 5/8 (Verizon - Existing)	B	No	CaAa (Out Of Face)	158.00 - 8.00	5	No Ice 1/2" Ice	0.00 0.00	1.04 2.55
HYBRIFLEX 1-5/8" (Verizon - Reserved)	B	No	CaAa (Out Of Face)	158.00 - 4.00	2	No Ice 1/2" Ice	0.00 0.00	1.90 3.41
1 5/8 (Sprint - Existing)	C	No	Inside Pole	148.00 - 11.00	6	No Ice 1/2" Ice	0.00 0.00	1.04 1.04
1 5/8 (AT&T - Existing)	C	No	Inside Pole	138.00 - 4.00	12	No Ice 1/2" Ice	0.00 0.00	1.04 1.04
3" dia Flex Conuit (AT&T - Existing)	C	No	Inside Pole	138.00 - 4.00	1	No Ice 1/2" Ice	0.00 0.00	5.00 5.00
RG6-Fiber (AT&T - Existing)	C	No	Inside Pole	143.00 - 4.00	1	No Ice 1/2" Ice	0.00 0.00	1.00 1.00
#8 AWG Copper WIre (AT&T - Existing)	C	No	Inside Pole	143.00 - 4.00	2	No Ice 1/2" Ice	0.00 0.00	0.05 0.05

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft²/ft	Weight plf
1/2	C	No	Inside Pole	117.00 - 11.00	2	No Ice	0.00	0.25
(Town - Existing)						1/2" Ice	0.00	0.25
1/2	C	No	Inside Pole	76.00 - 11.00	1	No Ice	0.00	0.25
(Sprint - Existing)						1/2" Ice	0.00	0.25
HYBRIFLEX 1-5/8"	A	No	CaAa (Out Of	170.00 - 4.00	1	No Ice	0.20	1.90
(T-Mobile - Proposed)			Face)			1/2" Ice	0.30	3.41

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L1	171.50-161.50	A	0.000	0.000	0.000	1.683	0.12
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.01
L2	161.50-127.46	A	0.000	0.000	0.000	6.741	0.49
		B	0.000	0.000	0.000	6.048	0.69
		C	0.000	0.000	0.000	0.000	0.36
L3	127.46-83.77	A	0.000	0.000	0.000	8.650	0.63
		B	0.000	0.000	0.000	8.650	0.98
		C	0.000	0.000	0.000	0.000	1.13
L4	83.77-41.12	A	0.000	0.000	0.000	8.445	0.61
		B	0.000	0.000	0.000	8.445	0.96
		C	0.000	0.000	0.000	0.000	1.12
L5	41.12-1.00	A	0.000	0.000	0.000	7.350	0.53
		B	0.000	0.000	0.000	6.558	0.76
		C	0.000	0.000	0.000	0.000	0.93

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L1	171.50-161.50	A	0.500	0.000	0.000	0.000	2.533	0.14
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.01
L2	161.50-127.46	A	0.500	0.000	0.000	0.000	10.145	0.54
		B		0.000	0.000	0.000	9.102	1.06
		C		0.000	0.000	0.000	0.000	0.36
L3	127.46-83.77	A	0.500	0.000	0.000	0.000	13.018	0.69
		B		0.000	0.000	0.000	13.018	1.51
		C		0.000	0.000	0.000	0.000	1.13
L4	83.77-41.12	A	0.500	0.000	0.000	0.000	12.710	0.68
		B		0.000	0.000	0.000	12.710	1.48
		C		0.000	0.000	0.000	0.000	1.12
L5	41.12-1.00	A	0.500	0.000	0.000	0.000	11.062	0.59
		B		0.000	0.000	0.000	9.870	1.17
		C		0.000	0.000	0.000	0.000	0.93

Discrete Tower Loads

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft ft ft*	*Azimuth Adjustment* °	*Placement* *ft*		C_AA_A *Front* ft^2	C_AA_A *Side* ft^2	*Weight* *K*
DB201-A	C	From Leg	3.00	0.0000	172.00	No Ice	1.05	1.05	0.03
(Town - Existing)			0.00			1/2" Ice	1.91	1.91	0.03
			0.00						
779-70	B	From Leg	3.00	0.0000	172.00	No Ice	2.80	2.80	0.03
(Town - Existing)			0.00			1/2" Ice	3.30	3.30	0.03
			0.00						
(2) AIR21	A	From Face	3.00	0.0000	170.00	No Ice	6.53	4.36	0.08
(T-Mobile - Proposed)			0.00			1/2" Ice	6.98	4.77	0.12
			0.00						
(2) AIR21	B	From Face	3.00	0.0000	170.00	No Ice	6.53	4.36	0.08
(T-Mobile - Proposed)			0.00			1/2" Ice	6.98	4.77	0.12
			0.00						
(2) AIR21	C	From Face	3.00	0.0000	170.00	No Ice	6.53	4.36	0.08
(T-Mobile - Proposed)			0.00			1/2" Ice	6.98	4.77	0.12
			0.00						
KRY 112 TMA	A	From Face	3.00	0.0000	170.00	No Ice	0.78	0.49	0.03
(T-Mobile - Proposed)			0.00			1/2" Ice	0.90	0.59	0.03
			0.00						
KRY 112 TMA	B	From Face	3.00	0.0000	170.00	No Ice	0.78	0.49	0.03
(T-Mobile - Proposed)			0.00			1/2" Ice	0.90	0.59	0.03
			0.00						
KRY 112 TMA	C	From Face	3.00	0.0000	170.00	No Ice	0.78	0.49	0.03
(T-Mobile - Proposed)			0.00			1/2" Ice	0.90	0.59	0.03
			0.00						
Valmont T-Arm (3)	C	None		0.0000	167.50	No Ice	21.00	21.00	1.01
(T-Mobile - Existing)						1/2" Ice	29.00	29.00	1.24
LPA-80063/6CF	A	From Face	3.00	0.0000	161.00	No Ice	10.31	9.01	0.03
(Verizon - Reserved)			6.00			1/2" Ice	10.87	9.55	0.10
			0.00						
LPA-171063-12CF	A	From Face	3.00	0.0000	161.00	No Ice	5.99	6.05	0.01
(Verizon - Reserved)			4.00			1/2" Ice	6.46	6.52	0.06
			0.00						
BXA-70063/6CF	A	From Face	3.00	0.0000	161.00	No Ice	7.73	4.16	0.02
(Verizon - Reserved)			1.00			1/2" Ice	8.27	4.60	0.06
			0.00						
BXA-70063/6CF	A	From Face	3.00	0.0000	161.00	No Ice	7.73	4.16	0.02
(Verizon - Reserved)			-1.00			1/2" Ice	8.27	4.60	0.06
			0.00						
LPA-171063-12CF	A	From Face	3.00	0.0000	161.00	No Ice	5.99	6.05	0.01
(Verizon - Reserved)			-4.00			1/2" Ice	6.46	6.52	0.06
			0.00						
LPA-80063/6CF	A	From Face	3.00	0.0000	161.00	No Ice	10.31	9.01	0.03
(Verizon - Reserved)			-6.00			1/2" Ice	10.87	9.55	0.10
			0.00						
LPA-80063/6CF	B	From Face	3.00	0.0000	161.00	No Ice	10.31	9.01	0.03
(Verizon - Reserved)			6.00			1/2" Ice	10.87	9.55	0.10
			0.00						
LPA-171063-12CF	B	From Face	3.00	0.0000	161.00	No Ice	5.99	6.05	0.01
(Verizon - Reserved)			4.00			1/2" Ice	6.46	6.52	0.06
			0.00						
BXA-70063/6CF	B	From Face	3.00	0.0000	161.00	No Ice	7.73	4.16	0.02
(Verizon - Reserved)			1.00			1/2" Ice	8.27	4.60	0.06
			0.00						
BXA-70063/6CF	B	From Face	3.00	0.0000	161.00	No Ice	7.73	4.16	0.02
(Verizon - Reserved)			-1.00			1/2" Ice	8.27	4.60	0.06
			0.00						
LPA-171063-12CF	B	From Face	3.00	0.0000	161.00	No Ice	5.99	6.05	0.01

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* °	*Placement* *ft*		C_AA_A *Front* *ft*²	C_AA_A *Side* *ft*²	*Weight* *K*
(Verizon - Reserved)			-4.00 0.00			1/2" Ice	6.46	6.52	0.06
LPA-80063/6CF (Verizon - Reserved)	B	From Face	3.00 -6.00 0.00	0.0000	161.00	No Ice 1/2" Ice	10.31 10.87	9.01 9.55	0.03 0.10
LPA-80063/6CF (Verizon - Reserved)	C	From Face	3.00 6.00 0.00	0.0000	161.00	No Ice 1/2" Ice	10.31 10.87	9.01 9.55	0.03 0.10
LPA-171063-12CF (Verizon - Reserved)	C	From Face	3.00 4.00 0.00	0.0000	161.00	No Ice 1/2" Ice	5.99 6.46	6.05 6.52	0.01 0.06
BXA-70063/6CF (Verizon - Reserved)	C	From Face	3.00 1.00 0.00	0.0000	161.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
BXA-70063/6CF (Verizon - Reserved)	C	From Face	3.00 -1.00 0.00	0.0000	161.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
LPA-171063-12CF (Verizon - Reserved)	C	From Face	3.00 -4.00 0.00	0.0000	161.00	No Ice 1/2" Ice	5.99 6.46	6.05 6.52	0.01 0.06
LPA-80063/6CF (Verizon - Reserved)	C	From Face	3.00 -6.00 0.00	0.0000	161.00	No Ice 1/2" Ice	10.31 10.87	9.01 9.55	0.03 0.10
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	A	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	0.00 0.00	0.08 0.14	0.00 0.01
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	B	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	0.00 0.00	0.08 0.14	0.00 0.01
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	C	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	0.00 0.00	0.08 0.14	0.00 0.01
RRH2x40-AWS (Verizon - Reserved)	A	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	2.52 2.75	1.59 1.80	0.04 0.06
RRH2x40-AWS (Verizon - Reserved)	B	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	2.52 2.75	1.59 1.80	0.04 0.06
RRH2x40-AWS (Verizon - Reserved)	C	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	2.52 2.75	1.59 1.80	0.04 0.06
RRH2x40-07-U (Verizon - Reserved)	A	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	2.25 2.45	1.23 1.39	0.05 0.07
RRH2x40-07-U (Verizon - Reserved)	B	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	2.25 2.45	1.23 1.39	0.05 0.07
RRH2x40-07-U (Verizon - Reserved)	C	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	2.25 2.45	1.23 1.39	0.05 0.07
DB-T1-6Z-8AB-0Z (Verizon - Reserved)	C	From Face	3.00 0.00 0.00	0.0000	161.00	No Ice 1/2" Ice	5.60 5.92	2.33 2.56	0.04 0.08
EEI Low Profile Platform (Verizon - Existing)	C	None		0.0000	160.00	No Ice 1/2" Ice	22.50 28.20	22.50 28.20	1.50 2.25
(2) DB980F90E-M (Sprint - Existing)	A	From Face	3.00 0.00	0.0000	148.00	No Ice 1/2" Ice	3.90 4.28	2.29 2.65	0.01 0.03

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft ft ft*	*Azimuth Adjustment* °	*Placement* *ft*		C_AA_A *Front* ft^2	C_AA_A *Side* ft^2	*Weight* *K*
			0.00						
(2) DB980F90E-M (Sprint - Existing)	B	From Face	3.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	3.90 4.28	2.29 2.65	0.01 0.03
(2) DB980F90E-M (Sprint - Existing)	C	From Face	3.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	3.90 4.28	2.29 2.65	0.01 0.03
EEI Low Profile Platform (Sprint - Existing)	C	None		0.0000	147.00	No Ice 1/2" Ice	22.50 28.20	22.50 28.20	1.50 2.25
(2) AM-X-CD-14-65-00TT-RET (AT&T - Existing)	A	From Face	3.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	5.51 5.90	2.83 3.14	0.04 0.07
(2) AM-X-CD-14-65-00TT-RET (AT&T - Existing)	B	From Face	3.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	5.51 5.90	2.83 3.14	0.04 0.07
(2) AM-X-CD-14-65-00TT-RET (AT&T - Existing)	C	From Face	3.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	5.51 5.90	2.83 3.14	0.04 0.07
7770.00 (AT&T - Existing)	A	From Face	3.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
7770.00 (AT&T - Existing)	B	From Face	3.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
7770.00 (AT&T - Existing)	C	From Face	3.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
(2) TT19-08BP111-001 TMA (AT&T - Existing)	A	From Face	3.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	0.64 0.76	0.52 0.62	0.02 0.02
(2) TT19-08BP111-001 TMA (AT&T - Existing)	B	From Face	3.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	0.64 0.76	0.52 0.62	0.02 0.02
(2) TT19-08BP111-001 TMA (AT&T - Existing)	C	From Face	3.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	0.64 0.76	0.52 0.62	0.02 0.02
EEI Low Profile Platform (AT&T - Existing)	C	None		0.0000	136.00	No Ice 1/2" Ice	22.50 28.20	22.50 28.20	1.50 2.25
(2) RRUS-11 (AT&T - Existing)	A	From Leg	0.50 0.00 0.00	0.0000	143.00	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	0.05 0.07
(2) RRUS-11 (AT&T - Existing)	B	From Leg	0.50 0.00 0.00	0.0000	143.00	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	0.05 0.07
(2) RRUS-11 (AT&T - Existing)	C	From Leg	0.50 0.00 0.00	0.0000	143.00	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	0.05 0.07
DC6-48-60-18-8F Surge Arrestor (AT&T - Existing)	C	From Face	0.50 0.00 0.00	0.0000	143.00	No Ice 1/2" Ice	2.23 2.45	2.23 2.45	0.02 0.04
Valmont Uni-Tri Bracket (AT&T - Existing)	C	None		0.0000	143.00	No Ice 1/2" Ice	1.75 1.94	1.75 1.94	0.29 0.31
4-ft Standoff (Town - Existing)	B	From Leg	2.00 0.00 0.00	0.0000	119.50	No Ice 1/2" Ice	1.40 1.73	0.09 0.13	0.03 0.04
779-70 (Town - Existing)	B	From Leg	4.00 0.00	0.0000	113.50	No Ice 1/2" Ice	2.80 3.30	2.80 3.30	0.03 0.03

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert (ft ft ft)	Azimuth Adjustment (°)	Placement (ft)		C_AA_A Front (ft^2)	C_AA_A Side (ft^2)	Weight (K)
4-ft Standoff (Town - Existing)	B	From Leg	0.00 2.00 0.00	0.0000	111.50	No Ice 1/2" Ice	1.40 1.73	0.09 0.13	0.03 0.04
GPS (Sprint - Existing)	A	From Face	0.00 3.00 0.00	0.0000	76.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
3' GPS Stand-off Mount (Sprint - Existing)	A	None	0.00	0.0000	76.00	No Ice 1/2" Ice	2.45 3.98	2.45 3.98	0.05 0.07

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	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 171.50-161.50	166.43	1.588	41	22.342	A	0.000	22.342	22.342	100.00	0.000	1.683
					B	0.000	22.342		100.00	0.000	0.000
					C	0.000	22.342		100.00	0.000	0.000
L2 161.50-127.46	143.75	1.523	39	93.519	A	0.000	93.519	93.519	100.00	0.000	6.741
					B	0.000	93.519		100.00	0.000	6.048
					C	0.000	93.519		100.00	0.000	0.000
L3 127.46-83.77	104.96	1.392	36	157.207	A	0.000	157.207	157.207	100.00	0.000	8.650
					B	0.000	157.207		100.00	0.000	8.650
					C	0.000	157.207		100.00	0.000	0.000
L4 83.77-41.12	62.23	1.199	31	191.322	A	0.000	191.322	191.322	100.00	0.000	8.445
					B	0.000	191.322		100.00	0.000	8.445
					C	0.000	191.322		100.00	0.000	0.000
L5 41.12-1.00	20.51	1	26	213.207	A	0.000	213.207	213.207	100.00	0.000	7.350
					B	0.000	213.207		100.00	0.000	6.558
					C	0.000	213.207		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G 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 171.50-161.50	166.43	1.588	30	0.5000	23.175	A	0.000	23.175	23.175	100.00	0.000	2.533
						B	0.000	23.175		100.00	0.000	0.000
						C	0.000	23.175		100.00	0.000	0.000
L2 161.50-127.46	143.75	1.523	29	0.5000	96.356	A	0.000	96.356	96.356	100.00	0.000	10.145
						B	0.000	96.356		100.00	0.000	9.102

Section Elevation ft	z ft	K_Z	q_z psf	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
						C	0.000	96.356		100.00	0.000	0.000
L3 127.46-83.77	104.96	1.392	27	0.5000	160.847	A	0.000	160.847	160.847	100.00	0.000	13.018
						B	0.000	160.847		100.00	0.000	13.018
						C	0.000	160.847		100.00	0.000	0.000
L4 83.77-41.12	62.23	1.199	23	0.5000	194.876	A	0.000	194.876	194.876	100.00	0.000	12.710
						B	0.000	194.876		100.00	0.000	12.710
						C	0.000	194.876		100.00	0.000	0.000
L5 41.12-1.00	20.51	1	19	0.5000	216.550	A	0.000	216.550	216.550	100.00	0.000	11.062
						B	0.000	216.550		100.00	0.000	9.870
						C	0.000	216.550		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G 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 171.50-161.50	166.43	1.588	10	22.342	A	0.000	22.342	22.342	100.00	0.000	1.683
					B	0.000	22.342		100.00	0.000	0.000
					C	0.000	22.342		100.00	0.000	0.000
L2 161.50-127.46	143.75	1.523	10	93.519	A	0.000	93.519	93.519	100.00	0.000	6.741
					B	0.000	93.519		100.00	0.000	6.048
					C	0.000	93.519		100.00	0.000	0.000
L3 127.46-83.77	104.96	1.392	9	157.207	A	0.000	157.207	157.207	100.00	0.000	8.650
					B	0.000	157.207		100.00	0.000	8.650
					C	0.000	157.207		100.00	0.000	0.000
L4 83.77-41.12	62.23	1.199	8	191.322	A	0.000	191.322	191.322	100.00	0.000	8.445
					B	0.000	191.322		100.00	0.000	8.445
					C	0.000	191.322		100.00	0.000	0.000
L5 41.12-1.00	20.51	1	6	213.207	A	0.000	213.207	213.207	100.00	0.000	7.350
					B	0.000	213.207		100.00	0.000	6.558
					C	0.000	213.207		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 171.50-161.50	0.13	0.54	A	1	0.65	1	1	1	22.342	1.11	111.32	C
			B	1	0.65	1	1	1	22.342			
			C	1	0.65	1	1	1	22.342			
L2 161.50-127.46	1.53	3.01	A	1	0.65	1	1	1	93.519	4.84	142.28	C
			B	1	0.65	1	1	1	93.519			
			C	1	0.65	1	1	1	93.519			
L3 127.46-83.77	2.75	8.35	A	1	0.65	1	1	1	157.207	7.18	164.37	C
			B	1	0.65	1	1	1	157.207			
			C	1	0.65	1	1	1	157.207			
L4 83.77-41.12	2.69	12.23	A	1	0.65	1	1	1	191.322	7.29	170.81	C
			B	1	0.65	1	1	1	191.322			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
			C	1	0.65	1	1	1	191.322			
L5 41.12-1.00	2.22	14.14	A	1	0.65	1	1	1	213.207	6.60	164.44	C
			B	1	0.65	1	1	1	213.207			
			C	1	0.65	1	1	1	213.207			
Sum Weight:	9.32	38.27						OTM	2196.84 kip-ft	27.02		

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 ft^2	F K	w plf	Ctrl. Face
L1 171.50-161.50	0.13	0.54	A	1	0.65	1	1	1	22.342	1.11	111.32	C
			B	1	0.65	1	1	1	22.342			
			C	1	0.65	1	1	1	22.342			
L2 161.50-127.46	1.53	3.01	A	1	0.65	1	1	1	93.519	4.84	142.28	C
			B	1	0.65	1	1	1	93.519			
			C	1	0.65	1	1	1	93.519			
L3 127.46-83.77	2.75	8.35	A	1	0.65	1	1	1	157.207	7.18	164.37	C
			B	1	0.65	1	1	1	157.207			
			C	1	0.65	1	1	1	157.207			
L4 83.77-41.12	2.69	12.23	A	1	0.65	1	1	1	191.322	7.29	170.81	C
			B	1	0.65	1	1	1	191.322			
			C	1	0.65	1	1	1	191.322			
L5 41.12-1.00	2.22	14.14	A	1	0.65	1	1	1	213.207	6.60	164.44	C
			B	1	0.65	1	1	1	213.207			
			C	1	0.65	1	1	1	213.207			
Sum Weight:	9.32	38.27						OTM	2196.84 kip-ft	27.02		

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 ft^2	F K	w plf	Ctrl. Face
L1 171.50-161.50	0.13	0.54	A	1	0.65	1	1	1	22.342	1.11	111.32	C
			B	1	0.65	1	1	1	22.342			
			C	1	0.65	1	1	1	22.342			
L2 161.50-127.46	1.53	3.01	A	1	0.65	1	1	1	93.519	4.84	142.28	C
			B	1	0.65	1	1	1	93.519			
			C	1	0.65	1	1	1	93.519			
L3 127.46-83.77	2.75	8.35	A	1	0.65	1	1	1	157.207	7.18	164.37	C
			B	1	0.65	1	1	1	157.207			
			C	1	0.65	1	1	1	157.207			
L4 83.77-41.12	2.69	12.23	A	1	0.65	1	1	1	191.322	7.29	170.81	C
			B	1	0.65	1	1	1	191.322			
			C	1	0.65	1	1	1	191.322			
L5 41.12-1.00	2.22	14.14	A	1	0.65	1	1	1	213.207	6.60	164.44	C
			B	1	0.65	1	1	1	213.207			

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
			C	1	0.65	1	1	1	213.207			
Sum Weight:	9.32	38.27						OTM	2196.84 kip-ft	27.02		

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 ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
L1 171.50-161.50	0.13	0.54	A	1	0.65	1	1	1	22.342	1.11	111.32	C
			B	1	0.65	1	1	1	22.342			
			C	1	0.65	1	1	1	22.342			
L2 161.50-127.46	1.53	3.01	A	1	0.65	1	1	1	93.519	4.84	142.28	C
			B	1	0.65	1	1	1	93.519			
			C	1	0.65	1	1	1	93.519			
L3 127.46-83.77	2.75	8.35	A	1	0.65	1	1	1	157.207	7.18	164.37	C
			B	1	0.65	1	1	1	157.207			
			C	1	0.65	1	1	1	157.207			
L4 83.77-41.12	2.69	12.23	A	1	0.65	1	1	1	191.322	7.29	170.81	C
			B	1	0.65	1	1	1	191.322			
			C	1	0.65	1	1	1	191.322			
L5 41.12-1.00	2.22	14.14	A	1	0.65	1	1	1	213.207	6.60	164.44	C
			B	1	0.65	1	1	1	213.207			
			C	1	0.65	1	1	1	213.207			
Sum Weight:	9.32	38.27						OTM	2196.84 kip-ft	27.02		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
L1 171.50-161.50	0.14	0.71	A	1	0.65	1	1	1	23.175	0.91	90.66	C
			B	1	0.65	1	1	1	23.175			
			C	1	0.65	1	1	1	23.175			
L2 161.50-127.46	1.95	3.71	A	1	0.65	1	1	1	96.356	4.04	118.75	C
			B	1	0.65	1	1	1	96.356			
			C	1	0.65	1	1	1	96.356			
L3 127.46-83.77	3.34	9.52	A	1	0.65	1	1	1	160.847	5.89	134.73	C
			B	1	0.65	1	1	1	160.847			
			C	1	0.65	1	1	1	160.847			
L4 83.77-41.12	3.27	13.66	A	1	0.65	1	1	1	194.876	5.88	137.94	C
			B	1	0.65	1	1	1	194.876			
			C	1	0.65	1	1	1	194.876			
L5 41.12-1.00	2.69	15.74	A	1	0.65	1	1	1	216.550	5.25	130.77	C
			B	1	0.65	1	1	1	216.550			
			C	1	0.65	1	1	1	216.550			
Sum Weight:	11.40	43.34						OTM	1801.52 kip-ft	21.96		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 171.50-161.50	0.14	0.71	A	1	0.65	1	1	1	23.175	0.91	90.66	C
			B	1	0.65	1	1	1	23.175			
			C	1	0.65	1	1	1	23.175			
L2 161.50-127.46	1.95	3.71	A	1	0.65	1	1	1	96.356	4.04	118.75	C
			B	1	0.65	1	1	1	96.356			
			C	1	0.65	1	1	1	96.356			
L3 127.46-83.77	3.34	9.52	A	1	0.65	1	1	1	160.847	5.89	134.73	C
			B	1	0.65	1	1	1	160.847			
			C	1	0.65	1	1	1	160.847			
L4 83.77-41.12	3.27	13.66	A	1	0.65	1	1	1	194.876	5.88	137.94	C
			B	1	0.65	1	1	1	194.876			
			C	1	0.65	1	1	1	194.876			
L5 41.12-1.00	2.69	15.74	A	1	0.65	1	1	1	216.550	5.25	130.77	C
			B	1	0.65	1	1	1	216.550			
			C	1	0.65	1	1	1	216.550			
Sum Weight:	11.40	43.34						OTM	1801.52 kip-ft	21.96		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 171.50-161.50	0.14	0.71	A	1	0.65	1	1	1	23.175	0.91	90.66	C
			B	1	0.65	1	1	1	23.175			
			C	1	0.65	1	1	1	23.175			
L2 161.50-127.46	1.95	3.71	A	1	0.65	1	1	1	96.356	4.04	118.75	C
			B	1	0.65	1	1	1	96.356			
			C	1	0.65	1	1	1	96.356			
L3 127.46-83.77	3.34	9.52	A	1	0.65	1	1	1	160.847	5.89	134.73	C
			B	1	0.65	1	1	1	160.847			
			C	1	0.65	1	1	1	160.847			
L4 83.77-41.12	3.27	13.66	A	1	0.65	1	1	1	194.876	5.88	137.94	C
			B	1	0.65	1	1	1	194.876			
			C	1	0.65	1	1	1	194.876			
L5 41.12-1.00	2.69	15.74	A	1	0.65	1	1	1	216.550	5.25	130.77	C
			B	1	0.65	1	1	1	216.550			
			C	1	0.65	1	1	1	216.550			
Sum Weight:	11.40	43.34						OTM	1801.52 kip-ft	21.96		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E *ft²*	*F* *K*	*w* *plf*	*Ctrl. Face*
L1 171.50-161.50	0.14	0.71	A	1	0.65	1	1	1	23.175	0.91	90.66	C
			B	1	0.65	1	1	1	23.175			
			C	1	0.65	1	1	1	23.175			
L2 161.50-127.46	1.95	3.71	A	1	0.65	1	1	1	96.356	4.04	118.75	C
			B	1	0.65	1	1	1	96.356			
			C	1	0.65	1	1	1	96.356			
L3 127.46-83.77	3.34	9.52	A	1	0.65	1	1	1	160.847	5.89	134.73	C
			B	1	0.65	1	1	1	160.847			
			C	1	0.65	1	1	1	160.847			
L4 83.77-41.12	3.27	13.66	A	1	0.65	1	1	1	194.876	5.88	137.94	C
			B	1	0.65	1	1	1	194.876			
			C	1	0.65	1	1	1	194.876			
L5 41.12-1.00	2.69	15.74	A	1	0.65	1	1	1	216.550	5.25	130.77	C
			B	1	0.65	1	1	1	216.550			
			C	1	0.65	1	1	1	216.550			
Sum Weight:	11.40	43.34						OTM	1801.52 kip-ft	21.96		

Tower Forces - Service - Wind Normal To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E *ft²*	*F* *K*	*w* *plf*	*Ctrl. Face*
L1 171.50-161.50	0.13	0.54	A	1	0.65	1	1	1	22.342	0.28	27.83	C
			B	1	0.65	1	1	1	22.342			
			C	1	0.65	1	1	1	22.342			
L2 161.50-127.46	1.53	3.01	A	1	0.65	1	1	1	93.519	1.21	35.57	C
			B	1	0.65	1	1	1	93.519			
			C	1	0.65	1	1	1	93.519			
L3 127.46-83.77	2.75	8.35	A	1	0.65	1	1	1	157.207	1.80	41.09	C
			B	1	0.65	1	1	1	157.207			
			C	1	0.65	1	1	1	157.207			
L4 83.77-41.12	2.69	12.23	A	1	0.65	1	1	1	191.322	1.82	42.70	C
			B	1	0.65	1	1	1	191.322			
			C	1	0.65	1	1	1	191.322			
L5 41.12-1.00	2.22	14.14	A	1	0.65	1	1	1	213.207	1.65	41.11	C
			B	1	0.65	1	1	1	213.207			
			C	1	0.65	1	1	1	213.207			
Sum Weight:	9.32	38.27						OTM	549.21 kip-ft	6.75		

Tower Forces - Service - Wind 45 To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E *ft²*	*F* *K*	*w* *plf*	*Ctrl. Face*
L1 171.50-161.50	0.13	0.54	A	1	0.65	1	1	1	22.342	0.28	27.83	C
			B	1	0.65	1	1	1	22.342			
			C	1	0.65	1	1	1	22.342			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L2 161.50-127.46	1.53	3.01	A	1	0.65	1	1	1	93.519	1.21	35.57	C
			B	1	0.65	1	1	1	93.519			
			C	1	0.65	1	1	1	93.519			
L3 127.46-83.77	2.75	8.35	A	1	0.65	1	1	1	157.207	1.80	41.09	C
			B	1	0.65	1	1	1	157.207			
			C	1	0.65	1	1	1	157.207			
L4 83.77-41.12	2.69	12.23	A	1	0.65	1	1	1	191.322	1.82	42.70	C
			B	1	0.65	1	1	1	191.322			
			C	1	0.65	1	1	1	191.322			
L5 41.12-1.00	2.22	14.14	A	1	0.65	1	1	1	213.207	1.65	41.11	C
			B	1	0.65	1	1	1	213.207			
			C	1	0.65	1	1	1	213.207			
Sum Weight:	9.32	38.27						OTM	549.21 kip-ft	6.75		

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 plf	Ctrl. Face
L1 171.50-161.50	0.13	0.54	A	1	0.65	1	1	1	22.342	0.28	27.83	C
			B	1	0.65	1	1	1	22.342			
			C	1	0.65	1	1	1	22.342			
L2 161.50-127.46	1.53	3.01	A	1	0.65	1	1	1	93.519	1.21	35.57	C
			B	1	0.65	1	1	1	93.519			
			C	1	0.65	1	1	1	93.519			
L3 127.46-83.77	2.75	8.35	A	1	0.65	1	1	1	157.207	1.80	41.09	C
			B	1	0.65	1	1	1	157.207			
			C	1	0.65	1	1	1	157.207			
L4 83.77-41.12	2.69	12.23	A	1	0.65	1	1	1	191.322	1.82	42.70	C
			B	1	0.65	1	1	1	191.322			
			C	1	0.65	1	1	1	191.322			
L5 41.12-1.00	2.22	14.14	A	1	0.65	1	1	1	213.207	1.65	41.11	C
			B	1	0.65	1	1	1	213.207			
			C	1	0.65	1	1	1	213.207			
Sum Weight:	9.32	38.27						OTM	549.21 kip-ft	6.75		

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 plf	Ctrl. Face
L1 171.50-161.50	0.13	0.54	A	1	0.65	1	1	1	22.342	0.28	27.83	C
			B	1	0.65	1	1	1	22.342			
			C	1	0.65	1	1	1	22.342			
L2 161.50-127.46	1.53	3.01	A	1	0.65	1	1	1	93.519	1.21	35.57	C
			B	1	0.65	1	1	1	93.519			
			C	1	0.65	1	1	1	93.519			

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	R_R	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
L3 127.46-83.77	2.75	8.35	A	1	0.65	1	1	1	157.207	1.80	41.09	C
			B	1	0.65	1	1	1	157.207			
			C	1	0.65	1	1	1	157.207			
L4 83.77-41.12	2.69	12.23	A	1	0.65	1	1	1	191.322	1.82	42.70	C
			B	1	0.65	1	1	1	191.322			
			C	1	0.65	1	1	1	191.322			
L5 41.12-1.00	2.22	14.14	A	1	0.65	1	1	1	213.207	1.65	41.11	C
			B	1	0.65	1	1	1	213.207			
			C	1	0.65	1	1	1	213.207			
Sum Weight:	9.32	38.27						OTM	549.21 kip-ft	6.75		

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	38.27					
Bracing Weight	0.00					
Total Member Self-Weight	38.27			0.47	-0.25	
Total Weight	55.70			0.47	-0.25	
Wind 0 deg - No Ice		-0.07	-51.06	-5893.05	7.80	1.07
Wind 30 deg - No Ice		25.40	-44.19	-5099.44	-2926.91	1.86
Wind 45 deg - No Ice		35.96	-36.06	-4161.18	-4143.34	2.07
Wind 60 deg - No Ice		44.06	-25.47	-2939.31	-5077.42	2.14
Wind 90 deg - No Ice		50.92	0.07	8.53	-5867.51	1.86
Wind 120 deg - No Ice		44.13	25.59	2954.21	-5085.48	1.07
Wind 135 deg - No Ice		36.06	36.16	4173.52	-4154.73	0.55
Wind 150 deg - No Ice		25.52	44.26	5108.44	-2940.86	-0.00
Wind 180 deg - No Ice		0.07	51.06	5894.00	-8.31	-1.07
Wind 210 deg - No Ice		-25.40	44.19	5100.39	2926.40	-1.86
Wind 225 deg - No Ice		-35.96	36.06	4162.13	4142.83	-2.07
Wind 240 deg - No Ice		-44.06	25.47	2940.26	5076.92	-2.14
Wind 270 deg - No Ice		-50.92	-0.07	-7.58	5867.01	-1.86
Wind 300 deg - No Ice		-44.13	-25.59	-2953.27	5084.97	-1.07
Wind 315 deg - No Ice		-36.06	-36.16	-4172.57	4154.22	-0.55
Wind 330 deg - No Ice		-25.52	-44.26	-5107.50	2940.35	0.00
Member Ice	5.07					
Total Weight Ice	67.31			0.74	-0.33	
Wind 0 deg - Ice		-0.06	-42.53	-4956.19	7.05	0.77
Wind 30 deg - Ice		21.16	-36.80	-4288.39	-2462.96	1.48
Wind 45 deg - Ice		29.96	-30.03	-3499.12	-3486.83	1.70
Wind 60 deg - Ice		36.71	-21.21	-2471.33	-4273.11	1.79
Wind 90 deg - Ice		42.43	0.06	8.12	-4938.37	1.62
Wind 120 deg - Ice		36.78	21.32	2485.60	-4280.49	1.02
Wind 135 deg - Ice		30.05	30.12	3511.04	-3497.28	0.60
Wind 150 deg - Ice		21.27	36.86	4297.26	-2475.75	0.14
Wind 180 deg - Ice		0.06	42.53	4957.67	-7.72	-0.77
Wind 210 deg - Ice		-21.16	36.80	4289.87	2462.29	-1.48
Wind 225 deg - Ice		-29.96	30.03	3500.59	3486.17	-1.70
Wind 240 deg - Ice		-36.71	21.21	2472.81	4272.44	-1.79
Wind 270 deg - Ice		-42.43	-0.06	-6.65	4937.71	-1.62
Wind 300 deg - Ice		-36.78	-21.32	-2484.12	4279.83	-1.02
Wind 315 deg - Ice		-30.05	-30.12	-3509.56	3496.61	-0.60
Wind 330 deg - Ice		-21.27	-36.86	-4295.78	2475.08	-0.14

Load Case	*Vertical Forces* *K*	*Sum of Forces X* *K*	*Sum of Forces Z* *K*	*Sum of Overturning Moments,* M_x *kip-ft*	*Sum of Overturning Moments,* M_z *kip-ft*	*Sum of Torques* *kip-ft*
Total Weight	55.70			0.47	-0.25	
Wind 0 deg - Service		-0.02	-12.77	-1472.91	1.76	0.27
Wind 30 deg - Service		6.35	-11.05	-1274.51	-731.92	0.46
Wind 45 deg - Service		8.99	-9.01	-1039.94	-1036.02	0.52
Wind 60 deg - Service		11.02	-6.37	-734.47	-1269.55	0.54
Wind 90 deg - Service		12.73	0.02	2.49	-1467.07	0.46
Wind 120 deg - Service		11.03	6.40	738.91	-1271.56	0.27
Wind 135 deg - Service		9.01	9.04	1043.73	-1038.87	0.14
Wind 150 deg - Service		6.38	11.06	1277.47	-735.41	-0.00
Wind 180 deg - Service		0.02	12.77	1473.85	-2.27	-0.27
Wind 210 deg - Service		-6.35	11.05	1275.45	731.41	-0.46
Wind 225 deg - Service		-8.99	9.01	1040.89	1035.52	-0.52
Wind 240 deg - Service		-11.02	6.37	735.42	1269.04	-0.54
Wind 270 deg - Service		-12.73	-0.02	-1.54	1466.56	-0.46
Wind 300 deg - Service		-11.03	-6.40	-737.96	1271.05	-0.27
Wind 315 deg - Service		-9.01	-9.04	-1042.79	1038.37	-0.14
Wind 330 deg - Service		-6.38	-11.06	-1276.52	734.90	0.00

Load Combinations

Comb. No.	*Description*
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp

Comb. No.	Description
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	171.5 - 161.5	Pole	Max Tension	43	0.00	0.00	0.00
			Max. Compression	18	-2.99	0.01	-0.13
			Max. Mx	14	-1.86	38.39	-0.07
			Max. My	10	-1.86	0.05	-38.49
			Max. Vy	6	5.39	-38.36	-0.07
			Max. Vx	10	5.39	0.05	-38.49
			Max. Torque	4			-0.69
L2	161.5 - 127.456	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-17.93	0.01	-0.54
			Max. Mx	14	-10.33	647.98	-0.25
			Max. My	10	-10.30	0.01	-654.65
			Max. Vy	6	29.35	-647.95	-0.28
			Max. Vx	10	29.58	0.01	-654.65
			Max. Torque	5			-1.50
L3	127.456 - 83.771	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-29.87	-0.40	-0.78
			Max. Mx	6	-20.92	-2045.75	-2.31
			Max. My	10	-20.91	-2.11	-2059.90
			Max. Vy	6	36.72	-2045.75	-2.31
			Max. Vx	10	36.86	-2.11	-2059.90
			Max. Torque	5			-2.38
L4	83.771 - 41.12	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-45.81	-0.33	-0.74
			Max. Mx	6	-35.57	-3715.18	-5.28
			Max. My	10	-35.56	-5.05	-3735.39
			Max. Vy	6	43.85	-3715.18	-5.28
			Max. Vx	10	43.99	-5.05	-3735.39
			Max. Torque	5			-2.38
L5	41.12 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-67.31	-0.33	-0.74
			Max. Mx	6	-55.67	-5995.42	-8.70
			Max. My	10	-55.67	-8.47	-6022.53
			Max. Vy	6	50.95	-5995.42	-8.70
			Max. Vx	10	51.09	-8.47	-6022.53
			Max. Torque	5			-2.13

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	27	67.31	-0.06	-42.53
	Max. H_x	14	55.70	50.92	0.07
	Max. H_z	2	55.70	0.07	51.06
	Max. M_x	2	6021.55	0.07	51.06
	Max. M_z	6	5995.42	-50.92	-0.07
	Max. Torsion	13	2.13	44.06	-25.47
	Min. Vert	1	55.70	0.00	0.00
	Min. H_x	6	55.70	-50.92	-0.07
	Min. H_z	10	55.70	-0.07	-51.06
	Min. M_x	10	-6022.53	-0.07	-51.06
	Min. M_z	14	-5994.89	50.92	0.07
	Min. Torsion	5	-2.13	-44.06	25.47

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	55.70	0.00	0.00	0.47	-0.25	0.00
Dead+Wind 0 deg - No Ice	55.70	-0.07	-51.06	-6021.55	7.95	1.06
Dead+Wind 30 deg - No Ice	55.70	25.40	-44.19	-5210.68	-2990.70	1.84
Dead+Wind 45 deg - No Ice	55.70	35.96	-36.06	-4251.97	-4233.65	2.06
Dead+Wind 60 deg - No Ice	55.70	44.06	-25.47	-3003.46	-5188.10	2.13
Dead+Wind 90 deg - No Ice	55.70	50.92	0.07	8.69	-5995.42	1.84
Dead+Wind 120 deg - No Ice	55.70	44.13	25.59	3018.64	-5196.30	1.07
Dead+Wind 135 deg - No Ice	55.70	36.06	36.16	4264.54	-4245.25	0.55
Dead+Wind 150 deg - No Ice	55.70	25.52	44.26	5219.84	-3004.92	0.00
Dead+Wind 180 deg - No Ice	55.70	0.07	51.06	6022.53	-8.47	-1.06
Dead+Wind 210 deg - No Ice	55.70	-25.40	44.19	5211.65	2990.19	-1.84
Dead+Wind 225 deg - No Ice	55.70	-35.96	36.06	4252.94	4233.14	-2.05
Dead+Wind 240 deg - No Ice	55.70	-44.06	25.47	3004.43	5187.59	-2.13
Dead+Wind 270 deg - No Ice	55.70	-50.92	-0.07	-7.73	5994.89	-1.84
Dead+Wind 300 deg - No Ice	55.70	-44.13	-25.59	-3017.67	5195.77	-1.07
Dead+Wind 315 deg - No Ice	55.70	-36.06	-36.16	-4263.56	4244.72	-0.55
Dead+Wind 330 deg - No Ice	55.70	-25.52	-44.26	-5218.86	3004.39	-0.00
Dead+Ice+Temp	67.31	0.00	0.00	0.74	-0.33	0.00
Dead+Wind 0 deg+Ice+Temp	67.31	-0.06	-42.53	-5103.83	7.23	0.77
Dead+Wind 30 deg+Ice+Temp	67.31	21.16	-36.80	-4416.17	-2536.30	1.47
Dead+Wind 45 deg+Ice+Temp	67.31	29.96	-30.03	-3603.39	-3590.65	1.69
Dead+Wind 60 deg+Ice+Temp	67.31	36.71	-21.21	-2544.99	-4400.34	1.78
Dead+Wind 90 deg+Ice+Temp	67.31	42.43	0.06	8.35	-5085.40	1.62
Dead+Wind 120 deg+Ice+Temp	67.31	36.78	21.32	2559.65	-4407.91	1.01
Dead+Wind 135 deg+Ice+Temp	67.31	30.05	30.12	3615.64	-3601.36	0.60
Dead+Wind 150 deg+Ice+Temp	67.31	21.27	36.86	4425.28	-2549.41	0.14
Dead+Wind 180 deg+Ice+Temp	67.31	0.06	42.53	5105.38	-7.92	-0.77
Dead+Wind 210 deg+Ice+Temp	67.31	-21.16	36.80	4417.72	2535.61	-1.47
Dead+Wind 225 deg+Ice+Temp	67.31	-29.96	30.03	3604.94	3589.97	-1.68

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead+Wind 240 deg+Ice+Temp	67.31	-36.71	21.21	2546.53	4399.65	-1.78
Dead+Wind 270 deg+Ice+Temp	67.31	-42.43	-0.06	-6.80	5084.70	-1.62
Dead+Wind 300 deg+Ice+Temp	67.31	-36.78	-21.32	-2558.10	4407.21	-1.02
Dead+Wind 315 deg+Ice+Temp	67.31	-30.05	-30.12	-3614.09	3600.66	-0.60
Dead+Wind 330 deg+Ice+Temp	67.31	-21.27	-36.86	-4423.73	2548.72	-0.14
Dead+Wind 0 deg - Service	55.70	-0.02	-12.77	-1506.45	1.79	0.27
Dead+Wind 30 deg - Service	55.70	6.35	-11.05	-1303.53	-748.58	0.46
Dead+Wind 45 deg - Service	55.70	8.99	-9.01	-1063.63	-1059.61	0.52
Dead+Wind 60 deg - Service	55.70	11.02	-6.37	-751.20	-1298.45	0.54
Dead+Wind 90 deg - Service	55.70	12.73	0.02	2.55	-1500.46	0.46
Dead+Wind 120 deg - Service	55.70	11.03	6.40	755.75	-1300.50	0.27
Dead+Wind 135 deg - Service	55.70	9.01	9.04	1067.52	-1062.52	0.14
Dead+Wind 150 deg - Service	55.70	6.38	11.06	1306.57	-752.14	0.00
Dead+Wind 180 deg - Service	55.70	0.02	12.77	1507.44	-2.32	-0.27
Dead+Wind 210 deg - Service	55.70	-6.35	11.05	1304.52	748.06	-0.46
Dead+Wind 225 deg - Service	55.70	-8.99	9.01	1064.61	1059.09	-0.52
Dead+Wind 240 deg - Service	55.70	-11.02	6.37	752.19	1297.92	-0.54
Dead+Wind 270 deg - Service	55.70	-12.73	-0.02	-1.56	1499.94	-0.46
Dead+Wind 300 deg - Service	55.70	-11.03	-6.40	-754.76	1299.97	-0.27
Dead+Wind 315 deg - Service	55.70	-9.01	-9.04	-1066.53	1061.99	-0.14
Dead+Wind 330 deg - Service	55.70	-6.38	-11.06	-1305.59	751.61	-0.00

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-55.70	0.00	0.00	55.70	0.00	0.000%
2	-0.07	-55.70	-51.06	0.07	55.70	51.06	0.000%
3	25.40	-55.70	-44.19	-25.40	55.70	44.19	0.000%
4	35.96	-55.70	-36.06	-35.96	55.70	36.06	0.000%
5	44.06	-55.70	-25.47	-44.06	55.70	25.47	0.000%
6	50.92	-55.70	0.07	-50.92	55.70	-0.07	0.000%
7	44.13	-55.70	25.59	-44.13	55.70	-25.59	0.000%
8	36.06	-55.70	36.16	-36.06	55.70	-36.16	0.000%
9	25.52	-55.70	44.26	-25.52	55.70	-44.26	0.000%
10	0.07	-55.70	51.06	-0.07	55.70	-51.06	0.000%
11	-25.40	-55.70	44.19	25.40	55.70	-44.19	0.000%
12	-35.96	-55.70	36.06	35.96	55.70	-36.06	0.000%
13	-44.06	-55.70	25.47	44.06	55.70	-25.47	0.000%
14	-50.92	-55.70	-0.07	50.92	55.70	0.07	0.000%
15	-44.13	-55.70	-25.59	44.13	55.70	25.59	0.000%
16	-36.06	-55.70	-36.16	36.06	55.70	36.16	0.000%
17	-25.52	-55.70	-44.26	25.52	55.70	44.26	0.000%
18	0.00	-67.31	0.00	0.00	67.31	0.00	0.000%
19	-0.06	-67.31	-42.53	0.06	67.31	42.53	0.000%
20	21.16	-67.31	-36.80	-21.16	67.31	36.80	0.000%
21	29.96	-67.31	-30.03	-29.96	67.31	30.03	0.000%
22	36.71	-67.31	-21.21	-36.71	67.31	21.21	0.000%
23	42.43	-67.31	0.06	-42.43	67.31	-0.06	0.000%
24	36.78	-67.31	21.32	-36.78	67.31	-21.32	0.000%
25	30.05	-67.31	30.12	-30.05	67.31	-30.12	0.000%
26	21.27	-67.31	36.86	-21.27	67.31	-36.86	0.000%
27	0.06	-67.31	42.53	-0.06	67.31	-42.53	0.000%
28	-21.16	-67.31	36.80	21.16	67.31	-36.80	0.000%
29	-29.96	-67.31	30.03	29.96	67.31	-30.03	0.000%
30	-36.71	-67.31	21.21	36.71	67.31	-21.21	0.000%
31	-42.43	-67.31	-0.06	42.43	67.31	0.06	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
32	-36.78	-67.31	-21.32	36.78	67.31	21.32	0.000%
33	-30.05	-67.31	-30.12	30.05	67.31	30.12	0.000%
34	-21.27	-67.31	-36.86	21.27	67.31	36.86	0.000%
35	-0.02	-55.70	-12.77	0.02	55.70	12.77	0.000%
36	6.35	-55.70	-11.05	-6.35	55.70	11.05	0.000%
37	8.99	-55.70	-9.01	-8.99	55.70	9.01	0.000%
38	11.02	-55.70	-6.37	-11.02	55.70	6.37	0.000%
39	12.73	-55.70	0.02	-12.73	55.70	-0.02	0.000%
40	11.03	-55.70	6.40	-11.03	55.70	-6.40	0.000%
41	9.01	-55.70	9.04	-9.01	55.70	-9.04	0.000%
42	6.38	-55.70	11.06	-6.38	55.70	-11.06	0.000%
43	0.02	-55.70	12.77	-0.02	55.70	-12.77	0.000%
44	-6.35	-55.70	11.05	6.35	55.70	-11.05	0.000%
45	-8.99	-55.70	9.01	8.99	55.70	-9.01	0.000%
46	-11.02	-55.70	6.37	11.02	55.70	-6.37	0.000%
47	-12.73	-55.70	-0.02	12.73	55.70	0.02	0.000%
48	-11.03	-55.70	-6.40	11.03	55.70	6.40	0.000%
49	-9.01	-55.70	-9.04	9.01	55.70	9.04	0.000%
50	-6.38	-55.70	-11.06	6.38	55.70	11.06	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00015022
3	Yes	5	0.00000001	0.00016506
4	Yes	5	0.00000001	0.00017494
5	Yes	5	0.00000001	0.00015566
6	Yes	4	0.00000001	0.00034990
7	Yes	5	0.00000001	0.00016387
8	Yes	5	0.00000001	0.00017515
9	Yes	5	0.00000001	0.00016105
10	Yes	4	0.00000001	0.00018930
11	Yes	5	0.00000001	0.00015667
12	Yes	5	0.00000001	0.00017486
13	Yes	5	0.00000001	0.00016565
14	Yes	4	0.00000001	0.00031004
15	Yes	5	0.00000001	0.00015826
16	Yes	5	0.00000001	0.00017507
17	Yes	5	0.00000001	0.00016152
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00009514
20	Yes	5	0.00000001	0.00036384
21	Yes	5	0.00000001	0.00040204
22	Yes	5	0.00000001	0.00035041
23	Yes	5	0.00000001	0.00009643
24	Yes	5	0.00000001	0.00036408
25	Yes	5	0.00000001	0.00040350
26	Yes	5	0.00000001	0.00035859
27	Yes	5	0.00000001	0.00009530
28	Yes	5	0.00000001	0.00035233
29	Yes	5	0.00000001	0.00040218
30	Yes	5	0.00000001	0.00036533
31	Yes	5	0.00000001	0.00009611
32	Yes	5	0.00000001	0.00035432

33	Yes	5	0.00000001	0.00040297
34	Yes	5	0.00000001	0.00036024
35	Yes	4	0.00000001	0.00003026
36	Yes	4	0.00000001	0.00023751
37	Yes	4	0.00000001	0.00025625
38	Yes	4	0.00000001	0.00020459
39	Yes	4	0.00000001	0.00004388
40	Yes	4	0.00000001	0.00023263
41	Yes	4	0.00000001	0.00025586
42	Yes	4	0.00000001	0.00022139
43	Yes	4	0.00000001	0.00003095
44	Yes	4	0.00000001	0.00020749
45	Yes	4	0.00000001	0.00025638
46	Yes	4	0.00000001	0.00024075
47	Yes	4	0.00000001	0.00004296
48	Yes	4	0.00000001	0.00021164
49	Yes	4	0.00000001	0.00025479
50	Yes	4	0.00000001	0.00022259

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
L1	171.5 - 161.5	23.584	43	1.2153	0.0028
L2	161.5 - 127.456	21.043	43	1.2080	0.0023
L3	132.711 - 83.771	14.173	43	1.0310	0.0012
L4	90.396 - 41.12	6.458	43	0.6790	0.0005
L5	49.05 - 1	1.892	42	0.3553	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* °	*Twist* °	*Radius of Curvature* *ft*
172.00	DB201-A	43	23.584	1.2153	0.0028	44982
170.00	(2) AIR21	43	23.201	1.2152	0.0027	44982
167.50	Valmont T-Arm (3)	43	22.564	1.2147	0.0026	44982
161.00	LPA-80063/6CF	43	20.917	1.2068	0.0023	21854
160.00	EEI Low Profile Platform	43	20.665	1.2043	0.0023	20146
148.00	(2) DB980F90E-M	43	17.704	1.1474	0.0018	10730
147.00	EEI Low Profile Platform	43	17.463	1.1409	0.0017	10330
143.00	(2) RRUS-11	43	16.513	1.1128	0.0016	8989
138.00	(2) AM-X-CD-14-65-00TT-RET	43	15.355	1.0742	0.0014	7734
136.00	EEI Low Profile Platform	43	14.903	1.0580	0.0013	7332
119.50	4-ft Standoff	43	11.435	0.9210	0.0009	6921
113.50	779-70	43	10.292	0.8708	0.0008	7006
111.50	4-ft Standoff	43	9.924	0.8540	0.0008	7035
76.00	GPS	43	4.519	0.5635	0.0004	6811

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	171.5 - 161.5	94.060	10	4.8460	0.0112
L2	161.5 - 127.456	83.939	10	4.8175	0.0094
L3	132.711 - 83.771	56.562	10	4.1141	0.0050
L4	90.396 - 41.12	25.787	10	2.7110	0.0021
L5	49.05 - 1	7.558	10	1.4192	0.0008

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
172.00	DB201-A	10	94.060	4.8460	0.0112	11560
170.00	(2) AIR21	10	92.537	4.8458	0.0109	11560
167.50	Valmont T-Arm (3)	10	90.000	4.8438	0.0105	11560
161.00	LPA-80063/6CF	10	83.437	4.8131	0.0093	5608
160.00	EEI Low Profile Platform	10	82.434	4.8031	0.0092	5166
148.00	(2) DB980F90E-M	10	70.633	4.5773	0.0071	2732
147.00	EEI Low Profile Platform	10	69.674	4.5513	0.0070	2630
143.00	(2) RRUS-11	10	65.887	4.4394	0.0064	2285
138.00	(2) AM-X-CD-14-65-00TT-RET	10	61.274	4.2858	0.0056	1963
136.00	EEI Low Profile Platform	10	59.471	4.2216	0.0054	1860
119.50	4-ft Standoff	10	45.642	3.6760	0.0037	1751
113.50	779-70	10	41.082	3.4757	0.0032	1771
111.50	4-ft Standoff	10	39.617	3.4089	0.0031	1778
76.00	GPS	10	18.048	2.2499	0.0016	1712

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	171.5 - 161.5 (1)	TP27.89x25.73x0.1875	10.00	0.00	0.0	39.000	16.4865	-1.86	642.97	0.003
L2	161.5 - 127.456 (2)	TP38.0379x27.89x0.25	34.04	0.00	0.0	39.000	28.7417	-10.30	1120.93	0.009
L3	127.456 - 83.771 (3)	TP48.9974x35.9715x0.375	48.94	0.00	0.0	39.000	55.7740	-20.91	2175.19	0.010
L4	83.771 - 41.12 (4)	TP59.433x46.4841x0.4375	49.28	0.00	0.0	39.000	79.0289	-35.56	3082.13	0.012
L5	41.12 - 1 (5)	TP69x56.4741x0.4375	48.05	0.00	0.0	38.257	95.2076	-55.67	3642.31	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	171.5 - 161.5 (1)	TP27.89x25.73x0.1875	38.49	4.094	39.000	0.105	0.00	0.000	39.000	0.000
L2	161.5 - 127.456 (2)	TP38.0379x27.89x0.25	654.65	30.551	39.000	0.783	0.00	0.000	39.000	0.000
L3	127.456 - 83.771 (3)	TP48.9974x35.9715x0.375	2059.90	38.334	39.000	0.983	0.00	0.000	39.000	0.000
L4	83.771 - 41.12 (4)	TP59.433x46.4841x0.4375	3735.39	40.382	39.000	1.035	0.00	0.000	39.000	0.000
L5	41.12 - 1 (5)	TP69x56.4741x0.4375	6022.98	44.805	38.257	1.171	0.00	0.000	38.257	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	171.5 - 161.5 (1)	TP27.89x25.73x0.1875	5.39	0.327	26.000	0.025	0.42	0.022	26.000	0.001
L2	161.5 - 127.456 (2)	TP38.0379x27.89x0.25	29.58	1.029	26.000	0.079	0.42	0.010	26.000	0.000
L3	127.456 - 83.771 (3)	TP48.9974x35.9715x0.375	36.86	0.661	26.000	0.051	1.31	0.012	26.000	0.000
L4	83.771 - 41.12 (4)	TP59.433x46.4841x0.4375	43.99	0.557	26.000	0.043	1.06	0.006	26.000	0.000
L5	41.12 - 1 (5)	TP69x56.4741x0.4375	51.12	0.537	26.000	0.041	0.00	0.000	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	171.5 - 161.5 (1)	0.003	0.105	0.000	0.025	0.001	0.108 ✔	1.333	H1-3+VT ✔
L2	161.5 - 127.456 (2)	0.009	0.783	0.000	0.079	0.000	0.794 ✔	1.333	H1-3+VT ✔
L3	127.456 - 83.771 (3)	0.010	0.983	0.000	0.051	0.000	0.993 ✔	1.333	H1-3+VT ✔
L4	83.771 - 41.12 (4)	0.012	1.035	0.000	0.043	0.000	1.047 ✔	1.333	H1-3+VT ✔
L5	41.12 - 1 (5)	0.015	1.171	0.000	0.041	0.000	1.187 ✔	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	171.5 - 161.5	Pole	TP27.89x25.73x0.1875	1	-1.86	857.08	8.1	Pass
L2	161.5 - 127.456	Pole	TP38.0379x27.89x0.25	2	-10.30	1494.20	59.6	Pass
L3	127.456 - 83.771	Pole	TP48.9974x35.9715x0.375	3	-20.91	2899.53	74.5	Pass
L4	83.771 - 41.12	Pole	TP59.433x46.4841x0.4375	4	-35.56	4108.48	78.6	Pass
L5	41.12 - 1	Pole	TP69x56.4741x0.4375	5	-55.67	4855.20	89.0	Pass
							Summary	
						Pole (L5)	89.0	Pass
						RATING =	**89.0**	**Pass**

Program Version 6.0.0.8 - 9/7/2011 File:J:/Jobs/1403300.WI/001 - CTNL802A/04_Structural/Backup Documentation/ERI Files/160' EEI Monopole_with 10-ft extension_Old Lyme_CT.eri

Flange Bolt and Flange Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	$OM := 38.4 \cdot ft \cdot kips$	(Input From tnxTower)
Shear Force =	$Shear := 5.4 \cdot kips$	(Input From tnxTower)
Axial Force =	$Axial := 3.0 \cdot kips$	(Input From tnxTower)

Flange Bolt Data:

Use ASTM A325

Number of Flange Bolts =	$N := 12$	(User Input)
Diameter of Bolt Circle =	$D_{bc} := 32.0 \cdot in$	(User Input)
Bolt Ultimate Strength =	$F_u := 120 \cdot ksi$	(User Input)
Bolt Yield Strength =	$F_y := 92 \cdot ksi$	(User Input)
Bolt Modulus =	$E := 29000 \cdot ksi$	(User Input)
Diameter of Flange Bolts =	$D := 1.0 \cdot in$	(User Input)
Threads per Inch =	$n := 8$	(User Input)

Flange Plate Data:

Use ASTM A572 Mod 65

Plate Yield Strength =	$Fy_{bp} := 65 \cdot ksi$	(User Input)
Flange Plate Thickness =	$t_{bp} := 1.25 \cdot in$	(User Input)
Flange Plate Diameter =	$D_{bp} := 36.0 \cdot in$	(User Input)
Outer Pole Diameter =	$D_{pole} := 27.89 \cdot in$	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 16\cdot in$

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

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

$d_1 = 8.00\cdot in$ $d_7 = -8.00\cdot in$

$d_2 = 13.86\cdot in$ $d_8 = -13.86\cdot in$

$d_3 = 16.00\cdot in$ $d_9 = -16.00\cdot in$

$d_4 = 13.86\cdot in$ $d_{10} = -13.86\cdot in$

$d_5 = 8.00\cdot in$ $d_{11} = -8.00\cdot in$

$d_6 = 0.00\cdot in$ $d_{12} = -0.00\cdot in$

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 13.9\cdot in$

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

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

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

$MA_3 = 2.05\cdot in$ $MA_9 = 0.00\cdot in$

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

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

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

Effective Width of Flangeplate for Bending = $B_{eff} := .8\cdot 2\cdot\sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 18.2\cdot in$

Flange Bolt Analysis:

Calculated Flange Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i (d_i)^2 = 1.536 \times 10^3 \cdot in^2$

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

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 = 0.606 \cdot in^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 0.878 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.22 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^{\ 3}}{32} = 0.066 \cdot in^3$

Check Flange Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 4.6 \cdot kips$

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Gross}} = 11 \cdot \%$

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

$Condition1 = \text{"OK"}$

Flange Plate Analysis:

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

$C_1 = 2.7 \cdot kips$	$C_7 = -2.2 \cdot kips$
$C_2 = 4.4 \cdot kips$	$C_8 = -3.9 \cdot kips$
$C_3 = 5.1 \cdot kips$	$C_9 = -4.6 \cdot kips$
$C_4 = 4.4 \cdot kips$	$C_{10} = -3.9 \cdot kips$
$C_5 = 2.7 \cdot kips$	$C_{11} = -2.2 \cdot kips$
$C_6 = 0.3 \cdot kips$	$C_{12} = 0.2 \cdot kips$

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^{\,2}\right)} = 2.2 \cdot ksi$$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 64.8 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 3.4 \cdot \%$

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

Condition2 = "Ok"

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	$OM := 6023 \cdot ft \cdot kips$	(Input From tnxTower)
Shear Force =	$Shear := 51 \cdot kips$	(Input From tnxTower)
Axial Force =	$Axial := 56 \cdot kips$	(Input From tnxTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	$N := 24$	(User Input)
Diameter of Bolt Circle =	$D_{bc} := 79.0 \cdot in$	(User Input)
Bolt "Column" Distance =	$l := 3.0 \cdot in$	(User Input)
Bolt Ultimate Strength =	$F_u := 100 \cdot ksi$	(User Input)
Bolt Yield Strength =	$F_y := 75 \cdot ksi$	(User Input)
Bolt Modulus =	$E := 29000 \cdot ksi$	(User Input)
Diameter of Anchor Bolts =	$D := 2.25 \cdot in$	(User Input)
Threads per Inch =	$n := 4.5$	(User Input)

Base Plate Data:

Use ASTM A572 60

Plate Yield Strength =	$Fy_{bp} := 60 \cdot ksi$	(User Input)
Base Plate Thickness =	$t_{bp} := 2.25 \cdot in$	(User Input)
Base Plate Diameter =	$D_{bp} := 85 \cdot in$	(User Input)
Outer Pole Diameter =	$D_{pole} := 69 \cdot in$	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 39.5\cdot in$

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

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

$d_1 = 10.22\cdot in$	$d_7 = 38.15\cdot in$
$d_2 = 19.75\cdot in$	$d_8 = 34.21\cdot in$
$d_3 = 27.93\cdot in$	$d_9 = 27.93\cdot in$
$d_4 = 34.21\cdot in$	$d_{10} = 19.75\cdot in$
$d_5 = 38.15\cdot in$	$d_{11} = 10.22\cdot in$
$d_6 = 39.50\cdot in$	etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 34.5\cdot in$

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

$MA_1 = 0.00\cdot in$	$MA_7 = 3.65\cdot in$
$MA_2 = 0.00\cdot in$	$MA_8 = 0.00\cdot in$
$MA_3 = 0.00\cdot in$	$MA_9 = 0.00\cdot in$
$MA_4 = 0.00\cdot in$	$MA_{10} = 0.00\cdot in$
$MA_5 = 3.65\cdot in$	$MA_{11} = 0.00\cdot in$
$MA_6 = 5.00\cdot in$	etc

Effective Width of Baseplate for Bending = $B_{eff} := .8\cdot 2\cdot\sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 39.7\cdot in$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i (d_i)^2 = 1.872 \times 10^4 \cdot in^2$

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

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

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

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

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 150.1 \cdot kips$

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 = $\frac{T_{Max}}{T_{ALL.Net}} \cdot 100 = 77$ Bolts are "upset bolts". Use net area per AISC

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.531 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 7.7 \cdot ksi$

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 = $C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 154.8 \cdot kips$

Maximum Compressive Stress = $f_a := \frac{C_{Max}}{A_n} = 47.7 \cdot ksi$

$K := 0.65$

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

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

Allowable Compressive Stress = $F_a := 1.333 \cdot F_a = 60 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity = $\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) \cdot 100 = 79.5$

Condition 2 = $Condition2 := if\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$

Condition2 = "OK"

Base Plate Analysis:

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

$C_1 = 41.8 \cdot kips$	$C_7 = 149.6 \cdot kips$
$C_2 = 78.6 \cdot kips$	$C_8 = 134.4 \cdot kips$
$C_3 = 110.2 \cdot kips$	$C_9 = 110.2 \cdot kips$
$C_4 = 134.4 \cdot kips$	$C_{10} = 78.6 \cdot kips$
$C_5 = 149.6 \cdot kips$	$C_{11} = 41.8 \cdot kips$
$C_6 = 154.8 \cdot kips$	etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} t_{bp}^2\right)} = 55.7 \cdot ksi$

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

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} \cdot 100 = 93.1$

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

Condition3 = "Ok"

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 6023 \cdot ft \cdot kips$	(User Input from tnxTower)
Shear Force =	$Shear := 51 \cdot kip$	(User Input from tnxTower)
Axial Force =	$Axial := 56 \cdot kip$	(User Input from tnxTower)
Tower Height =	$H_t := 170 \cdot ft$	(User Input)

Footing Data:

Overall Depth of Footing =	$D_f := 7.0 \cdot ft$	(User Input)
Length of Pier =	$L_p := 4.5 \cdot ft$	(User Input)
Extension of Pier Above Grade =	$L_{pag} := 1.0 \cdot ft$	(User Input)
Diameter of Pier =	$d_p := 8.5 \cdot ft$	(User Input)
Thickness of Footing =	$T_f := 3.5 \cdot ft$	(User Input)
Width of Footing =	$W_f := 31.0 \cdot ft$	(User Input)

Anchor Bolt Data:

Length of Anchor Bolts =	$L_{st} := 96 \cdot in$	(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 =	$MP := 79.0 \cdot in$	(User Input)

Material Properties:

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

Pier Reinforcement:

Bar Size =	$BS_{pier} := 9$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.128 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 52$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 0.5 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 9$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.128 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 27$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 9$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.128 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 54$	(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 = $$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.999 \cdot in^2$$

Pad Top Reinforcement Bar Area = $$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.999 \cdot in^2$$

Pad Bottom Reinforcement Bar Area = $$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.999 \cdot in^2$$

Coefficient of Lateral Soil Pressure = $$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$$

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

Stability of Footing:

Adjusted Concrete Unit Weight = $\gamma_c := \text{if}(\text{Bouyancy} = 1, \gamma_{conc} - 62.4\text{pcf}, \gamma_{conc}) = 150\cdot\text{pcf}$

Adjusted Soil Unit Weight = $\gamma_s := \text{if}(\text{Bouyancy} = 1, \gamma_{soil} - 62.4\text{pcf}, \gamma_{soil}) = 100\cdot\text{pcf}$

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

$P_{pt} := K_p\cdot\gamma_s\cdot(D_f - T_f) + c\cdot 2\cdot\sqrt{K_p} = 1.05\cdot\text{ksf}$

$P_{top} := \text{if}[n < (D_f - T_f), P_{pt}, P_{pn}] = 1.05\cdot\text{ksf}$

$P_{bot} := K_p\cdot\gamma_s\cdot D_f + c\cdot 2\cdot\sqrt{K_p} = 2.1\cdot\text{ksf}$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.575\cdot\text{ksf}$

$T_p := \text{if}[n < (D_f - T_f), T_f, (D_f - n)] = 3.5$

$A_p := W_f\cdot T_p = 108.5$

Ultimate Shear = $S_u := P_{ave}\cdot A_p = 170.888\cdot\text{kip}$

Weight of Concrete Pad = $WT_c := \left[\left(W_f^{\,2}\cdot T_f\right) + d_p^{\,2}\cdot L_p\right]\cdot\gamma_c = 553.294\cdot\text{kip}$

Weight of Soil Above Footing = $WT_{s1} := \left[\left(W_f^{\,2} - d_p^{\,2}\right)\cdot \begin{cases} (L_p - L_{pag} - n) & \text{if } (L_p - L_{pag} - n) \ge 0 \\ 0 & \text{if } (L_p - L_{pag} - n) \le 0 \end{cases}\right]\cdot\gamma_s = 311.06\cdot\text{kip}$

Weight of Soil Wedge at Back Face = $WT_{s2} := \left(\frac{D_f^{\,2}\cdot\tan(\Phi_s)}{2}\cdot W_f\right)\cdot\gamma_s = 43.85\cdot\text{kip}$

Weight of Soil Wedge at back face Corners = $WT_{s3} := 2\left[(D_f)^3\cdot\frac{\tan(\Phi_s)}{3}\right]\cdot\gamma_s = 13.202\cdot\text{kips}$

Total Weight = $WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 920.356\cdot\text{kip}$

Resisting Moment = $M_r := (WT_{tot})\cdot\frac{W_f}{2} + S_u\cdot\frac{T_f}{3} + \left[(WT_{s2} + WT_{s3})\cdot\left(W_f + \frac{D_f\cdot\tan(\Phi_s)}{3}\right)\right] = 16310\cdot\text{kip}\cdot\text{ft}$

Overturning Moment = $M_{ot} := OM + \text{Shear}\cdot(L_p + T_f) = 6431\cdot\text{kip}\cdot\text{ft}$

Factor of Safety Actual = $FS := \frac{M_r}{M_{ot}} = 2.54$

Factor of Safety Required = $FS_{req} := 2$

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

$\text{OverTurning\_Moment\_Check} = \text{"Okay"}$

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 207.08 \cdot kips$

Shear_Check := if(S_p > Shear, "Okay", "No Good")

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Area of the Mat = $A_{mat} := W_f^{\,2} = 961$

Section Modulus of Mat = $S := \frac{W_f^{\,3}}{6} = 4965.17 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 2.253 \cdot ksf$

Max_Pressure_Check := if($P_{max} < q_s$, "Okay", "No Good")

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.338 \cdot ksf$

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 = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 8.987$

Distance to Kern = $X_k := \frac{W_f}{6} = 5.167$

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

Eccentricity = $e := \frac{M_{ot}}{WT_{tot}} = 6.988$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 2.325 \cdot ksf$

$q_{adj} := \text{if}(P_{min} < 0, P_a, P_{max}) = 2.325 \cdot ksf$

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

Pressure_Check = "Okay"

Concrete Bearing Capacity:

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

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.806 \times 10^4 \cdot \text{kips}$ (ACI-2008 10.14)

Bearing_Check := if(P_b > LF·Axial, "Okay", "No Good")

Bearing_Check = "Okay"

Shear Strength of Concrete:

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

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 37.872 \cdot in$

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

$d_2 := d_1 - d$

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

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

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

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

Beam_Shear_Check := if($V_{req} < V_{Avail}$, "Okay", "No Good")

Beam_Shear_Check = "Okay"

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

Critical Perimeter of Punching Shear = $b_o := (d_p + d) \cdot \pi = 36.6$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4} = 106.7$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 854.3$

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

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

$v_u := \text{Find}(v_u) = 8 \cdot \text{ksf}$

$V_u := v_u \cdot d \cdot W_f = 779.1 \cdot \text{kips}$

Required Shear Strength = $V_{req} := LF \cdot V_u = 1 \times 10^3 \cdot \text{kips}$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot \text{psi}} \cdot b_o \cdot d = 3578.6 \cdot \text{kip}$ (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)

$q_b := q_{adj} - d_1 \cdot \text{Slope} = 1.301 \cdot \text{ksf}$

Maximum Bending at Face of Pier = $M_u := LF \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 5187.3 \cdot \text{kip} \cdot \text{ft}$

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

(ACI-200810.2.7.3)

$$R_n := \frac{M_u}{\phi_m \cdot W_f \cdot d^2} = 129.6 \cdot \text{psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) = 0.0022$$

$\rho_{min} := \rho = 0.0022$

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:

$$As := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \frac{d}{2} & \text{otherwise} \end{cases} = 31.041 \cdot in^2$$

$$As_{prov} := A_{bbot} \cdot NB_{bot} = 54 \cdot in^2$$

Pad_Reinforcement_Bot := if(As_{prov} > As, "Okay", "No Good")

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$$As := \rho_{sh} \cdot \left(W_f \cdot \frac{d}{2} \right) = 12.7 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 27 \cdot in^2$$

Pad_Reinforcement_Top := if(As_{prov} > As, "Okay", "No Good")

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing = $$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 5.76 \cdot in$$

Spacing or Cover Dimension = $$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2} \right) = 2.878 \cdot in$$

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

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 31.5 \cdot in$$

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

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

Available Length in Pad = $$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 132 \cdot in$$

Lpad_Check := if($L_{Pad} > L_{dbt}$, "Okay", "No Good")

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier = $A_p := \frac{\pi \cdot d_p^2}{4} = 8171.28 \cdot in^2$

$A_{smin} := 0.01 \cdot 0.5 \cdot A_p = 40.86 \cdot in^2$ (ACI-2008 10.8.4 & 10.9.1)

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 51.97 \cdot in^2$

Steel_Area_Check := if($A_{sprov} > A_{smin}$, "Okay" , "No Good")

Steel_Area_Check = "Okay"

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 5.034 \cdot in$

Diameter of Reinforcement Cage = $Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 96 \cdot in$

Maximum Moment in Pier = $M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 1 \times 10^5 \cdot in \cdot kips$

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

$$\begin{pmatrix} D & N & n & P_u & M_{xu} \end{pmatrix} := \begin{pmatrix} d_p \cdot 12 & NB_{pier} & BS_{pier} & \frac{Axial \cdot 1.333}{kips} & \frac{M_p}{in \cdot kips} \end{pmatrix}$$

$$\begin{pmatrix} D & N & n & P_u & M_{xu} \end{pmatrix} = \begin{pmatrix} 102 & 52 & 9 & 74.648 & 1.004 \times 10^5 \end{pmatrix}$$

$$\begin{pmatrix} \phi P_n & \phi M_{xn} & f_{sp} & \rho \end{pmatrix} := \begin{pmatrix} 0 & 0 & 0 & 0 \end{pmatrix}$$

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

$$\begin{pmatrix} \phi P_n & \phi M_{xn} & f_{sp} & \rho \end{pmatrix} = \begin{pmatrix} 90.858 & 1.222 \times 10^5 & -60 & 6.364 \times 10^{-3} \end{pmatrix}$$

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

Axial_Load_Check = "Okay"

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

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$$L_{pier} := L_p - Cvr_{pier} = 51 \cdot in$$

$$L_{pad} := T_f - Cvr_{pad} = 39 \cdot in$$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension = $c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 2.517 \cdot in$

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

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 35.97 \cdot in$$

Minimum Development Length = $L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 14.982 \cdot in$ (ACI 12.2.1)

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

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

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

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

Compression: (ACI-2008 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 21.402 \cdot in$$

$$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 20.304 \cdot in$$

$$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 21.402 \cdot in$$

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

$L_{compression\_Check}$ = "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)

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 18.048 \cdot in$

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

$s_{lim3} := D_f \cdot z = 84 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing = $s_{tie} := min\left(\left(\begin{matrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{matrix}\right)\right) = 18 \cdot in$

Number of Ties Required = $n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 3.667$

Check Anchor Steel Embedment:

Depth Available = $D_{ab} := L_{st} - A_{BP} = 7 \cdot ft$

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

T-Mobile

Site ID	**CTNL802A**	**Latitude**	41.30561
		Longitude	-72.29708
Site Name	Amtrak Old Lyme Verizon	**Site Type**	Structure (Non-Building)
Address	125 Mile Creek Rd, Old Lyme, CONNECTICUT, 06371	**Site Class**	Monopole
Market	CONNECTICUT	**Landlord**	Verizon Wireless

Configuration

2C

Approvals	
Market RF	
Market Development	

RFDS Revision	
RFDS Final	

Date 01/16/2014

Work Order #	

NOC# (888) 218-6664

Site Information

Existing 1	Existing 2	Existing 3	Existing 4	Cabinet #	Proposed 1	Proposed 2	Proposed 3	Proposed 4
UMTS	GSM			Technology	GSM/UMTS/LTE	GSM		
3106	S8000			Cabinet type	3106	S8000		
1				CBU				
				DUW30	2			
				DUL20	1			
				DUG20	1			
				DUS41				
				RBS6601				
	6			dTRU/TRX				
6				RU22 B4	6			
				RUS01 B2				
				RUS01 B4				

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

Scope of Work

Keep existing 3106 UMTS cabinet, replace CBU and RAX/TX boards with DUW30. Turn off and keep in place existing S8000 GSM cabinet. Add another DUW30, DUL20 and DUG20 and keep 6 RU22 B4 radios in the existing 3106 cabinet. Install 3 E/// TMAs, remove all existing TMAs. Install power upgrade kit 6131.

ALPHA - Scope of Work

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

Add AIR21 B4A|B2P antenna at position 1. Connect DATA 1 (CPRI) active port of AIR21 B4A/B2P antenna to DUL20 via fiber line. Connect spare (yellow) fiber jumper to DATA 2 (CPRI) active port of AIR B4A/B2P antenna to allow future implementation of AWS UMTS over fiber. Swap existing passive antenna at position 3 with AIR21 B2A|B4P. Keep existing UMTS dd B4 TMA at position 3/right and remove/disconnect obsolete GSM TMAs. Keep existing coax lines at position 3/left for LMU. Keep existing coax lines at position 3/right for AWS UMTS. Connect DATA (CPRI) active ports of AIR21 B2A/B4P antenna to DUG20 and PCS UMTS DUW30 via fiber lines. Connect RF passive port of AIR21 B2A/B4P antenna to in cabinet radio/filter units via coax lines. Install 1 E/// TMA remove existing TMAs.

BETA - Scope of Work

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

Add AIR21 B4A|B2P antenna at position 1. Connect DATA 1 (CPRI) active port of AIR21 B4A/B2P antenna to DUL20 via fiber line. Connect spare (yellow) fiber jumper to DATA 2 (CPRI) active port of AIR B4A/B2P antenna to allow future implementation of AWS UMTS over fiber. Swap existing passive antenna at position 3 with AIR21 B2A|B4P. Keep existing UMTS dd B4 TMA at position 3/right and remove/disconnect obsolete GSM TMAs. Keep existing coax lines at position 3/left for LMU. Keep existing coax lines at position 3/right for AWS UMTS. Connect DATA (CPRI) active ports of AIR21 B2A/B4P antenna to DUG20 and PCS UMTS DUW30 via fiber lines. Connect RF passive port of AIR21 B2A/B4P antenna to in cabinet radio/filter units via coax lines. Install 1 E/// TMA remove existing TMAs.

GAMMA - Scope of Work

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

Add AIR21 B4A|B2P antenna at position 1. Connect DATA 1 (CPRI) active port of AIR21 B4A/B2P antenna to DUL20 via fiber line. Connect spare (yellow) fiber jumper to DATA 2 (CPRI) active port of AIR B4A/B2P antenna to allow future implementation of AWS UMTS over fiber. Swap existing passive antenna at position 3 with AIR21 B2A|B4P. Keep existing UMTS dd B4 TMA at position 3/right and remove/disconnect obsolete GSM TMAs. Keep existing coax lines at position 3/left for LMU. Keep existing coax lines at position 3/right for AWS UMTS. Connect DATA (CPRI) active ports of AIR21 B2A/B4P antenna to DUG20 and PCS UMTS DUW30 via fiber lines. Connect RF passive port of AIR21 B2A/B4P antenna to in cabinet radio/filter units via coax lines. Install 1 E/// TMA remove existing TMAs.

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

T-Mobile

Site ID	CTNL802A	Latitude	41.30561
		Longitude	-72.29708
Site Name	Amtrak Old Lyme Verizon	Site Type	Structure (Non-Building)
Address	125 Mile Creek Rd, Old Lyme, CONNECTICUT, 06371	Site Class	Monopole
Market	CONNECTICUT	Landlord	Verizon Wireless

Configuration
2C

Approvals	
Market RF	
Market Development	

RFDS Revision	
RFDS Final	

Date 01/16/2014

ALPHA (view from behind)

	Existing Configuration				Proposed Configuration			
Mount	X	X	X		X	X	X	
Technology			GSM / UMTS		LTE		GSM/UMTS / UMTS	
Band			B2 / B4		B4		B2 / B4	
Active/Passive			P / P		A		A / P	
Ant. Type			Quad pole		Quad pole		Quad pole	
Ant. Model			APX16DWV-16DWV-S		AIR21 B4A/B2P		AIR21 B2A/B4P	
Ant. Vendor			RFS		Ericsson		Ericsson	
Ant. Height			170		170		170	
Azimuth			0		0		0	
RET deployed			Yes / Yes		Yes		Yes / Yes	
E-Tilt			2 / 2		2		2 / 2	
M-Tilt								
TMA #			1 / 1				/ 1	
TMA Type			dd B2 / dd B4				/ dd B4	
RRU #								
RRU Type								
Used Coax #			2 / 2				2 (LMU) / 2	
Coax Type			1 5/8" / 1 5/8"				1 5/8" / 1 5/8"	
Coax Length (ft)			190				190	
Fiber (CPRI) #					2		2	
Splitter #								
Combiner #								
Combiner Type								

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

Scope of work

Add AIR21 B4A|B2P antenna at position 1. Connect DATA 1 (CPRI) active port of AIR21 B4A/B2P antenna to DUL20 via fiber line. Connect spare (yellow) fiber jumper to DATA 2 (CPRI) active port of AIR B4A/B2P antenna to allow future implementation of AWS UMTS over fiber. Swap existing passive antenna at position 3 with AIR21 B2A|B4P. Keep existing UMTS dd B4 TMA at position 3/right and remove/disconnect obsolete GSM TMAs. Keep existing coax lines at position 3/left for LMU. Keep existing coax lines at position 3/right for AWS UMTS. Connect DATA (CPRI) active ports of AIR21 B2A/B4P antenna to DUG20 and PCS UMTS DUW30 via fiber lines. Connect RF passive port of AIR21 B2A/B4P antenna to in cabinet radio/filter units via coax lines. Install 1 E/// TMA remove existing TMAs.

BETA (view from behind)

	Existing Configuration				Proposed Configuration			
Mount	X	X	X		X	X	X	
Technology			GSM / UMTS		LTE		GSM/UMTS / UMTS	
Band			B2 / B4		B4		B2 / B4	
Active/Passive			P / P		A		A / P	
Ant. Type			Quad pole		Quad pole		Quad pole	
Ant. Model			APX16DWV-16DWV-S		AIR21 B4A/B2P		AIR21 B2A/B4P	
Ant. Vendor			RFS		Ericsson		Ericsson	
Ant. Height			170		170		170	
Azimuth			120		120		120	
RET deployed			Yes / Yes		Yes		Yes / Yes	
E-Tilt			2 / 2		2		2 / 2	
M-Tilt								
TMA #			1 / 1				/ 1	
TMA Type			dd B2 / dd B4				/ dd B4	
RRU #								
RRU Type								
Used Coax #			2 / 2				2 (LMU) / 2	
Coax Type			1 5/8" / 1 5/8"				1 5/8" / 1 5/8"	
Coax Length (ft)			190				190	
Fiber (CPRI) #					2		2	
Splitter #								
Combiner #								
Combiner Type								

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

Scope of work

Add AIR21 B4A|B2P antenna at position 1. Connect DATA 1 (CPRI) active port of AIR21 B4A/B2P antenna to DUL20 via fiber line. Connect spare (yellow) fiber jumper to DATA 2 (CPRI) active port of AIR B4A/B2P antenna to allow future implementation of AWS UMTS over fiber. Swap existing passive antenna at position 3 with AIR21 B2A|B4P. Keep existing UMTS dd B4 TMA at position 3/right and remove/disconnect obsolete GSM TMAs. Keep existing coax lines at position 3/left for LMU. Keep existing coax lines at position 3/right for AWS UMTS. Connect DATA (CPRI) active ports of AIR21 B2A/B4P antenna to DUG20 and PCS UMTS DUW30 via fiber lines. Connect RF passive port of AIR21 B2A/B4P antenna to in cabinet radio/filter units via coax lines. Install 1 E/// TMA remove existing TMAs.

Network Modernization RFDS v3.0

T-Mobile

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		Longitude	-72.29708
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Market	CONNECTICUT	Landlord	Verizon Wireless

Configuration
2C

Approvals	
Market RF	
Market Development	

RFDS Revision	
RFDS Final	

Date: 01/16/2014

GAMMA (view from behind)

	Existing Configuration 1	Existing Configuration 2	Existing Configuration 3	Existing Configuration 4	Proposed Configuration 1	Proposed Configuration 2	Proposed Configuration 3	Proposed Configuration 4
Mount	X	X	X		X	X	X	
Technology			GSM / UMTS		LTE		GSM/UMTS / UMTS	
Band			B2 / B4		B4		B2 / B4	
Active/Passive			P / P		A		A / P	
Ant. Type			Quad pole		Quad pole		Quad pole	
Ant. Model			APX16DWV-16DWV-S		AIR21 B4A/B2P		AIR21 B2A/B4P	
Ant. Vendor			RFS		Ericsson		Ericsson	
Ant. Height			170		170		170	
Azimuth			240		240		240	
RET deployed			Yes / Yes		Yes		Yes / Yes	
E-Tilt			2 / 2		2		2 / 2	
M-Tilt								
TMA #			1 / 1				/ 1	
TMA Type			dd B2 / dd B4				/ dd B4	
RRU #								
RRU Type								
Used Coax #			2 / 2				2 (LMU) / 2	
Coax Type			1 5/8" / 1 5/8"				1 5/8" / 1 5/8"	
Coax Length (ft)			190				190	
Fiber (CPRI) #					2		2	
Splitter #								
Combiner #								
Combiner Type								

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

Scope of work

Add AIR21 B4A|B2P antenna at position 1. Connect DATA 1 (CPRI) active port of AIR21 B4A/B2P antenna to DUL20 via fiber line. Connect spare (yellow) fiber jumper to DATA 2 (CPRI) active port of AIR B4A/B2P antenna to allow future implementation of AWS UMTS over fiber. Swap existing passive antenna at position 3 with AIR21 B2A|B4P. Keep existing UMTS dd B4 TMA at position 3/right and remove/disconnect obsolete GSM TMAs. Keep existing coax lines at position 3/left for LMU. Keep existing coax lines at position 3/right for AWS UMTS. Connect DATA (CPRI) active ports of AIR21 B2A/B4P antenna to DUG20 and PCS UMTS DUW30 via fiber lines. Connect RF passive port of AIR21 B2A/B4P antenna to in cabinet radio/filter units via coax lines. Install 1 E/// TMA remove existing TMAs.

DELTA (view from behind)

	Existing Configuration 1	Existing Configuration 2	Existing Configuration 3	Existing Configuration 4	Proposed Configuration 1	Proposed Configuration 2	Proposed Configuration 3	Proposed Configuration 4
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
- [ ] 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

Scope of work

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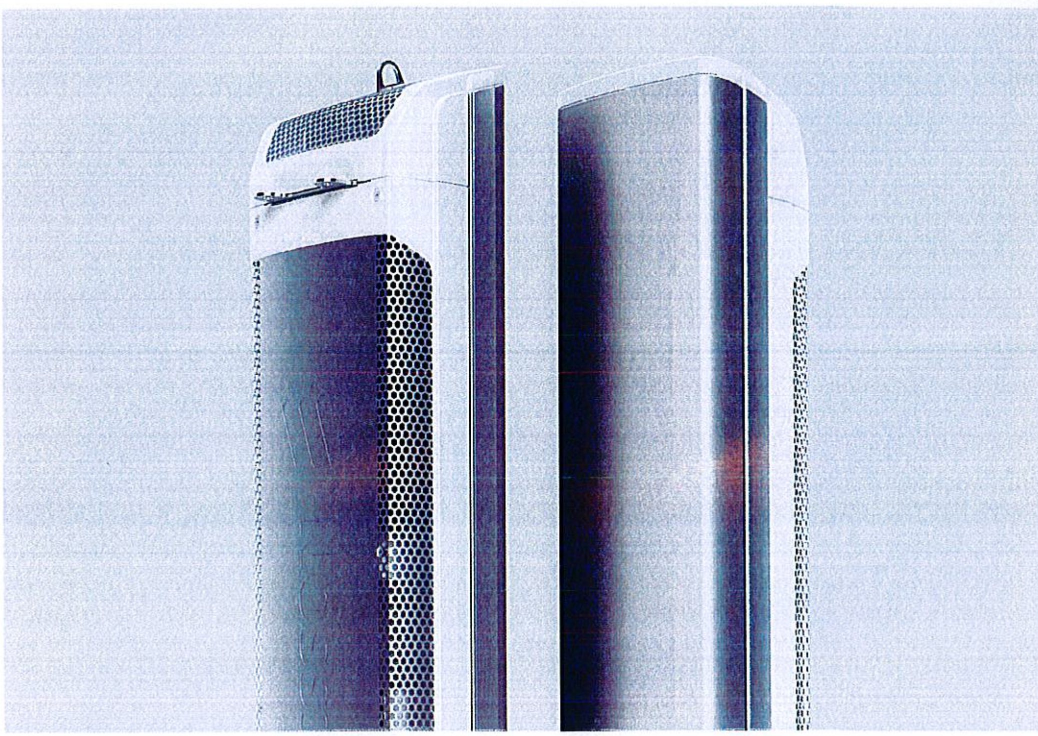
DATA-SHEET FOR

AIR 21, 1.3 M, B2A B4P



The Antenna-Integrated Radio (AIR) is a single tower-mounted unit that can replace the antenna/s and radio for one sector. Additional electronics such as ASC? and a RET Actuator and control are also included. A passive antenna function for an extra band is optional.

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com

ANTENNA-INTEGRATED RADIO

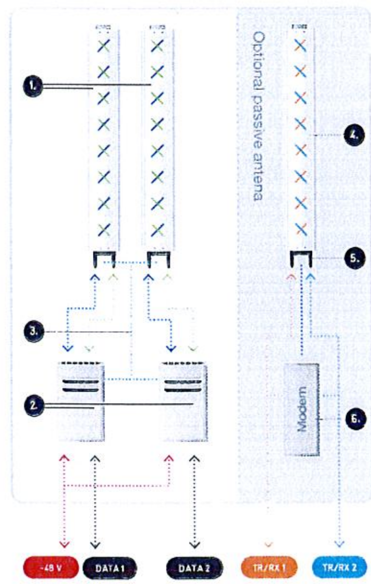
Figure 2 →
Three-sector tower site with three AIR units.e

The Antenna-Integrated Radio (AIR) is a single tower-mounted unit that can replace the antenna/s and radio for one sector. Additional electronics such as ASC? and a RET Actuator and control are also included. A passive antenna function for an extra band is optional. (The option has to be specified when ordering, retrofit is not possible).
The height and width are the same as for a passive antenna with similar characteristics. The depth is increased to house the radios' electronics. Digital Units (DUs) from Ericsson's RBS 6000 family provide the baseband function and support GSM, WCDMA and LTE.

Digital Units (DUs) from Ericsson's RBS 6000 family provide the baseband function and support GSM, WCDMA and LTE.

One or two DUs, depending on capacity and the standards to be supported, are needed for a three-sector site with AIR units.

The AIR is especially suited for state of the art mobile broadband basestations utilizing advanced MIMO techniques. Less tower-mounted equipment is required and the unit's attractive appearance enables it to blend in well with other existing equipment. The same applies to sites with multiple access technologies on different frequency bands. With Air, it is only necessary to swap antennas in order to add new 3G/4G technology on-site or at a new site. The AIR also saves power compared to traditional macro RBSs that use long feeders for antenna connections.



← Figure 2
Example of hardware that a single AIR unit can replace

Functionality for the AIR unit
Figure 2 shows an example of the hardware that a single AIR unit can replace. The function of the AIR unit is the same, but the implementation is different.
The AIR unit's active band has two radios (2) connected to a pair of cross-polarized antenna arrays (1). Remote electrical tilt (3) is included. Air supports 2 TX for the down-link and 4 RX for the up-link.
The passive antenna function on the frequency band not used by the AIR unit's active part is optional. The passive function includes an antenna array (4) and a RET motor (5) with a modem to control it (6).
The tilts for the active part and the passive part are controlled independently, but each band has the same tilt for both arrays and for both polarizations.

Configuration Example
Figure 3 shows a typical configuration with WCDMA with 2 x 2 MIMO for Band 1.
One AIR unit is deployed in each sector.
A common base band unit with a DUW inside provides base band processing and back-haul.
The AIR units can be specified with passive antennas for Band 4.

Figure 3 →
Three sector configuration example: RBS 6601 with three AIR units.

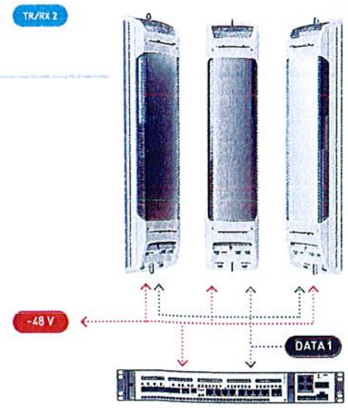
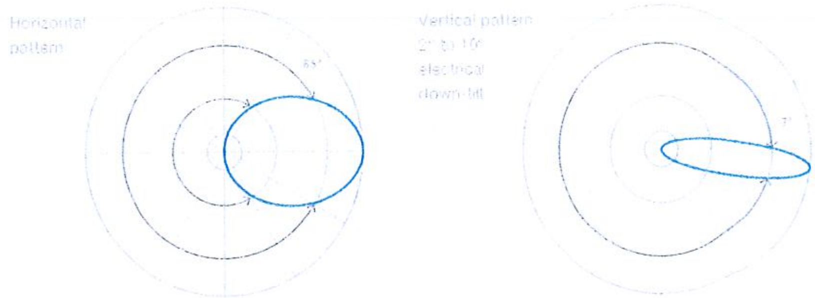


Figure 4
Antenna
Characteristics



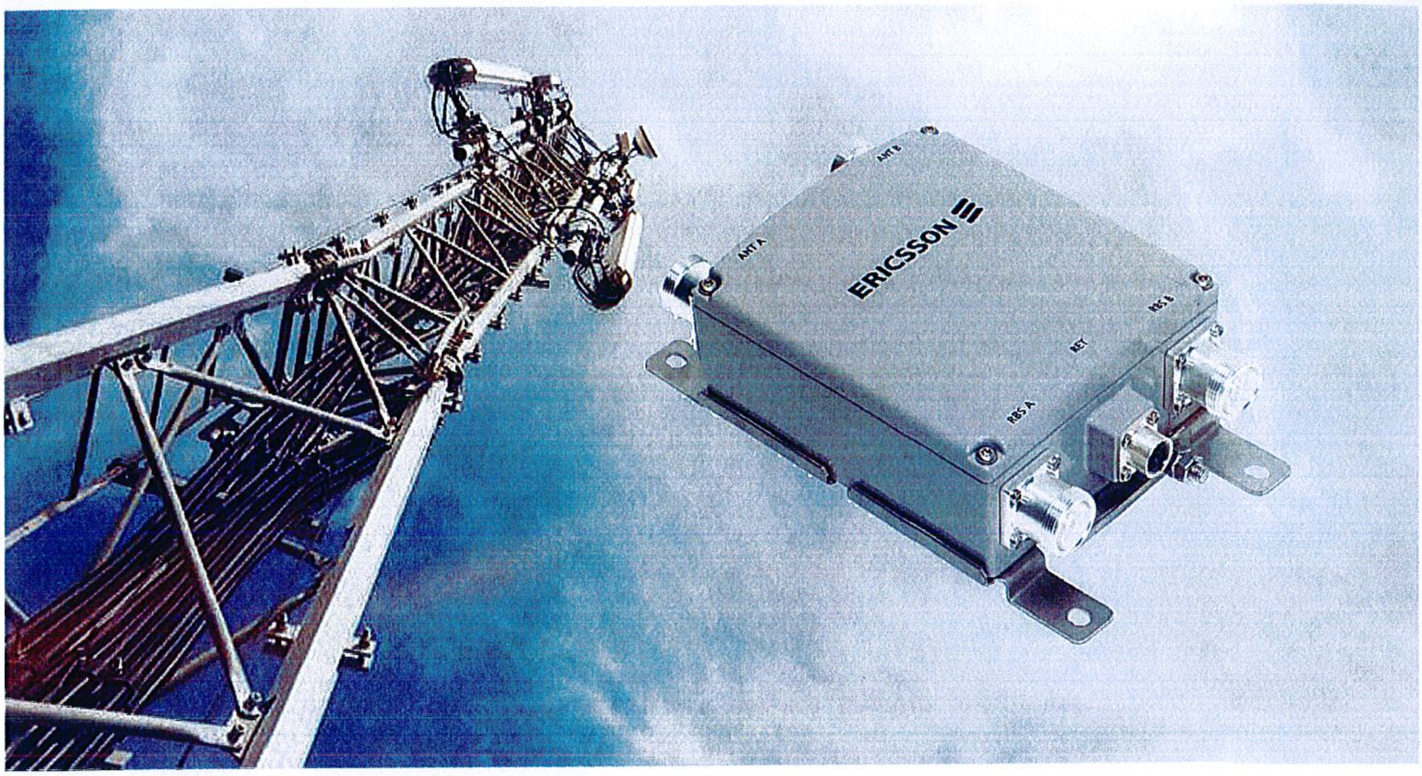
Technical Specification

RADIO	
Active frequency band	Band 2 (1850-1910 / 1930-1990 MHz)
Passive frequency band (optional)	Band 4 (1710-1755 / 2110-2155 MHz)
Downlink EIRP in bore-sight direction for the active band	2 x 63 dBm
Uplink sensitivity	TBD*
Remote electrical tilt	-2° to -12°, independently controlled per frequency band
MIMO	2 x 2 for DL 4 RX branches to be used for diversity/beam-steering
Instantaneous bandwidth	20 MHz
Capacity (single standard per sector)	Up to 8 carriers GSM Up to 4 carriers WCDMA with 2 x 2 DL MIMO Up to 20 MHz LTE with 2 x 2 DL MIMO
Multi-RAT capability	Single standard or two simultaneous standards (Capacity above is reduced for multi-RAT)
Bore-sight antenna gain for passive antenna option	17.5 dBi
Nominal beam-width, azimuth	65°
Nominal beam-width, elevation	7°
Additional antenna parameters	See Figure 3
MECHANICAL	
Weight	32 kg (70 lb) for active only 38 kg (83 lb) for active and passive
Size (H x W x D)	56" x 12" x 8" (1422 mm x 300 mm x 200 mm)
Wind load (frontal/lateral/rear-side) @ 150 km/h wind speed	580 N / 300 N / 720 N
INTERFACES	
AIR – DU	DATA 1, Data 2: CPRI links (SFP modules with LC socket + flanges that match protective cover TYCO C20611458)
Power	- 48 V DC (TYCO/Ericsson RPT 447 04)
Passive antenna (option)	TX/RX 1, TX/RX 2: RF connectors (7/16 female)
SUPPORTING BASE-BAND	
RBS 6601	One or two units depending on configuration.

* Target: 1 dB better than best-in-class RRU connected to same size best-in-class antenna
** Other base-band configurations are available

DOUBLE TMA 17/21, PREMIUM

3GPP/AISG compatible with RET interface



Improving a radio uplink by using tower mounted amplifiers is perceived as a key method of optimizing radio networks. By ensuring maximum coverage including in-door penetration, a TMA supports the design of cost-efficient networks and extended talk-time handsets, low dropped call rates and high traffic billing.

TMA design
This Double Premium TMA for 17/2100 MHz has 12dB gain and is 3GPP/AISG 2.0 compatible, with a RET interface. It has superior RF performance, small size and low weight. There is a corresponding TMA version called ASC that has a higher gain and a VSWR measuring coupler.

System integration
The Double TMA 17/2100 is a part of Ericsson's TMA family. Power, control and supervision are provided by the RBS 3000. If sold to other RBS brand installations, it can be controlled and supervised from the "Antenna System & TMA Control Module", AST-CM, via the RF feeder.

3GPP/AISG
TMA communication is based on the 3GPP/AISG protocol standard and has a RET port for controlling antenna RET units. The communication port allows multiple RETs or Antenna Line Devices to be supervised and controlled via the TMA.

Future-proof
The Double TMA 17/21 Premium is designed for co-existence with future complementary, mast-mounted devices.

Excellent reliability
As the world's largest supplier of TMAs, Ericsson has a well-proven track record of reliable TMA designs. Reliability enhancing features include dual LNAs, weatherproof design, integrated alarm and lightning protection.

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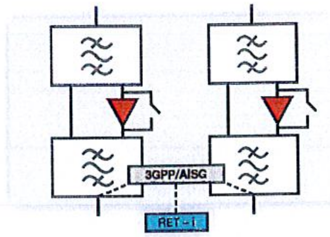
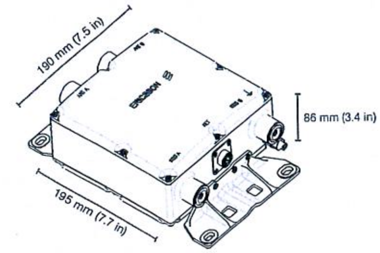
Features

- Specified and verified as an integrated system solution for Ericsson RBSs
- Possible to power both TMAs from one feeder, or from both feeders
- High power capacity
- Automatic LNA by-pass function
- Built in lightning protection
- Excellent RF performance
- Connectors "in line"
- Distance between connectors simplifies sealing work
- A range of accessories for flexible site configurations





Technical Specifications for Double TMA 1700/2100, MHz Premium

Product name	**Product number**
Double TMA 17/21, Premium	KRY 112 144/1
3GPP/ASIG compatible with RET interface	
Radio performance	
Bandwidth:	45 MHz
Receiving pass band:	1710 - 1755 MHz
Transmitting pass band:	2110 - 2155 MHz
RX Gain:	12± 1 dB
Input IP3:	16 dBm*
IM3 at antenna port (2x43dBM):	-128 dBm
Noise figure midband:	1.0 dB*
TX max input power (Max Peak):	57 dBm
TX insertion loss:	0.25 dB*
RX return loss:	22 dB*
TX return loss:	22 dB*
Electrical specifications	
Input power:	+12 - 32 VDC
Power consumption:	< 4.5 W
Mechanical specifications	
Dimensions (W x H x D):	155 x 176 x 71 mm
Weight:	5 kg
RF connectors:	7-16 DIN female
Ground connectors:	M8
DC/Alarm:	Superimposed on the RF signal
Mounting:	Pole or wall mounting
RET connectors:	Din con. IEC 60130-9 - Ed. 3.0 female
Environmental specifications	
Temperature range, full performance:	-40°C - +55°C
MTBF:	80 years
Sealing:	IP67
Lightning protection:	IEC 62305-1, IEC 61000-6
Safety approval:	International: CB certified, IEC 60 529 Europe: EN 60 529 North America: NRTL, NEMA 3R
Safety standard:	UL 60950-1, IEC 60950-1

* Typical values

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: CTNL802A

Amtrak Old Lyme Verizon
125 Mile Creek Road
Old Lyme, CT 06371

March 14, 2014

EBI Project Number: 62141447

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

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March 14, 2014

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

Re: Emissions Values for Site: **CTNL802A - Amtrak Old Lyme Verizon**

EBI Consulting was directed to analyze the proposed T-Mobile facility located at 125 Mile Creek Road, Old Lyme, 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 μW/cm2 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 (μW/cm2). The general population exposure limit for the cellular band is 567 μW/cm2, and the general population exposure limit for the PCS and AWS bands is 1000 μW/cm2. 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 125 Mile Creek Road, Old Lyme, 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, the actual antenna pattern gain value in the direction of the sample area was used. For this report the sample point is 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 / UMTS channels (1935.000 MHz to 1945.000 MHz / 1983.000 MHz to 1984.000 MHz) were considered for each sector of the proposed installation.
2) 4 UMTS / LTE channels (2110.000 to 2120.000 MHz / 2140.000 MHz to 2145.000 MHz) were considered for each sector of the proposed installation
3) 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.
4) For the following calculations the sample point was the top of a six foot person standing at the base of the tower. The actual gain in this direction was used per the manufactures supplied specifications.
5) The antenna used in this modeling is the Ericsson AIR21 for LTE, UMTS and GSM. This is based on feedback from the carrier with regards to anticipated antenna selection. This antenna has a 15.6 dBd gain value at its main lobe. Actual antenna gain values were used for all calculations as per the manufacturers specifications

6) The antenna mounting height centerline of the proposed antennas is **170 feet** above ground level (AGL)
7) 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 calculation were done with respect to uncontrolled / general public threshold limits

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Site ID	CTNL802A - Amtrak Old Lyme Verizon
Site Addresss	125 Mile Creek Road, Old Lyme, CT 06371
Site Type	Monopole

Sector 1

Antenna Number	Antenna Make	Antenna Model	Status	Frequency Band	Technology	Power Out Per Channel (Watts)	Number of Channels	Composite Power	Antenna Gain in direction of sample point (dBd)	Antenna Height (ft)	analysis height	Cable Size	Cable Loss (dB)	Additional Loss	ERP	Power Density Value	Power Density Percentage
1a	Ericsson	AIR21 B4A/B2P	Active	AWS - 2100 MHz	LTE	60	2	120	-3.95	170	164	None	0	0	48.326044	0.645951	0.06460%
1b	Ericsson	AIR21 B4A/B2P	Not Used	-	-			0	-3.95	170	164	None	0	0	0	0	0.00000%
2a	Ericsson	AIR21 B2A / B4P	Active	PCS - 1950 MHz	GSM / UMTS	30	2	60	-3.95	170	164	None	0	0	24.163022	0.322975	0.03230%
1b	Ericsson	AIR21 B4A/B2P	Passive	AWS - 2100 MHz	UMTS	40	2	80	-3.95	170	114	None	0	0	32.217363	0.891223	0.08912%
													Sector total Power Density Value:		0.186%		

Sector 2

Antenna Number	Antenna Make	Antenna Model	Status	Frequency Band	Technology	Power Out Per Channel (Watts)	Number of Channels	Composite Power	Antenna Gain in direction of sample point (dBd)	Antenna Height (ft)	analysis height	Cable Size	Cable Loss (dB)	Additional Loss	ERP	Power Density Value	Power Density Percentage
1a	Ericsson	AIR21 B4A/B2P	Active	AWS - 2100 MHz	LTE	60	2	120	-3.95	170	164	None	0	0	48.326044	0.645951	0.06460%
1b	Ericsson	AIR21 B4A/B2P	Not Used	-	-			0	-3.95	170	164	None	0	0	0	0	0.00000%
2a	Ericsson	AIR21 B2A / B4P	Active	PCS - 1950 MHz	GSM / UMTS	30	2	60	-3.95	170	164	None	0	0	24.163022	0.322975	0.03230%
1b	Ericsson	AIR21 B4A/B2P	Passive	AWS - 2100 MHz	UMTS	40	2	80	-3.95	170	114	None	0	0	32.217363	0.891223	0.08912%
													Sector total Power Density Value:		0.186%		

Sector 3

Antenna Number	Antenna Make	Antenna Model	Status	Frequency Band	Technology	Power Out Per Channel (Watts)	Number of Channels	Composite Power	Antenna Gain in direction of sample point (dBd)	Antenna Height (ft)	analysis height	Cable Size	Cable Loss (dB)	Additional Loss	ERP	Power Density Value	Power Density Percentage
1a	Ericsson	AIR21 B4A/B2P	Active	AWS - 2100 MHz	LTE	60	2	120	-3.95	170	164	None	0	0	48.326044	0.645951	0.06460%
1b	Ericsson	AIR21 B4A/B2P	Not Used	-	-			0	-3.95	170	164	None	0	0	0	0	0.00000%
2a	Ericsson	AIR21 B2A / B4P	Active	PCS - 1950 MHz	GSM / UMTS	30	2	60	-3.95	170	164	None	0	0	24.163022	0.322975	0.03230%
1b	Ericsson	AIR21 B4A/B2P	Passive	AWS - 2100 MHz	UMTS	40	2	80	-3.95	170	114	None	0	0	32.217363	0.891223	0.08912%
													Sector total Power Density Value:		0.186%		

Site Composite MPE %	
Carrier	MPE %
T-Mobile	0.558%
Verizon Wireless	11.780%
AT&T	6.840%
Total Site MPE %	19.178%

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Summary

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

The anticipated Maximum Composite contributions from the T-Mobile facility are **0.558% (0.186% from each sector)** of the allowable FCC established general public limit considering all three sectors simultaneously sampled at the ground level.

The anticipated composite MPE value for this site assuming all carriers present is **19.178%** 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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