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

April 1, 2015

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 equipment upgrade
T-Mobile Site ID CT11075
2 Sunny Lane, Westport CT

Dear Attorney Bachman:

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

In this case, Verizon Wireless owns the existing telecommunications tower and related facility at 2 Sunny Lane, Westport Connecticut (latitude 41.162773, longitude -73.373336). T-Mobile intends to replace three (3) antennas and add related equipment at this existing facility in Westport ("Westport Facility"). Please accept this letter as notification, pursuant to R.C.S.A. § 16-50j-73, of construction which constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to the First Selectman, Jim Marpe, and the property owner, Cellco Partnership d/b/a/ Verizon Wireless.

The existing Westport Facility consists of a 130 foot tower.[1] T-Mobile plans to replace three (3) antennas mounted on the tower at a centerline of 110 feet. T-Mobile will add three remote radio heads at the same centerline. (See the plans revised to February 10, 2015 attached hereto as Exhibit A). The existing tower is structurally capable of supporting T-Mobile's proposed use, as indicated in the structural analysis report dated March 9, 2015 and attached hereto as Exhibit B.

[1] The Westport Facility was approved in Docket No. 188. The Decision and Order in Docket No. 188 contains no relevant limitations or restrictions on T-Mobile's proposed modifications.

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

1 . The proposed modification will not increase the height of the tower. T-Mobile's replacement antennas and equipment will be installed at the 110 foot level. The enclosed tower drawing confirms that the proposed modification will not increase the height of the tower.

2 . T-Mobile does not plan any modification within the existing compound, so no extensions of the site boundaries are proposed.

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

4 . The operation of the 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 23, 2015 T-Mobile's operations would add 11.16% 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 74.12% of the FCC Standard as calculated for a mixed frequency site as evidenced by the engineering exhibit attached hereto as Exhibit C.

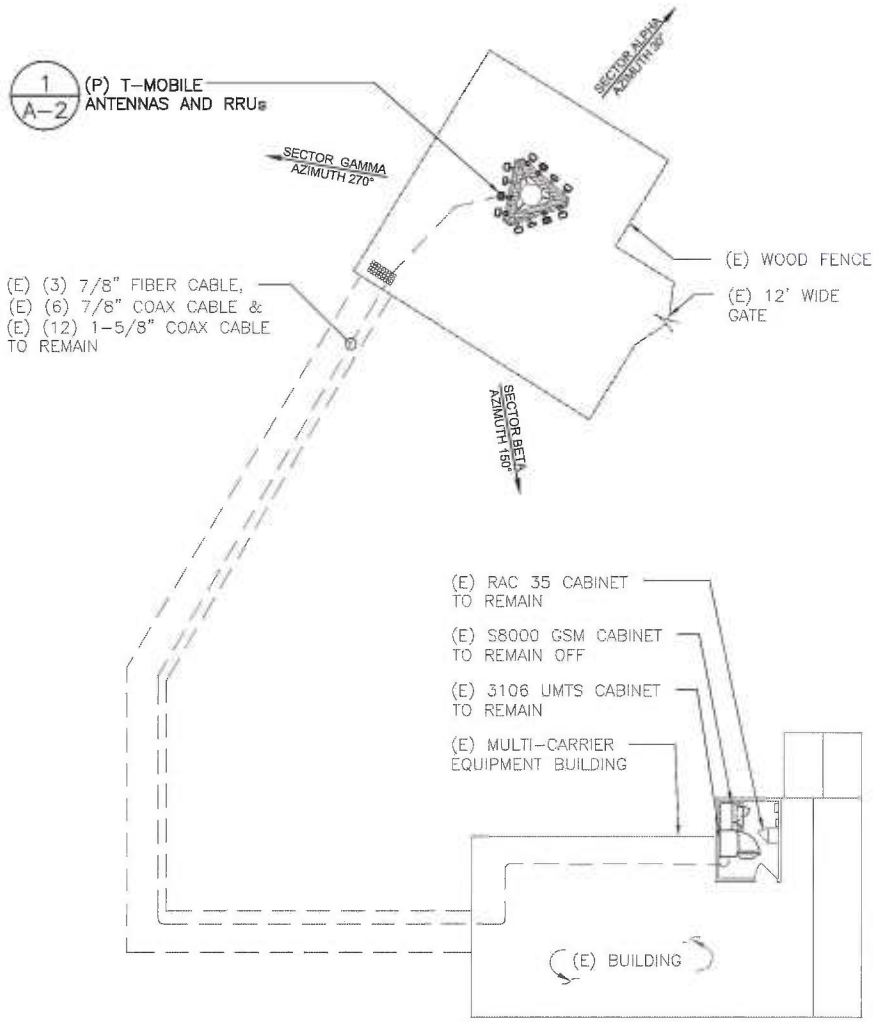
For the foregoing reasons, T-Mobile respectfully submits that the proposed replacement antennas and equipment at the Westport Facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2). Upon acknowledgement by the Council of this proposed exempt modification, T-Mobile shall commence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

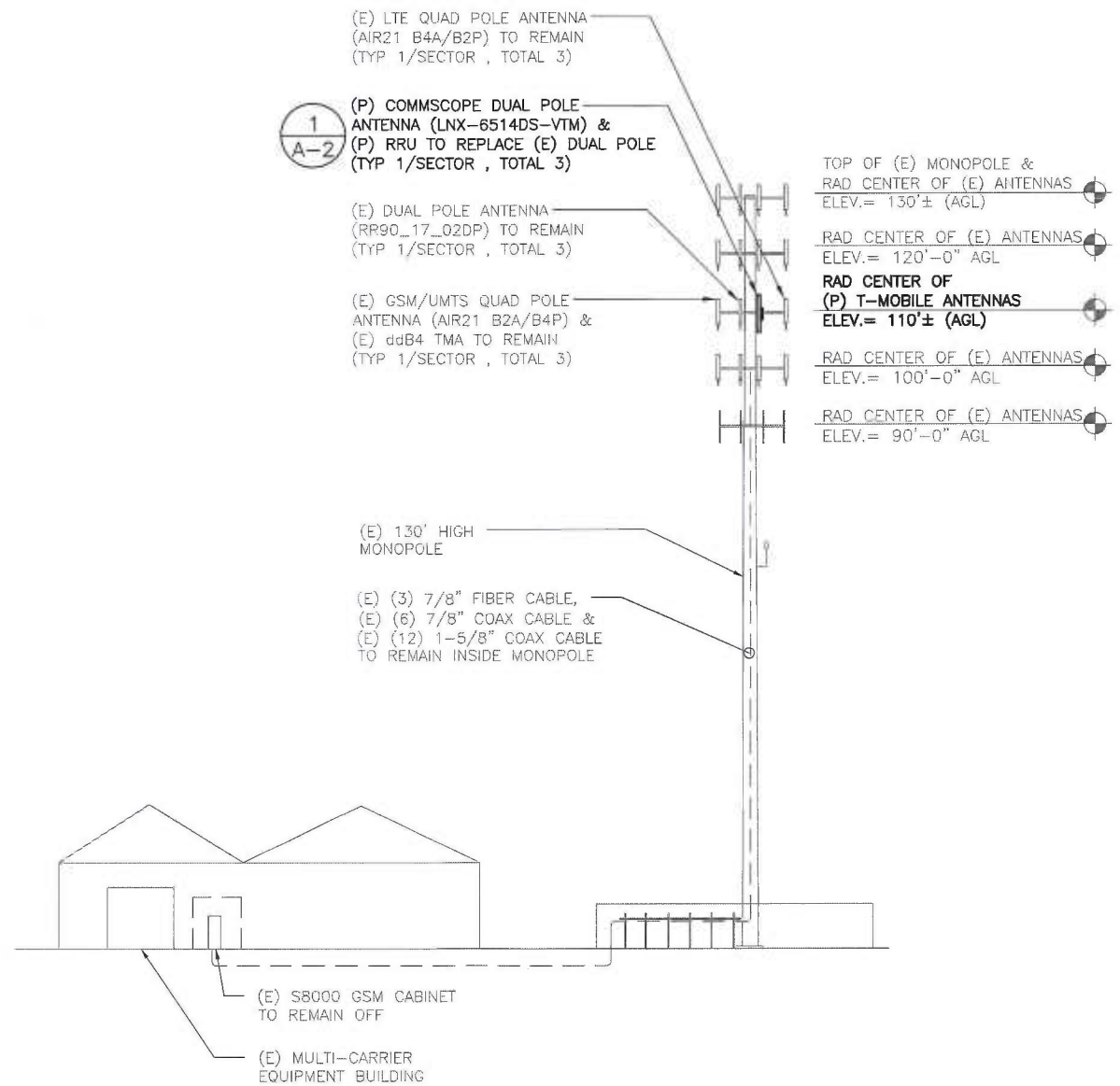
Sincerely,

Julie D. Kohler, Esq.

cc: First Selectman Jim Marpe, Town of Westport
Kenneth C. Baldwin Esq. for Verizon Wireless
Cellco Partnership d/b/a Verizon Wireless
Sheldon Freincle, NSS

EXHIBIT A





SITE PLAN

1
A-1

SCALE: 1" = 30'-0" (11x17)
1" = 15'-0" (24x36)

0 30 60 90

SCALE 1"=30' (11x17)
1"=15' (24x36)

ELEVATION VIEW

2
A-1

SCALE: 1" = 30'-0" (11x17)
1" = 15'-0" (24x36)

0 30 60 90

SCALE 1"=30' (11x17)
1"=15' (24x36)

GENERAL SITE NOTES

1. SITE INFORMATION WAS OBTAINED FROM A FIELD INVESTIGATION PERFORMED BY ATLANTIS GROUP, INC. CONTRACTOR TO FIELD VERIFY DIMENSIONS AS NECESSARY BEFORE CONSTRUCTION.

2. THE PROPOSED DEVELOPMENT DOES NOT INCLUDE SIGNS OF ADVERTISING.

3. THE PROPOSED DEVELOPMENT IS UNMANNED AND THEREFORE DOES NOT REQUIRE A MEANS OF WATER SUPPLY OR SEWAGE DISPOSAL.

4. NO LANDSCAPING WORK IS PROPOSED IN CONJUNCTION WITH THIS DEVELOPMENT OTHER THAN THAT WHICH IS SHOWN.

5. THE PROPOSED DEVELOPMENT DOES NOT INCLUDE OUTDOOR STORAGE OR ANY SOLID WASTE RECEPTACLES.

6. UTILITIES SHOWN ON PLAN ARE TAKEN FROM OWNERS RECORDS AND FIELD LOCATION OF VISIBLE SURFACE FEATURES. THE EXISTENCE, EXTENT AND EXACT HORIZONTAL AND VERTICAL LOCATIONS OF UTILITIES HAS NOT BEEN VERIFIED. ANY CONTRACTOR PERFORMING WORK ON THIS SITE MUST CONTACT CALL BEFORE YOU DIG THREE WORKING DAYS PRIOR TO COMMENCING WORK.

7. ALL OBSOLETE OR UNUSED FACILITIES SHALL BE REMOVED WITHIN 12 MONTHS OF CESSATION OF OPERATIONS.

SITE LEGEND

- SITE PROPERTY LINE
- STREET OR ROAD
- CHAIN LINK FENCE
- OPAQUE WOODEN FENCE
- BOARD ON BOARD FENCE
- DECIDUOUS TREES/SHRUBS
- EVERGREEN TREES/SHRUBS
- TREE LINE
- UTILITY POLE
- (E) EXISTING
- (N) NEW
- (P) PROPOSED
- (F) FUTURE
- PROP. LTE ANTENNA
- PROP. UMTS/GSM ANTENNA
- EX. GSM ANTENNA
- EX. UMTS ANTENNA

T-Mobile

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

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

SUBMITTALS

DATE	DESCRIPTION	REVISION
02/10/15	ISSUED FOR REVIEW	A

DEPT.	DATE	APP'D	REVISIONS
RFE			
RF MAN.			
ZONING			
OPS			
CONSTR.			
SITE AC.			

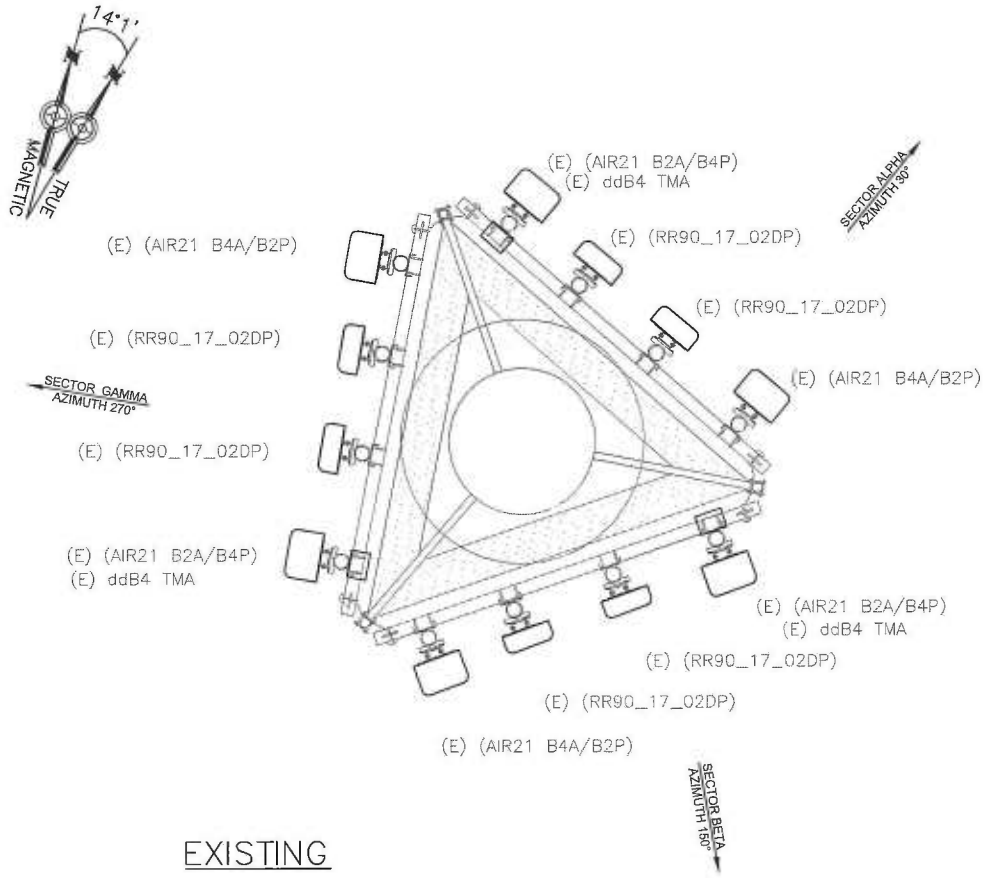
PROJECT NO:	CT11075C
DRAWN BY:	EB
CHECKED BY:	SM

PROFESSIONAL SEAL

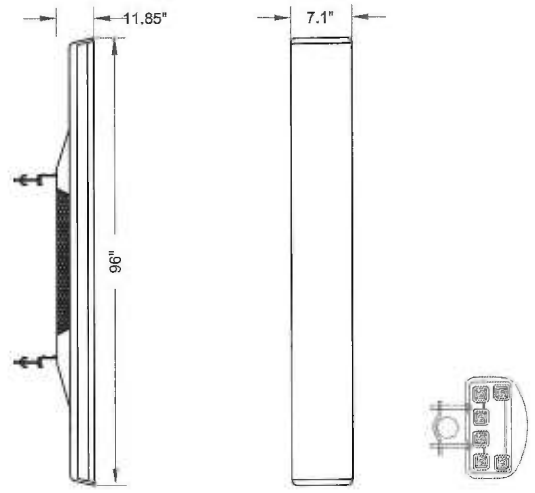
SITE NAME
CT11075C
SITE NAME
WESTPORT/ MP X 41
SITE ADDRESS
2 SUNNY LANE
WESTPORT ,CT 06880

SHEET TITLE
PLOT PLAN,
SITE PLAN
AND
ELEVATION

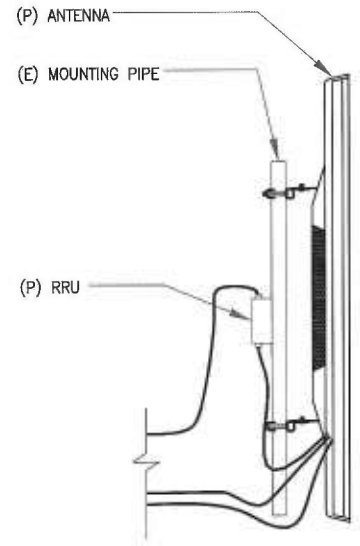
SHEET NUMBER
A-1

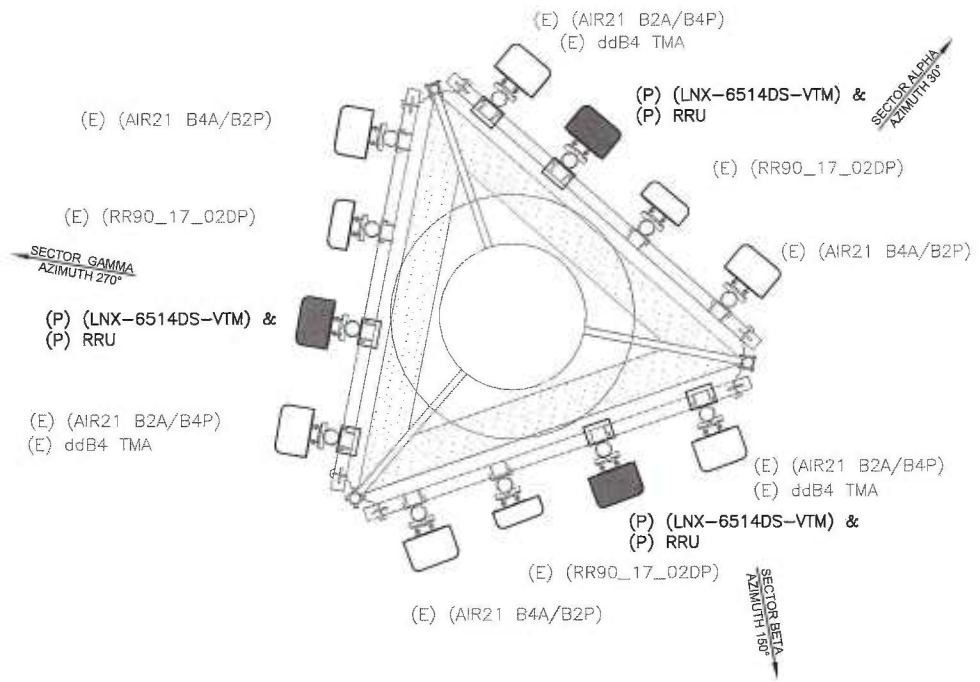


EXISTING



MANUFACTURER: COMMSCOPE
MODEL NO.: LNX-6515DS-VTM
DIMENSIONS – HxWxD, (IN) 96x11.85x7.1



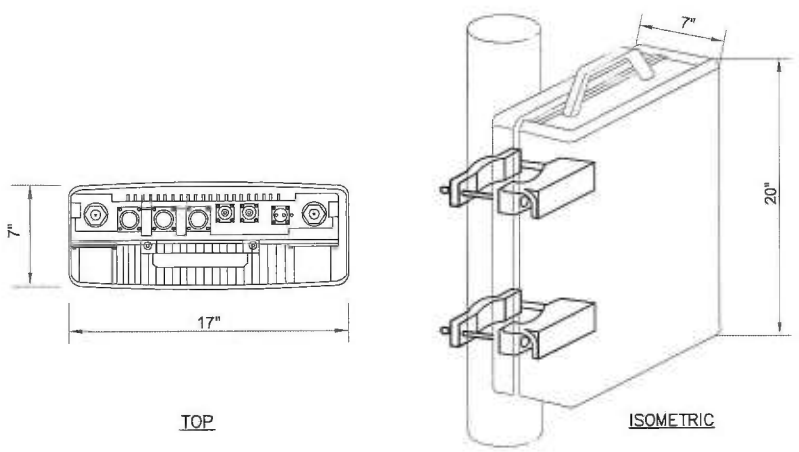


FINAL

ANTENNA PLAN (1 / A-2)
SCALE: N.T.S

COMMSCOPE ANTENNA DETAIL (1 / A-3)
SCALE: N.T.S

ANTENNA MOUNT DETAIL (2 / A-3)
SCALE: N.T.S



RRUS 11 B12 DETAILS (3 / A-3)
SCALE: N.T.S

T-Mobile

T-MOBILE NORTHEAST, LLC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
OFFICE: (860) 692-7100
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Newton Center, MA 02459
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Fax: 617-213-5056

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DATE	DESCRIPTION	REVISION
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RFE			
RF MAN.			
ZONING			
OPS			
CONSTR.			
SITE AC.			

PROJECT NO:	CT11075C
DRAWN BY:	EB
CHECKED BY:	SM

PROFESSIONAL SEAL

SITE NAME
CT11075C
SITE NAME
WESTPORT/ MP X 41
SITE ADDRESS
2 SUNNY LANE
WESTPORT ,CT 06880

SHEET TITLE
ANTENNA PLAN AND DETAILS

SHEET NUMBER
A-2

EXHIBIT B

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

130-ft Existing EEI Monopole

Proposed T-Mobile
Antenna Upgrade

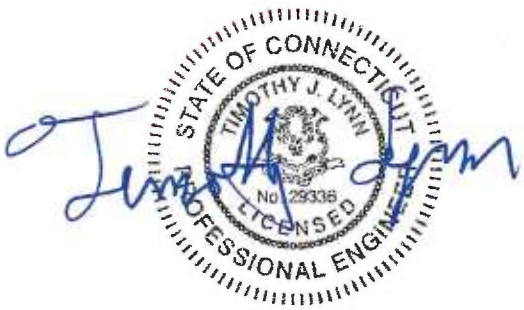
T-Mobile Site Ref: CT11075C

Verizon Site Ref: Cranbury

2 Sunny Lane
Westport, CT

Centek Project No. 15049.001

Date: March 9, 2015



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

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

Table of Contents

Introduction

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

The host tower is a 130-ft tall, three-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI job no; 10847-E01), signed and sealed June 6, 2002. The manufacturer's drawings and calculations were unavailable for use in this report. The tower geometry, structure member sizes and foundation system information were obtained from a previous structural analysis report prepared by Centek Engineering job no; 14033.012 dated November 11, 2014.

Antenna and appurtenance information were obtained from the aforementioned structural report, a tower mapping report prepared by Eastern Communications dated October 20, 2014 and a T-Mobile RF data sheet.

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

T-Mobile proposes the removal of three (3) panel antennas and the installation of three (3) panel antennas and three (3) remote radio heads mounted to the existing antenna platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

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

- 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 130-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/CLEARWIRE (Existing):
  Antennas: Three (3) Kathrein 840-10054 panel antennas w/ Samsung Remote Radio Heads U-RAS , one (1) Andrew VHLP800-11-DW1 microwave dish, three (3) RFS APXVSPP18-C-A20 panel antennas, three (3) RFS APXVTM14-C-I20 panel antennas, three (3) Alcatel-Lucent TD-RRH8x20 remote radio heads, three (3) ALU 1900 MHz RRH's and three (3) ALU 800 MHz RRH's mounted on an existing low profile platform with a RAD center elevation of 120-ft above the existing tower base plate.
  Coax Cables: Two (2) 2" ∅ flex conduits (with three (3) fiber and three (3) dc control cables running in each one), one (1) 7/8" ∅ coax cable and four (4) 1-1/4" ∅ Hybriflex cables running on the interior of the existing tower.

- AT&T (Existing):
  Antennas: Three (3) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted to one (1) universal ring mount with a RAD center elevation of 104-ft above grade level.
  Coax Cables: One (1) fiber cable and two (2) dc control cables running within the interior of the existing tower.
- AT&T (Existing):
  Antennas: Six (6) Powerwave 7770 panel antennas, three (3) Powerwave P65-16-XLH-RR panel antennas, twelve (12) Powerwave LGP21401 TMA's and one (1) GPS mounted on an existing low profile platform with a RAD center elevation of 100-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables, one (1) 1/2" ∅ coax cable and three (3) 3/8 ∅ RET cables running on the inside of the existing tower.
- VACANT (Existing):
  Antennas: One (1) low profile platform with an elevation of 89-ft above the existing tower base plate.
- UNKNOWN (Existing):
  GPS Antennas: Five (5) GPS antennas and mounted on five GPS stand-off mounts with RAD center elevations of 70-ft and 72-ft above grade level.
  Coax Cables: Five (5) 1/2" ∅ coax cables running within the interior of the existing tower.
- AT&T (Existing):
  LTE GPS Antenna: One (1) LTE GPS antenna and mounted on one (1) SitePro1 2-ft GPS stand-off mount (P/N #CHGPS) with a RAD center elevation of 60-ft above grade level.
  Coax Cables: One (1) 1/2" ∅ coax cable running within the interior of the existing tower.
- T-MOBILE (Existing to Remain):
  Antennas: Three (3) RR90-17-02DP panel antennas, six (6) Ericsson AIR21-B2A/B4P panel antennas, three (3) RFS ATMP1412D-1A20 TMA's and one (1) GPS mounted on an existing low profile platform with a RAD center elevation of 110-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅, six (6) 7/8" ∅, one (1) 1/2" ∅ coax cables and one (1) 1-5/8" ∅ hybrid cable running on the inside of the existing tower.
- T-MOBILE (Existing to Remove):
  Antennas: Three (3) RR90-17-02DP panel antennas mounted on an existing low profile platform with a RAD center elevation of 110-ft above the existing tower base plate.
- **T-MOBILE (Proposed):**
  Antennas: Three (3) Andrew LNX-6515DS panel antennas and three (3) Ericsson RRUS-11 remote radio heads mounted on an existing low profile platform with a RAD center elevation of 110-ft above the existing tower base plate.

Primary Assumptions Used in the Analysis

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

Analysis

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

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

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

Tower Loading

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

Basic Wind Speed:	Fairfield; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Westport; v = 110 mph (3 second gust) equivalent to v = 90 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	Appendix K wind speed controls.	
Load Cases:	Load Case 1; 90 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 78 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 78 mph wind speed velocity represents 75% of the wind pressure generated by the 90 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

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

Tower Capacity

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

- Calculated stresses were found to be within allowable limits. In Load Case 1, per tnxTower "Section Capacity Table", the maximum tower steel usage was found to be at **71.5%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L1)	82.17'-130.00'	50.8%	**PASS**
Pole Shaft (L2)	42.01'-82.17'	69.4%	**PASS**
Pole Shaft (L3)	0.00'-42.01'	71.5%	**PASS**

Foundation and Anchors

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

- 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	40 kips
	Compression	47 kips
	Moment	3966 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	2.32	**PASS**

Note 1: FS denotes Factor of Safety.

Note 2: OTM denotes Overturning Moment

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Combined Axial & Bending	70.0%	**PASS**
Base Plate	Bending	91.3%	**PASS**

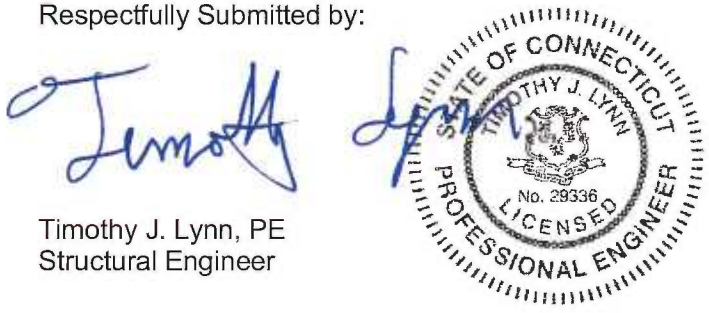
Conclusion

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:



Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information 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.

tnxTower	Job	Page
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	15049.001 - CT11075C	1 of 23
	Project 130-ft EEI Monopole - 2 Sunny Lane Westport, CT	Date 09:16:00 03/09/15
	Client T-Mobile	Designed by TJL

Tower Input Data

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

Tower is located in Fairfield County, Connecticut.
Basic wind speed of 90 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 78 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

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

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

Tapered Pole Properties

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

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

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement	Total Number		C_AA_A	Weight
				ft			ft^2/ft	klf
1 5/8	C	No	Inside Pole	130.000 - 3.000	12	No Ice	0.000	0.001
(Verizon - Existing)						1/2" Ice	0.000	0.001
2" dia Flex Conuit	A	No	Inside Pole	120.000 - 3.000	2	No Ice	0.000	0.005
(Clearwire - Existing)						1/2" Ice	0.000	0.005
1/2	A	No	Inside Pole	120.000 - 3.000	1	No Ice	0.000	0.000
(Clearwire - Existing)						1/2" Ice	0.000	0.000
7/8	C	No	Inside Pole	110.000 - 3.000	6	No Ice	0.000	0.001
(T-Mobile - Existing)						1/2" Ice	0.000	0.001
1/2	C	No	Inside Pole	110.000 - 3.000	1	No Ice	0.000	0.000
(T-Mobile - Existing)						1/2" Ice	0.000	0.000
1 5/8	C	No	Inside Pole	100.000 - 3.000	12	No Ice	0.000	0.001
(AT&T - Existing)						1/2" Ice	0.000	0.001
1/2	C	No	Inside Pole	100.000 - 3.000	1	No Ice	0.000	0.000
(AT&T - Existing)						1/2" Ice	0.000	0.000
1/2	C	No	Inside Pole	72.000 - 3.000	2	No Ice	0.000	0.000
(GPS)						1/2" Ice	0.000	0.000
1/2	C	No	Inside Pole	70.000 - 3.000	3	No Ice	0.000	0.000
(GPS)						1/2" Ice	0.000	0.000
RG6-Fiber	C	No	Inside Pole	130.000 - 3.000	1	No Ice	0.000	0.001
(AT&T - Existing)						1/2" Ice	0.000	0.001
#8 AWG Copper WIre	C	No	Inside Pole	130.000 - 3.000	2	No Ice	0.000	0.000

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
(AT&T - Existing)						1/2" Ice	0.000	0.000
0.3" dia RET	C	No	Inside Pole	100.000 - 0.000	3	No Ice	0.000	0.000
(AT&T - Existing)						1/2" Ice	0.000	0.000
1/2	C	No	Inside Pole	60.000 - 3.000	1	No Ice	0.000	0.000
(AT&T - Existing)						1/2" Ice	0.000	0.000
1 5/8	C	No	Inside Pole	110.000 - 3.000	12	No Ice	0.000	0.001
(T-Mobile - Existing)						1/2" Ice	0.000	0.001
1 5/8	C	No	Inside Pole	110.000 - 3.000	1	No Ice	0.000	0.001
(T-Mobile - Existing)						1/2" Ice	0.000	0.001
HYBRIFLEX 1-1/4"	C	No	Inside Pole	120.000 - 3.000	3	No Ice	0.000	0.001
(Sprint - Existing)						1/2" Ice	0.000	0.001
HYBRIFLEX 1-5/8"	C	No	CaAa (Out Of	130.000 - 3.000	2	No Ice	0.000	0.002
(Verizon - Reserved)			Face)			1/2" Ice	0.000	0.003
1 5/8	C	No	CaAa (Out Of	130.000 - 3.000	1	No Ice	0.198	0.001
(Verizon - Reserved)			Face)			1/2" Ice	0.298	0.003
1 5/8	C	No	CaAa (Out Of	130.000 - 3.000	5	No Ice	0.000	0.001
(Verizon - Reserved)			Face)			1/2" Ice	0.000	0.003
HYBRIFLEX 1-1/4"	C	No	Inside Pole	120.000 - 3.000	1	No Ice	0.000	0.001
(Sprint - Existing)						1/2" Ice	0.000	0.001

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	130.000-82.170	A	0.000	0.000	0.000	0.000	0.388
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	9.470	2.027
L2	82.170-42.010	A	0.000	0.000	0.000	0.000	0.412
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	7.952	2.392
L3	42.010-0.000	A	0.000	0.000	0.000	0.000	0.400
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	7.724	2.343

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	130.000-82.170	A	0.500	0.000	0.000	0.000	0.000	0.388
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	14.253	2.605
L2	82.170-42.010	A	0.500	0.000	0.000	0.000	0.000	0.412
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	11.968	2.878
L3	42.010-0.000	A	0.500	0.000	0.000	0.000	0.000	0.400
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	11.625	2.815

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
EEI Low Profile Platform	C	None		0.000	129.000	No Ice	22.500	22.500	1.500
(Verizon - Existing)						1/2" Ice	28.200	28.200	2.250
LPA-80063/6CF	A	From Face	3.000	0.000	130.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-171063-12CF	A	From Face	3.000	0.000	130.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
BXA-70063/6CF	A	From Face	3.000	0.000	130.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
BXA-70063/6CF	A	From Face	3.000	0.000	130.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			-1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
LPA-171063-12CF	A	From Face	3.000	0.000	130.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			-4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
LPA-80063/6CF	A	From Face	3.000	0.000	130.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-80063/6CF	B	From Face	3.000	0.000	130.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-171063-12CF	B	From Face	3.000	0.000	130.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
BXA-70063/6CF	B	From Face	3.000	0.000	130.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
BXA-70063/6CF	B	From Face	3.000	0.000	130.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			-1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
LPA-171063-12CF	B	From Face	3.000	0.000	130.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			-4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
LPA-80063/6CF	B	From Face	3.000	0.000	130.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-80063/6CF	C	From Face	3.000	0.000	130.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-171063-12CF	C	From Face	3.000	0.000	130.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
BXA-70063/6CF	C	From Face	3.000	0.000	130.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
BXA-70063/6CF	C	From Face	3.000	0.000	130.000	No Ice	7.731	4.158	0.012
(Verizon - Reserved)			-1.000			1/2" Ice	8.268	4.595	0.054
			0.000						
LPA-171063-12CF	C	From Face	3.000	0.000	130.000	No Ice	5.994	6.054	0.012
(Verizon - Reserved)			-4.000			1/2" Ice	6.462	6.523	0.055
			0.000						
LPA-80063/6CF	C	From Face	3.000	0.000	130.000	No Ice	10.308	9.005	0.027
(Verizon - Reserved)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(2) FD9R6004/2C-3L	A	From Face	3.000	0.000	130.000	No Ice	0.367	0.085	0.003
Diplexer			0.000			1/2" Ice	0.451	0.136	0.005
(Verizon - Reserved)			0.000						
(2) FD9R6004/2C-3L	B	From Face	3.000	0.000	130.000	No Ice	0.367	0.085	0.003
Diplexer			0.000			1/2" Ice	0.451	0.136	0.005
(Verizon - Reserved)			0.000						
(2) FD9R6004/2C-3L	C	From Face	3.000	0.000	130.000	No Ice	0.367	0.085	0.003
Diplexer			0.000			1/2" Ice	0.451	0.136	0.005
(Verizon - Reserved)			0.000						
RRH2x40-AWS	A	From Face	3.000	0.000	130.000	No Ice	2.522	1.589	0.044
(Verizon - Reserved)			0.000			1/2" Ice	2.753	1.795	0.061
			0.000						
RRH2x40-AWS	B	From Face	3.000	0.000	130.000	No Ice	2.522	1.589	0.044
(Verizon - Reserved)			0.000			1/2" Ice	2.753	1.795	0.061
			0.000						
RRH2x40-AWS	C	From Face	3.000	0.000	130.000	No Ice	2.522	1.589	0.044
(Verizon - Reserved)			0.000			1/2" Ice	2.753	1.795	0.061
			0.000						
RRH2x40-07-U	A	From Face	3.000	0.000	130.000	No Ice	2.246	1.228	0.050
(Verizon - Reserved)			0.000			1/2" Ice	2.447	1.385	0.067
			0.000						
RRH2x40-07-U	B	From Face	3.000	0.000	130.000	No Ice	2.246	1.228	0.050
(Verizon - Reserved)			0.000			1/2" Ice	2.447	1.385	0.067
			0.000						
RRH2x40-07-U	C	From Face	3.000	0.000	130.000	No Ice	2.246	1.228	0.050
(Verizon - Reserved)			0.000			1/2" Ice	2.447	1.385	0.067
			0.000						
DB-T1-6Z-8AB-0Z	A	From Face	3.000	0.000	130.000	No Ice	5.600	2.333	0.044
(Verizon - Reserved)			0.000			1/2" Ice	5.915	2.558	0.080
			0.000						
EEI Low Profile Platform	C	None		0.000	119.000	No Ice	22.500	22.500	1.500
(Sprint - Existing)						1/2" Ice	28.200	28.200	2.250
APXVSPP18-C-A20	A	From Face	3.500	0.000	120.000	No Ice	8.260	5.283	0.057
(Sprint - Existing)			6.000			1/2" Ice	8.807	5.736	0.107
			0.000						
APXVSPP18-C-A20	B	From Face	3.500	0.000	120.000	No Ice	8.260	5.283	0.057
(Sprint - Existing)			-6.000			1/2" Ice	8.807	5.736	0.107
			0.000						
APXVSPP18-C-A20	C	From Face	3.500	0.000	120.000	No Ice	8.260	5.283	0.057
(Sprint - Existing)			6.000			1/2" Ice	8.807	5.736	0.107
			0.000						
APXVTM14	A	From Face	3.500	0.000	120.000	No Ice	6.897	3.607	0.056
(Sprint - Existing)			-6.000			1/2" Ice	7.348	3.967	0.096
			0.000						
APXVTM14	B	From Face	3.500	0.000	120.000	No Ice	6.897	3.607	0.056
(Sprint - Existing)			-6.000			1/2" Ice	7.348	3.967	0.096
			0.000						
APXVTM14	C	From Face	3.500	0.000	120.000	No Ice	6.897	3.607	0.056
(Sprint - Existing)			-6.000			1/2" Ice	7.348	3.967	0.096
			0.000						
TD-RRH8x20-25	A	From Face	0.500	0.000	117.000	No Ice	4.720	1.700	0.070
(Sprint - Existing)			-1.000			1/2" Ice	5.014	1.917	0.097
			0.000						
TD-RRH8x20-25	B	From Face	0.500	0.000	117.000	No Ice	4.720	1.700	0.070
(Sprint - Existing)			-1.000			1/2" Ice	5.014	1.917	0.097
			0.000						
TD-RRH8x20-25	C	From Face	0.500	0.000	117.000	No Ice	4.720	1.700	0.070

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(Sprint - Existing)			-1.000 0.000			1/2" Ice	5.014	1.917	0.097
FD-RRH 2x50 800	A	From Face	0.500	0.000	117.000	No Ice	2.401	2.254	0.064
(Sprint - Existing)			-1.000 0.000			1/2" Ice	2.613	2.460	0.086
FD-RRH 2x50 800	B	From Face	0.500	0.000	117.000	No Ice	2.401	2.254	0.064
(Sprint - Existing)			-1.000 0.000			1/2" Ice	2.613	2.460	0.086
FD-RRH 2x50 800	C	From Face	0.500	0.000	117.000	No Ice	2.401	2.254	0.064
(Sprint - Existing)			-1.000 0.000			1/2" Ice	2.613	2.460	0.086
FD-RRH 4x40 1900	A	From Face	0.500	0.000	117.000	No Ice	2.609	2.709	0.060
(Sprint - Existing)			1.000 0.000			1/2" Ice	2.845	2.948	0.083
FD-RRH 4x40 1900	B	From Face	0.500	0.000	117.000	No Ice	2.609	2.709	0.060
(Sprint - Existing)			1.000 0.000			1/2" Ice	2.845	2.948	0.083
FD-RRH 4x40 1900	C	From Face	0.500	0.000	117.000	No Ice	2.609	2.709	0.060
(Sprint - Existing)			1.000 0.000			1/2" Ice	2.845	2.948	0.083
Valmont Uni-Tri Bracket	C	None		0.000	117.000	No Ice	1.750	1.750	0.290
(Sprint - Existing)						1/2" Ice	1.940	1.940	0.306
840-10054	A	From Face	3.500	0.000	120.000	No Ice	5.186	1.361	0.000
(Clearwire - Existing)			2.000 0.000			1/2" Ice	5.545	1.620	0.024
840-10054	B	From Face	3.500	0.000	120.000	No Ice	5.186	1.361	0.000
(Clearwire - Existing)			2.000 0.000			1/2" Ice	5.545	1.620	0.024
840-10054	C	From Face	3.500	0.000	120.000	No Ice	5.186	1.361	0.000
(Clearwire - Existing)			2.000 0.000			1/2" Ice	5.545	1.620	0.024
RRH	A	From Face	3.000	0.000	120.000	No Ice	1.804	0.778	0.033
(Clearwire - Existing)			0.000 0.000			1/2" Ice	2.000	0.920	0.045
RRH	B	From Face	3.000	0.000	120.000	No Ice	1.804	0.778	0.033
(Clearwire - Existing)			0.000 0.000			1/2" Ice	2.000	0.920	0.045
RRH	C	From Face	3.000	0.000	120.000	No Ice	1.804	0.778	0.033
(Clearwire - Existing)			0.000 0.000			1/2" Ice	2.000	0.920	0.045
6'x3" Pipe Mount	A	From Face	3.500	0.000	120.000	No Ice	1.767	1.767	0.035
(Clearwire - Existing)			-2.000 0.000			1/2" Ice	2.129	2.129	0.048
6'x3" Pipe Mount	B	From Face	3.500	0.000	120.000	No Ice	1.767	1.767	0.035
(Clearwire - Existing)			-2.000 0.000			1/2" Ice	2.129	2.129	0.048
Filter Box	A	From Face	3.500	0.000	120.000	No Ice	3.500	1.400	0.040
(Clearwire - Existing)			2.000 0.000			1/2" Ice	3.751	1.573	0.063
EEI Low Profile Platform	C	None		0.000	109.000	No Ice	22.500	22.500	1.500
(T-Mobile - Existing)						1/2" Ice	28.200	28.200	2.250
LNX-6515DS	A	From Face	3.500	0.000	110.000	No Ice	11.445	7.696	0.055
(T-Mobile - Proposed)			-2.000 0.000			1/2" Ice	12.064	8.289	0.121
RR90-17-02DP	A	From Face	3.500	0.000	110.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			-6.000 0.000			1/2" Ice	4.775	2.312	0.040

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
LNX-6515DS	B	From Face	3.500	0.000	110.000	No Ice	11.445	7.696	0.055
(T-Mobile - Proposed)			-2.000			1/2" Ice	12.064	8.289	0.121
			0.000						
RR90-17-02DP	B	From Face	3.500	0.000	110.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			-6.000			1/2" Ice	4.775	2.312	0.040
			0.000						
LNX-6515DS	C	From Face	3.500	0.000	110.000	No Ice	11.445	7.696	0.055
(T-Mobile - Proposed)			-2.000			1/2" Ice	12.064	8.289	0.121
			0.000						
RR90-17-02DP	C	From Face	3.500	0.000	110.000	No Ice	4.356	1.974	0.018
(T-Mobile - Existing)			-6.000			1/2" Ice	4.775	2.312	0.040
			0.000						
ATMAP1412D-1A20	A	From Face	3.500	0.000	110.000	No Ice	1.167	0.467	0.013
(T-Mobile - Existing)			2.000			1/2" Ice	1.314	0.575	0.021
			0.000						
ATMAP1412D-1A20	B	From Face	3.500	0.000	110.000	No Ice	1.167	0.467	0.013
(T-Mobile - Existing)			2.000			1/2" Ice	1.314	0.575	0.021
			0.000						
ATMAP1412D-1A20	C	From Face	3.500	0.000	110.000	No Ice	1.167	0.467	0.013
(T-Mobile - Existing)			2.000			1/2" Ice	1.314	0.575	0.021
			0.000						
GPS	A	From Face	2.000	0.000	113.000	No Ice	1.000	1.000	0.010
(T-Mobile - Existing)			0.000			1/2" Ice	1.500	1.500	0.015
			0.000						
AIR21	A	From Face	3.500	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Existing)			6.000			1/2" Ice	6.978	4.775	0.125
			0.000						
AIR21	A	From Face	3.500	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Existing)			2.000			1/2" Ice	6.978	4.775	0.125
			0.000						
AIR21	B	From Face	3.500	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Existing)			6.000			1/2" Ice	6.978	4.775	0.125
			0.000						
AIR21	B	From Face	3.500	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Existing)			2.000			1/2" Ice	6.978	4.775	0.125
			0.000						
AIR21	C	From Face	3.500	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Existing)			6.000			1/2" Ice	6.978	4.775	0.125
			0.000						
AIR21	C	From Face	3.500	0.000	110.000	No Ice	6.533	4.356	0.083
(T-Mobile - Existing)			2.000			1/2" Ice	6.978	4.775	0.125
			0.000						
RRUS-11	A	From Face	3.500	0.000	110.000	No Ice	2.994	1.246	0.050
(T-Mobile - Proposed)			-2.000			1/2" Ice	3.226	1.412	0.070
			0.000						
RRUS-11	B	From Face	3.500	0.000	110.000	No Ice	2.994	1.246	0.050
(T-Mobile - Proposed)			-2.000			1/2" Ice	3.226	1.412	0.070
			0.000						
RRUS-11	C	From Face	3.500	0.000	110.000	No Ice	2.994	1.246	0.050
(T-Mobile - Proposed)			-2.000			1/2" Ice	3.226	1.412	0.070
			0.000						
EEI Low Profile Platform	C	None		0.000	99.000	No Ice	22.500	22.500	1.500
(AT&T - Existing)						1/2" Ice	28.200	28.200	2.250
7770.00	A	From Face	3.000	0.000	100.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			-6.000			1/2" Ice	6.314	3.273	0.068
			0.000						
7770.00	A	From Face	3.000	0.000	100.000	No Ice	5.882	2.928	0.035

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

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(3) 6'x3" Pipe Mount (Vacant)	C	From Face	3.000 0.000 0.000	0.000	90.000	No Ice 1/2" Ice	1.767 2.129	1.767 2.129	0.035 0.048
GPS	A	From Face	1.000 0.000 0.000	0.000	70.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
GPS	B	From Face	1.000 0.000 0.000	0.000	70.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
GPS	C	From Face	1.000 0.000 0.000	0.000	70.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
GPS	A	From Face	1.000 0.000 0.000	0.000	72.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
GPS	C	From Face	1.000 0.000 0.000	0.000	72.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
3' GPS Stand-off Mount	A	From Face	1.500 0.000 0.000	0.000	70.000	No Ice 1/2" Ice	2.450 3.980	2.450 3.980	0.051 0.075
3' GPS Stand-off Mount	B	From Face	1.500 0.000 0.000	0.000	70.000	No Ice 1/2" Ice	2.450 3.980	2.450 3.980	0.051 0.075
Valmont B2069 2' GPS Mount	C	From Face	1.000 0.000 0.000	0.000	70.000	No Ice 1/2" Ice	0.780 1.100	0.680 1.100	0.025 0.033
3' GPS Stand-off Mount	A	From Face	1.500 0.000 0.000	0.000	72.000	No Ice 1/2" Ice	2.450 3.980	2.450 3.980	0.051 0.075
3' GPS Stand-off Mount	C	From Face	1.500 0.000 0.000	0.000	72.000	No Ice 1/2" Ice	2.450 3.980	2.450 3.980	0.051 0.075
GPS (AT&T - Existing)	B	From Face	2.000 0.000 0.000	0.000	60.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
3' GPS Stand-off Mount (AT&T - Existing)	B	From Face	1.500 0.000 0.000	0.000	60.000	No Ice 1/2" Ice	2.450 3.980	2.450 3.980	0.051 0.075

Dishes

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

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	104.971	1.392	0.029	138.308	A	0.000	138.308	138.308	100.00	0.000	0.000
130.000-82.17					B	0.000	138.308		100.00	0.000	0.000
0					C	0.000	138.308		100.00	0.000	9.470
L2	61.769	1.196	0.025	153.946	A	0.000	153.946	153.946	100.00	0.000	0.000
82.170-42.010					B	0.000	153.946		100.00	0.000	0.000
					C	0.000	153.946		100.00	0.000	7.952
L3	20.301	1	0.021	197.217	A	0.000	197.217	197.217	100.00	0.000	0.000
42.010-0.000					B	0.000	197.217		100.00	0.000	0.000
					C	0.000	197.217		100.00	0.000	7.724

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	104.971	1.392	0.022	0.500	142.294	A	0.000	142.294	142.294	100.00	0.000	0.000
130.000-82.170						B	0.000	142.294		100.00	0.000	0.000
						C	0.000	142.294		100.00	0.000	14.253
L2	61.769	1.196	0.019	0.500	157.293	A	0.000	157.293	157.293	100.00	0.000	0.000
82.170-42.010						B	0.000	157.293		100.00	0.000	0.000
						C	0.000	157.293		100.00	0.000	11.968
L3 42.010-0.000	20.301	1	0.016	0.500	200.718	A	0.000	200.718	200.718	100.00	0.000	0.000
						B	0.000	200.718		100.00	0.000	0.000
						C	0.000	200.718		100.00	0.000	11.625

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	104.971	1.392	0.009	138.308	A	0.000	138.308	138.308	100.00	0.000	0.000
130.000-82.17					B	0.000	138.308		100.00	0.000	0.000
0					C	0.000	138.308		100.00	0.000	9.470
L2	61.769	1.196	0.008	153.946	A	0.000	153.946	153.946	100.00	0.000	0.000
82.170-42.010					B	0.000	153.946		100.00	0.000	0.000
					C	0.000	153.946		100.00	0.000	7.952
L3	20.301	1	0.006	197.217	A	0.000	197.217	197.217	100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
42.010-0.000					B	0.000	197.217		100.00	0.000	0.000
					C	0.000	197.217		100.00	0.000	7.724

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.415	5.551	A	1	0.65	1	1	1	138.308	4.835	0.101	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.804	8.327	A	1	0.65	1	1	1	153.946	4.506	0.112	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.743	12.726	A	1	0.65	1	1	1	197.217	4.763	0.113	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.962	26.604						OTM	882.586 kip-ft	14.104		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.415	5.551	A	1	0.65	1	1	1	138.308	4.835	0.101	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.804	8.327	A	1	0.65	1	1	1	153.946	4.506	0.112	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.743	12.726	A	1	0.65	1	1	1	197.217	4.763	0.113	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.962	26.604						OTM	882.586 kip-ft	14.104		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.415	5.551	A	1	0.65	1	1	1	138.308	4.835	0.101	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.804	8.327	A	1	0.65	1	1	1	153.946	4.506	0.112	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.743	12.726	A	1	0.65	1	1	1	197.217	4.763	0.113	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.962	26.604						OTM	882.586 kip-ft	14.104		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.415	5.551	A	1	0.65	1	1	1	138.308	4.835	0.101	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.804	8.327	A	1	0.65	1	1	1	153.946	4.506	0.112	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.743	12.726	A	1	0.65	1	1	1	197.217	4.763	0.113	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.962	26.604						OTM	882.586 kip-ft	14.104		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.993	6.590	A	1	0.65	1	1	1	142.294	3.896	0.081	C
130.000-82.17			B	1	0.65	1	1	1	142.294			
0			C	1	0.65	1	1	1	142.294			
L2	3.290	9.479	A	1	0.65	1	1	1	157.293	3.573	0.089	C
82.170-42.010			B	1	0.65	1	1	1	157.293			
			C	1	0.65	1	1	1	157.293			
L3	3.215	14.200	A	1	0.65	1	1	1	200.718	3.735	0.089	C
42.010-0.000			B	1	0.65	1	1	1	200.718			
			C	1	0.65	1	1	1	200.718			
Sum Weight:	9.497	30.269						OTM	705.448 kip-ft	11.203		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.993	6.590	A	1	0.65	1	1	1	142.294	3.896	0.081	C
130.000-82.17			B	1	0.65	1	1	1	142.294			
0			C	1	0.65	1	1	1	142.294			
L2	3.290	9.479	A	1	0.65	1	1	1	157.293	3.573	0.089	C
82.170-42.010			B	1	0.65	1	1	1	157.293			
			C	1	0.65	1	1	1	157.293			
L3	3.215	14.200	A	1	0.65	1	1	1	200.718	3.735	0.089	C
42.010-0.000			B	1	0.65	1	1	1	200.718			
			C	1	0.65	1	1	1	200.718			
Sum Weight:	9.497	30.269						OTM	705.448 kip-ft	11.203		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.993	6.590	A	1	0.65	1	1	1	142.294	3.896	0.081	C
130.000-82.17			B	1	0.65	1	1	1	142.294			
0			C	1	0.65	1	1	1	142.294			
L2	3.290	9.479	A	1	0.65	1	1	1	157.293	3.573	0.089	C
82.170-42.010			B	1	0.65	1	1	1	157.293			
			C	1	0.65	1	1	1	157.293			
L3	3.215	14.200	A	1	0.65	1	1	1	200.718	3.735	0.089	C
42.010-0.000			B	1	0.65	1	1	1	200.718			
			C	1	0.65	1	1	1	200.718			
Sum Weight:	9.497	30.269						OTM	705.448 kip-ft	11.203		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.993	6.590	A	1	0.65	1	1	1	142.294	3.896	0.081	C
130.000-82.17			B	1	0.65	1	1	1	142.294			
0			C	1	0.65	1	1	1	142.294			
L2	3.290	9.479	A	1	0.65	1	1	1	157.293	3.573	0.089	C
82.170-42.010			B	1	0.65	1	1	1	157.293			
			C	1	0.65	1	1	1	157.293			
L3	3.215	14.200	A	1	0.65	1	1	1	200.718	3.735	0.089	C
42.010-0.000			B	1	0.65	1	1	1	200.718			
			C	1	0.65	1	1	1	200.718			
Sum Weight:	9.497	30.269						OTM	705.448 kip-ft	11.203		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.415	5.551	A	1	0.65	1	1	1	138.308	1.492	0.031	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.804	8.327	A	1	0.65	1	1	1	153.946	1.391	0.035	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.743	12.726	A	1	0.65	1	1	1	197.217	1.470	0.035	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.962	26.604						OTM	272.403 kip-ft	4.353		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.415	5.551	A	1	0.65	1	1	1	138.308	1.492	0.031	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.804	8.327	A	1	0.65	1	1	1	153.946	1.391	0.035	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.743	12.726	A	1	0.65	1	1	1	197.217	1.470	0.035	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.962	26.604						OTM	272.403 kip-ft	4.353		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	2.415	5.551	A	1	0.65	1	1	1	138.308	1.492	0.031	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.804	8.327	A	1	0.65	1	1	1	153.946	1.391	0.035	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.743	12.726	A	1	0.65	1	1	1	197.217	1.470	0.035	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.962	26.604						OTM	272.403 kip-ft	4.353		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	2.415	5.551	A	1	0.65	1	1	1	138.308	1.492	0.031	C
130.000-82.17			B	1	0.65	1	1	1	138.308			
0			C	1	0.65	1	1	1	138.308			
L2	2.804	8.327	A	1	0.65	1	1	1	153.946	1.391	0.035	C
82.170-42.010			B	1	0.65	1	1	1	153.946			
			C	1	0.65	1	1	1	153.946			
L3	2.743	12.726	A	1	0.65	1	1	1	197.217	1.470	0.035	C
42.010-0.000			B	1	0.65	1	1	1	197.217			
			C	1	0.65	1	1	1	197.217			
Sum Weight:	7.962	26.604						OTM	272.403 kip-ft	4.353		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	26.604					
Bracing Weight	0.000					
Total Member Self-Weight	26.604			-1.151	0.930	
Total Weight	46.832			-1.151	0.930	
Wind 0 deg - No Ice		-0.119	-40.235	-3868.945	15.994	-4.319
Wind 30 deg - No Ice		20.081	-34.784	-3343.227	-1928.466	-6.686
Wind 45 deg - No Ice		28.460	-28.366	-2725.443	-2735.446	-7.220
Wind 60 deg - No Ice		34.900	-20.014	-1922.002	-3355.946	-7.261
Wind 90 deg - No Ice		40.368	0.119	13.913	-3883.954	-5.891
Wind 120 deg - No Ice		35.020	20.221	1945.792	-3371.010	-2.942
Wind 135 deg - No Ice		28.629	28.535	2744.444	-2756.749	-1.111
Wind 150 deg - No Ice		20.288	34.904	3355.989	-1954.557	0.795
Wind 180 deg - No Ice		0.119	40.235	3866.643	-14.133	4.319
Wind 210 deg - No Ice		-20.081	34.784	3340.925	1930.327	6.686
Wind 225 deg - No Ice		-28.460	28.366	2723.141	2737.307	7.220
Wind 240 deg - No Ice		-34.900	20.014	1919.700	3357.807	7.261
Wind 270 deg - No Ice		-40.368	-0.119	-16.215	3885.815	5.891
Wind 300 deg - No Ice		-35.020	-20.221	-1948.094	3372.871	2.942
Wind 315 deg - No Ice		-28.629	-28.535	-2746.746	2758.610	1.111
Wind 330 deg - No Ice		-20.288	-34.904	-3358.291	1956.418	-0.795
Member Ice	3.665					
Total Weight Ice	58.954			-1.958	1.586	
Wind 0 deg - Ice		-0.092	-33.546	-3239.797	13.237	-3.485
Wind 30 deg - Ice		16.746	-29.005	-2800.183	-1613.970	-5.488
Wind 45 deg - Ice		23.730	-23.655	-2283.218	-2289.186	-5.957
Wind 60 deg - Ice		29.098	-16.693	-1610.788	-2808.290	-6.020
Wind 90 deg - Ice		33.652	0.092	9.693	-3249.705	-4.939
Wind 120 deg - Ice		29.190	16.853	1627.051	-2819.940	-2.535
Wind 135 deg - Ice		23.861	23.786	2295.778	-2305.662	-1.028
Wind 150 deg - Ice		16.906	29.098	2807.918	-1634.149	0.549
Wind 180 deg - Ice		0.092	33.546	3235.881	-10.064	3.485
Wind 210 deg - Ice		-16.746	29.005	2796.268	1617.143	5.488

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 225 deg - Ice		-23.730	23.655	2279.302	2292.359	5.957
Wind 240 deg - Ice		-29.098	16.693	1606.873	2811.462	6.020
Wind 270 deg - Ice		-33.652	-0.092	-13.608	3252.878	4.939
Wind 300 deg - Ice		-29.190	-16.853	-1630.966	2823.112	2.535
Wind 315 deg - Ice		-23.861	-23.786	-2299.693	2308.835	1.028
Wind 330 deg - Ice		-16.906	-29.098	-2811.834	1637.321	-0.549
Total Weight	46.832			-1.151	0.930	
Wind 0 deg - Service		-0.037	-12.418	-1194.915	5.580	-1.333
Wind 30 deg - Service		6.198	-10.736	-1032.656	-594.562	-2.064
Wind 45 deg - Service		8.784	-8.755	-841.982	-843.630	-2.228
Wind 60 deg - Service		10.772	-6.177	-594.006	-1035.143	-2.241
Wind 90 deg - Service		12.459	0.037	3.498	-1198.108	-1.818
Wind 120 deg - Service		10.809	6.241	599.757	-1039.792	-0.908
Wind 135 deg - Service		8.836	8.807	846.255	-850.205	-0.343
Wind 150 deg - Service		6.262	10.773	1035.003	-602.615	0.245
Wind 180 deg - Service		0.037	12.418	1192.613	-3.719	1.333
Wind 210 deg - Service		-6.198	10.736	1030.354	596.423	2.064
Wind 225 deg - Service		-8.784	8.755	839.680	845.491	2.228
Wind 240 deg - Service		-10.772	6.177	591.704	1037.004	2.241
Wind 270 deg - Service		-12.459	-0.037	-5.800	1199.969	1.818
Wind 300 deg - Service		-10.809	-6.241	-602.059	1041.653	0.908
Wind 315 deg - Service		-8.836	-8.807	-848.557	852.066	0.343
Wind 330 deg - Service		-6.262	-10.773	-1037.305	604.476	-0.245

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

Comb. No.	Description
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	130 - 82.17	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-27.007	1.622	1.800
			Max. Mx	14	-17.525	815.280	5.606
			Max. My	2	-17.538	5.533	810.006
			Max. Vy	14	-30.432	815.280	5.606
			Max. Vx	2	-30.290	5.533	810.006
			Max. Torque	4			7.200
L2	82.17 - 42.01	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-39.325	1.599	1.971
			Max. Mx	14	-28.621	2096.633	10.590
			Max. My	2	-28.628	10.372	2086.077
			Max. Vy	14	-35.477	2096.633	10.590
			Max. Vx	2	-35.341	10.372	2086.077
			Max. Torque	4			7.311
L3	42.01 - 0	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-58.954	1.599	1.971
			Max. Mx	14	-46.811	3956.587	16.547
			Max. My	2	-46.811	16.324	3939.391
			Max. Vy	14	-40.393	3956.587	16.547
			Max. Vx	2	-40.260	16.324	3939.391
			Max. Torque	5			7.213

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	58.954	33.652	0.092
	Max. H_x	14	46.832	40.368	0.119
	Max. H_z	2	46.832	0.119	40.235
	Max. M_x	2	3939.391	0.119	40.235
	Max. M_z	6	3954.668	-40.368	-0.119
	Max. Torsion	5	7.210	-34.900	20.014
	Min. Vert	1	46.832	0.000	0.000
	Min. H_x	6	46.832	-40.368	-0.119
	Min. H_z	10	46.832	-0.119	-40.235
	Min. M_x	10	-3937.022	-0.119	-40.235
	Min. M_z	14	-3956.587	40.368	0.119
	Min. Torsion	13	-7.210	34.900	-20.014

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	46.832	0.000	0.000	-1.151	0.930	0.000
Dead+Wind 0 deg - No Ice	46.832	-0.119	-40.235	-3939.391	16.324	-4.286
Dead+Wind 30 deg - No Ice	46.832	20.081	-34.784	-3404.089	-1963.568	-6.637
Dead+Wind 45 deg - No Ice	46.832	28.460	-28.366	-2775.044	-2785.251	-7.168
Dead+Wind 60 deg - No Ice	46.832	34.900	-20.014	-1956.965	-3417.053	-7.210
Dead+Wind 90 deg - No Ice	46.832	40.368	0.119	14.198	-3954.668	-5.851
Dead+Wind 120 deg - No Ice	46.832	35.020	20.221	1981.220	-3432.389	-2.924
Dead+Wind 135 deg - No Ice	46.832	28.629	28.535	2794.399	-2806.955	-1.107
Dead+Wind 150 deg - No Ice	46.832	20.288	34.904	3417.070	-1990.168	0.786
Dead+Wind 180 deg - No Ice	46.832	0.119	40.235	3937.022	-14.420	4.286
Dead+Wind 210 deg - No Ice	46.832	-20.081	34.784	3401.731	1965.466	6.637
Dead+Wind 225 deg - No Ice	46.832	-28.460	28.366	2772.693	2787.152	7.168
Dead+Wind 240 deg - No Ice	46.832	-34.900	20.014	1954.618	3418.960	7.210
Dead+Wind 270 deg - No Ice	46.832	-40.368	-0.119	-16.546	3956.587	5.851
Dead+Wind 300 deg - No Ice	46.832	-35.020	-20.221	-1983.580	3434.313	2.924
Dead+Wind 315 deg - No Ice	46.832	-28.629	-28.535	-2796.766	2808.876	1.107
Dead+Wind 330 deg - No Ice	46.832	-20.288	-34.904	-3419.441	1992.084	-0.786
Dead+Ice+Temp	58.954	0.000	0.000	-1.971	1.599	-0.000
Dead+Wind 0 deg+Ice+Temp	58.954	-0.092	-33.546	-3323.170	13.643	-3.453
Dead+Wind 30 deg+Ice+Temp	58.954	16.746	-29.005	-2872.229	-1655.453	-5.441
Dead+Wind 45 deg+Ice+Temp	58.954	23.730	-23.655	-2341.952	-2348.052	-5.907
Dead+Wind 60 deg+Ice+Temp	58.954	29.098	-16.693	-1652.214	-2880.518	-5.970
Dead+Wind 90 deg+Ice+Temp	58.954	33.652	0.092	9.954	-3333.296	-4.900
Dead+Wind 120 deg+Ice+Temp	58.954	29.190	16.853	1668.896	-2892.483	-2.517
Dead+Wind 135 deg+Ice+Temp	58.954	23.861	23.786	2354.813	-2364.982	-1.023
Dead+Wind 150 deg+Ice+Temp	58.954	16.906	29.098	2880.118	-1676.201	0.541
Dead+Wind 180 deg+Ice+Temp	58.954	0.092	33.546	3319.080	-10.334	3.454
Dead+Wind 210 deg+Ice+Temp	58.954	-16.746	29.005	2868.150	1658.756	5.441
Dead+Wind 225 deg+Ice+Temp	58.954	-23.730	23.655	2337.880	2351.358	5.907
Dead+Wind 240 deg+Ice+Temp	58.954	-29.098	16.693	1648.146	2883.829	5.970
Dead+Wind 270 deg+Ice+Temp	58.954	-33.652	-0.092	-14.023	3336.619	4.900
Dead+Wind 300 deg+Ice+Temp	58.954	-29.190	-16.853	-1672.977	2895.811	2.517
Dead+Wind 315 deg+Ice+Temp	58.954	-23.861	-23.786	-2358.900	2368.308	1.023
Dead+Wind 330 deg+Ice+Temp	58.954	-16.906	-29.098	-2884.208	1679.521	-0.541
Dead+Wind 0 deg - Service	46.832	-0.037	-12.418	-1217.224	5.709	-1.327
Dead+Wind 30 deg - Service	46.832	6.198	-10.736	-1051.932	-605.638	-2.056
Dead+Wind 45 deg - Service	46.832	8.784	-8.755	-857.698	-859.357	-2.220
Dead+Wind 60 deg - Service	46.832	10.772	-6.177	-605.094	-1054.446	-2.233
Dead+Wind 90 deg - Service	46.832	12.459	0.037	3.559	-1220.458	-1.812

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 120 deg - Service	46.832	10.809	6.241	610.940	-1059.191	-0.906
Dead+Wind 135 deg - Service	46.832	8.836	8.807	862.034	-866.068	-0.343
Dead+Wind 150 deg - Service	46.832	6.262	10.773	1054.301	-613.859	0.244
Dead+Wind 180 deg - Service	46.832	0.037	12.418	1214.846	-3.785	1.327
Dead+Wind 210 deg - Service	46.832	-6.198	10.736	1049.556	607.562	2.056
Dead+Wind 225 deg - Service	46.832	-8.784	8.755	855.322	861.281	2.220
Dead+Wind 240 deg - Service	46.832	-10.772	6.177	602.719	1056.371	2.233
Dead+Wind 270 deg - Service	46.832	-12.459	-0.037	-5.935	1222.384	1.812
Dead+Wind 300 deg - Service	46.832	-10.809	-6.241	-613.317	1061.118	0.906
Dead+Wind 315 deg - Service	46.832	-8.836	-8.807	-864.411	867.995	0.343
Dead+Wind 330 deg - Service	46.832	-6.262	-10.773	-1056.679	615.784	-0.244

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.000	-46.832	0.000	0.000	46.832	0.000	0.000%
2	-0.119	-46.832	-40.235	0.119	46.832	40.235	0.000%
3	20.081	-46.832	-34.784	-20.081	46.832	34.784	0.000%
4	28.460	-46.832	-28.366	-28.460	46.832	28.366	0.000%
5	34.900	-46.832	-20.014	-34.900	46.832	20.014	0.000%
6	40.368	-46.832	0.119	-40.368	46.832	-0.119	0.000%
7	35.020	-46.832	20.221	-35.020	46.832	-20.221	0.000%
8	28.629	-46.832	28.535	-28.629	46.832	-28.535	0.000%
9	20.288	-46.832	34.904	-20.288	46.832	-34.904	0.000%
10	0.119	-46.832	40.235	-0.119	46.832	-40.235	0.000%
11	-20.081	-46.832	34.784	20.081	46.832	-34.784	0.000%
12	-28.460	-46.832	28.366	28.460	46.832	-28.366	0.000%
13	-34.900	-46.832	20.014	34.900	46.832	-20.014	0.000%
14	-40.368	-46.832	-0.119	40.368	46.832	0.119	0.000%
15	-35.020	-46.832	-20.221	35.020	46.832	20.221	0.000%
16	-28.629	-46.832	-28.535	28.629	46.832	28.535	0.000%
17	-20.288	-46.832	-34.904	20.288	46.832	34.904	0.000%
18	0.000	-58.954	0.000	0.000	58.954	0.000	0.000%
19	-0.092	-58.954	-33.546	0.092	58.954	33.546	0.000%
20	16.746	-58.954	-29.005	-16.746	58.954	29.005	0.000%
21	23.730	-58.954	-23.655	-23.730	58.954	23.655	0.000%
22	29.098	-58.954	-16.693	-29.098	58.954	16.693	0.000%
23	33.652	-58.954	0.092	-33.652	58.954	-0.092	0.000%
24	29.190	-58.954	16.853	-29.190	58.954	-16.853	0.000%
25	23.861	-58.954	23.786	-23.861	58.954	-23.786	0.000%
26	16.906	-58.954	29.098	-16.906	58.954	-29.098	0.000%
27	0.092	-58.954	33.546	-0.092	58.954	-33.546	0.000%
28	-16.746	-58.954	29.005	16.746	58.954	-29.005	0.000%
29	-23.730	-58.954	23.655	23.730	58.954	-23.655	0.000%
30	-29.098	-58.954	16.693	29.098	58.954	-16.693	0.000%
31	-33.652	-58.954	-0.092	33.652	58.954	0.092	0.000%
32	-29.190	-58.954	-16.853	29.190	58.954	16.853	0.000%
33	-23.861	-58.954	-23.786	23.861	58.954	23.786	0.000%
34	-16.906	-58.954	-29.098	16.906	58.954	29.098	0.000%
35	-0.037	-46.832	-12.418	0.037	46.832	12.418	0.000%
36	6.198	-46.832	-10.736	-6.198	46.832	10.736	0.000%
37	8.784	-46.832	-8.755	-8.784	46.832	8.755	0.000%
38	10.772	-46.832	-6.177	-10.772	46.832	6.177	0.000%
39	12.459	-46.832	0.037	-12.459	46.832	-0.037	0.000%
40	10.809	-46.832	6.241	-10.809	46.832	-6.241	0.000%
41	8.836	-46.832	8.807	-8.836	46.832	-8.807	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
42	6.262	-46.832	10.773	-6.262	46.832	-10.773	0.000%
43	0.037	-46.832	12.418	-0.037	46.832	-12.418	0.000%
44	-6.198	-46.832	10.736	6.198	46.832	-10.736	0.000%
45	-8.784	-46.832	8.755	8.784	46.832	-8.755	0.000%
46	-10.772	-46.832	6.177	10.772	46.832	-6.177	0.000%
47	-12.459	-46.832	-0.037	12.459	46.832	0.037	0.000%
48	-10.809	-46.832	-6.241	10.809	46.832	6.241	0.000%
49	-8.836	-46.832	-8.807	8.836	46.832	8.807	0.000%
50	-6.262	-46.832	-10.773	6.262	46.832	10.773	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	0.00023964
3	Yes	5	0.00000001	0.00002268
4	Yes	5	0.00000001	0.00003000
5	Yes	5	0.00000001	0.00003046
6	Yes	4	0.00000001	0.00028296
7	Yes	5	0.00000001	0.00002451
8	Yes	5	0.00000001	0.00002920
9	Yes	5	0.00000001	0.00002539
10	Yes	4	0.00000001	0.00021500
11	Yes	5	0.00000001	0.00002998
12	Yes	5	0.00000001	0.00002990
13	Yes	5	0.00000001	0.00002252
14	Yes	4	0.00000001	0.00030791
15	Yes	5	0.00000001	0.00002775
16	Yes	5	0.00000001	0.00002932
17	Yes	5	0.00000001	0.00002654
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00003834
20	Yes	5	0.00000001	0.00007068
21	Yes	5	0.00000001	0.00008306
22	Yes	5	0.00000001	0.00007890
23	Yes	5	0.00000001	0.00003898
24	Yes	5	0.00000001	0.00007270
25	Yes	5	0.00000001	0.00008246
26	Yes	5	0.00000001	0.00007361
27	Yes	5	0.00000001	0.00003809
28	Yes	5	0.00000001	0.00007827
29	Yes	5	0.00000001	0.00008294
30	Yes	5	0.00000001	0.00007053
31	Yes	5	0.00000001	0.00003928
32	Yes	5	0.00000001	0.00007647
33	Yes	5	0.00000001	0.00008297
34	Yes	5	0.00000001	0.00007508
35	Yes	4	0.00000001	0.00003600
36	Yes	4	0.00000001	0.00006303
37	Yes	4	0.00000001	0.00009211
38	Yes	4	0.00000001	0.00010043
39	Yes	4	0.00000001	0.00004429
40	Yes	4	0.00000001	0.00006084
41	Yes	4	0.00000001	0.00007666
42	Yes	4	0.00000001	0.00006393

43	Yes	4	0.00000001	0.00003485
44	Yes	4	0.00000001	0.00009701
45	Yes	4	0.00000001	0.00009163
46	Yes	4	0.00000001	0.00006405
47	Yes	4	0.00000001	0.00004550
48	Yes	4	0.00000001	0.00007867
49	Yes	4	0.00000001	0.00007781
50	Yes	4	0.00000001	0.00007071

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 82.17	15.139	48	0.979	0.009
L2	87.84 - 42.01	7.134	48	0.766	0.004
L3	49.01 - 0	2.213	48	0.412	0.001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.000	LPA-80063/6CF	48	15.139	0.979	0.009	57355
129.000	EEI Low Profile Platform	48	14.937	0.975	0.009	57355
124.000	VHLP800-11-DW1	48	13.927	0.955	0.008	47796
120.000	APXVSPP18-C-A20	48	13.124	0.939	0.007	28677
119.000	EEI Low Profile Platform	48	12.924	0.935	0.007	26070
117.000	TD-RRH8x20-25	48	12.525	0.927	0.007	22059
113.000	GPS	48	11.735	0.910	0.007	16869
110.000	LNX-6515DS	48	11.150	0.896	0.006	14338
109.000	EEI Low Profile Platform	48	10.956	0.891	0.006	13656
104.000	GPS	48	10.003	0.867	0.005	11029
102.500	Valmont Uni-Tri Bracket	48	9.722	0.859	0.005	10428
100.000	7770.00	48	9.259	0.845	0.005	9559
99.000	EEI Low Profile Platform	48	9.076	0.839	0.005	9250
90.000	(3) 6'x3" Pipe Mount	48	7.495	0.782	0.004	7185
89.000	EEI Low Profile Platform	48	7.327	0.775	0.004	7033
72.000	GPS	48	4.751	0.632	0.002	5935
70.000	GPS	48	4.485	0.614	0.002	5841
60.000	GPS	48	3.281	0.517	0.002	5413

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 82.17	48.899	15	3.158	0.029
L2	87.84 - 42.01	23.065	15	2.477	0.012
L3	49.01 - 0	7.159	15	1.331	0.004

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.000	LPA-80063/6CF	15	48.899	3.158	0.029	17931
129.000	EEI Low Profile Platform	15	48.247	3.146	0.028	17931
124.000	VHLP800-11-DW1	15	44.989	3.084	0.026	14942
120.000	APXVSPP18-C-A20	15	42.396	3.033	0.024	8965
119.000	EEI Low Profile Platform	15	41.751	3.020	0.024	8150
117.000	TD-RRH8x20-25	15	40.465	2.993	0.023	6896
113.000	GPS	15	37.915	2.938	0.021	5272
110.000	LNX-6515DS	15	36.027	2.894	0.020	4481
109.000	EEI Low Profile Platform	15	35.402	2.879	0.019	4268
104.000	GPS	15	32.326	2.800	0.017	3446
102.500	Valmont Uni-Tri Bracket	15	31.419	2.774	0.017	3258
100.000	7770.00	15	29.926	2.730	0.016	2986
99.000	EEI Low Profile Platform	15	29.336	2.712	0.015	2890
90.000	(3) 6'x3" Pipe Mount	15	24.229	2.527	0.012	2244
89.000	EEI Low Profile Platform	15	23.687	2.505	0.012	2196
72.000	GPS	15	15.367	2.045	0.008	1845
70.000	GPS	15	14.506	1.985	0.007	1815
60.000	GPS	15	10.612	1.674	0.006	1678

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	130 - 82.17 (1)	TP41.22x28.18x0.313	47.830	0.000	0.0	39.000	39.042	-17.518	1522.630	0.012
L2	82.17 - 42.01 (2)	TP51.42x39.049x0.375	45.830	0.000	0.0	39.000	58.507	-28.617	2281.790	0.013
L3	42.01 - 0 (3)	TP62x48.781x0.438	49.010	0.000	0.0	39.000	85.487	-46.810	3334.000	0.014

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	130 - 82.17 (1)	TP41.22x28.18x0.313	818.366	25.899	39.000	0.664	0.000	0.000	39.000	0.000
L2	82.17 - 42.01 (2)	TP51.42x39.049x0.375	2102.558	35.544	39.000	0.911	0.000	0.000	39.000	0.000
L3	42.01 - 0 (3)	TP62x48.781x0.438	3965.992	36.620	39.000	0.939	0.000	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	130 - 82.17 (1)	TP41.22x28.18x0.313	30.503	0.781	26.000	0.060	2.657	0.041	26.000	0.002
L2	82.17 - 42.01 (2)	TP51.42x39.049x0.375	35.549	0.608	26.000	0.047	2.926	0.024	26.000	0.001
L3	42.01 - 0 (3)	TP62x48.781x0.438	40.463	0.473	26.000	0.036	2.924	0.013	26.000	0.001

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	130 - 82.17 (1)	0.012	0.664	0.000	0.060	0.002	0.677 ✔	1.333	H1-3+VT ✔
L2	82.17 - 42.01 (2)	0.013	0.911	0.000	0.047	0.001	0.925 ✔	1.333	H1-3+VT ✔
L3	42.01 - 0 (3)	0.014	0.939	0.000	0.036	0.001	0.953 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	130 - 82.17	Pole	TP41.22x28.18x0.313	1	-17.518	2029.666	50.8	Pass
L2	82.17 - 42.01	Pole	TP51.42x39.049x0.375	2	-28.617	3041.626	69.4	Pass
L3	42.01 - 0	Pole	TP62x48.781x0.438	3	-46.810	4444.222	71.5	Pass
							Summary	
						Pole (L3)	71.5	Pass
						RATING =	**71.5**	**Pass**

Program Version 6.0.0.8 - 9/7/2011 File:J:/Jobs/1504900.WI/001 - CT11075C/04_Structural/Backup Documentation/Calcs/ERI Files/130' EEI Monopole_Westport_CT.eri

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Subject:	Anchor Bolt and Baseplate Analysis
Location:	130-ft EEI Monopole Westport, CT
Rev. 0: 03/09/15	Prepared by: T.J.L Checked by: C.F.C. Job No. 15049.001

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 3966·ft·kips	(Input From tnxTower)
Shear Force =	Shear := 40·kips	(Input From tnxTower)
Axial Force =	Axial := 47·kips	(Input From tnxTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

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

Base Plate Data:

Use ASTM A572 Mod 60

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

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 35.5 \cdot in$$

Distance to Bolts =

$$i := 1 .. N$$

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

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

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 31 \cdot in$$

Moment Arms of Bolts about Neutral Axis =

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

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

Effective Width of Baseplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 36.53 \cdot in$$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

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

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

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

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

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

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 131.7 \cdot kips$

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

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 67.6\,\%$ Bolts are "upset bolts". Use net area per AISC

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.542 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 7.9 \cdot ksi$

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.

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{l_p} + \frac{Axial}{N} = 136.4 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 42 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 70 \cdot \%$$

Condition 2 =

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

Condition2 = "OK"

Base Plate Analysis:

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

$C_1 = 43.8 \cdot kips$ $C_7 = 110.8 \cdot kips$

$C_2 = 81.1 \cdot kips$ $C_8 = 81.1 \cdot kips$

$C_3 = 110.8 \cdot kips$ $C_9 = 43.8 \cdot kips$

$C_4 = 129.9 \cdot kips$ $C_{10} = 2.4 \cdot kips$

$C_5 = 136.4 \cdot kips$ $C_{11} = -39.1 \cdot kips$

$C_6 = 129.9 \cdot kips$ etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 54.7 \cdot ksi$

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

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 91.3 \cdot \%$

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

Condition3 = "Ok"

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Subject:		FOUNDATION ANALYSIS
Location:		130-ft EEI Monopole Westport, CT
Rev. 0: 03/09/15		Prepared by: T.J.L. Checked by: C.F.C. Job No. 15049.001

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	OM := 3966·ft·kips	(User Input from tnxTower)	
Shear Force =	Shear := 40·kip	(User Input from tnxTower)	
Axial Force =	Axial := 47·kip	(User Input from tnxTower	
Tower Height =	H_t := 130·ft	(User Input)	

Footing Data:

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

Anchor Bolt Data:

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

Material Properties:

Concrete Compressive Strength =	f_c := 4000·psi	(User Input)	
Steel Reinforcment Yield Strength =	f_y := 60000·psi	(User Input)	
Anchor Bolt Yield Strength =	f_{ya} := 75000·psi	(User Input)	
Internal Friction Angle of Soil =	Φ_s := 30·deg	(User Input)	
Allowable Soil Bearing Capacity =	q_s := 3000·psf	(User Input)	
Unit Weight of Soil =	γ_{soil} := 100·pcf	(User Input)	
Unit Weight of Concrete =	γ_{conc} := 150·pcf	(User Input)	
Foundation Bouyancy =	Bouyancy := 0	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	n := 0·ft	(User Input)	
Cohesion of Clay Type Soil =	c := 0·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 =	μ := 0.45	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.000 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 44$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 3 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.000 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 28$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.000 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 44$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =

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

Pad Top Reinforcement Bar Area =

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

Pad Bottom Reinforcement Bar Area =

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

Coefficient of Lateral Soil Pressure =

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

Load Factor =

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

Stability of Footing:

Adjusted Concrete Unit Weight =

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

Adjusted Soil Unit Weight =

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

Passive Pressure =

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

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

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

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

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

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

$$A_p := W_f \cdot T_p = 88.5$$

Ultimate Shear =

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

Weight of Concrete Pad =

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

Weight of Soil Above Footing =

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

Weight of Soil Wedge at Back Face =

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

Weight of Soil Wedge at back face Corners =

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

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + Axial = 583.55 \cdot kip$$

Resisting Moment =

$$M_r := \left(WT_{tot}\right) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[\left(WT_{s2} + WT_{s3}\right) \cdot \left(W_f + \frac{D_f \cdot \tan\left(\Phi_s\right)}{3}\right)\right] = 9696 \cdot kip \cdot ft$$

Overturning Moment =

$$M_{ot} := OM + Shear \cdot \left(L_p + T_f\right) = 4186 \cdot kip \cdot ft$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.32$$

Factor of Safety Required =

$$FS_{req} := 2$$

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

OverTurning_Moment_Check = "Okay"

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 131.299 \cdot kips$

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

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

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

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

Maximum Pressure in Mat = $P_{max} := \frac{(WT_c + Axial)}{A_{mat}} + \frac{M_{ot}}{S} = 1.51 \cdot ksf$

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

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \frac{(WT_c + Axial)}{A_{mat}} - \frac{M_{ot}}{S} = -0.447 \cdot ksf$

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

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 7.588$

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

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

Eccentricity = $e := \frac{M_{ot}}{WT_{tot}} = 7.173$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot (WT_c + Axial)}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.38 \cdot ksf$

$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.38 \cdot ksf$

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

Pressure_Check = "Okay"

Concrete Bearing Capacity:

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

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

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

Bearing_Check = "Okay"

Shear Strength of Concrete:

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

$\phi_c := 0.85$ (ACI 9.3.2.5)

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

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

$d_2 := d_1 - d$

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

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

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

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

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

Beam_Shear_Check = "Okay"

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

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

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

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

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

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

$v_u := \text{Find}(v_u) = 6.5 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 513.7 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 684.8 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 2767.1 \cdot kip$ (ACI-2008 11.11.2.1)

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

Punching_Shear_Check = "Okay"

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

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

$q_b := q_{adj} - d_1 \cdot Slope = 0.727 \cdot ksf$

Maximum Bending at Face of Pier = $M_u := LF \cdot \left[\left(q_{adj} - q_b \right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 2640.9 \cdot kip \cdot ft$

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

(ACI-200810.2.7.3)

$R_n := \frac{M_u}{\phi_m \cdot W_f \cdot d^2} = 97.1 \cdot psi$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) = 0.0016$

$\rho_{min} := \rho = 0.00164$

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:

$$As := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \frac{d}{2} & \text{otherwise} \end{cases} = 18.61 \cdot in^2$$

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

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

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

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

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

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

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

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

Spacing or Cover Dimension =

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

Transverse Reinforcement Index =

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

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

Minimum Development Length =

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

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

Available Length in Pad =

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

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

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

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

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

Maximum Moment in Pier = $M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 65359.7 \cdot in \cdot kips$

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

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

$$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) = \left(96 \;\; 44 \;\; 8 \;\; 62.651 \;\; 6.536 \times 10^{4}\right)$$

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

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

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) = \left(75.903 \;\; 7.918 \times 10^{4} \;\; -60 \;\; 4.802 \times 10^{-3}\right)$$

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

Axial_Load_Check = "Okay"

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

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

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

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

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

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

Transverse Reinforcement =

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

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

Minimum Development Length =

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

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

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

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

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

Compression: (ACI-2008 12.3.2)

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

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

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

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

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

Tie Size and Spacing in Column:

Minimum Tie Size =

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

Used #4 Ties

Seismic Factor =

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

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

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

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

$s_{lim4} := 18in$

Maximum Spacing =

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

Number of Ties Required =

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

Check Anchor Steel Embedment:

Depth Available =

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

Length of Anchor Bolt =

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

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

Depth_Check = "No Good"

Note: Anchor plate is provided

Network Modernization RFDS v3.0

Site ID	**CT11075C**	**Latitude**	41.16277
		Longitude	-73.37334
Site Name	Westport/ MP X 41	**Site Type**	Structure (Non-Building)
Address	2 Sunny Lane, Westport, CT 06880	**Site Class**	Self Support Tower
Market	Connecticut	**Landlord**	Verizon

Configuration
702Cu

Approvals	
Market RF	
Market Development	

RFDS Revision		**Date**	
RFDS Final			
Work Order #		**NOC#**	(888) 218-6664

Site Information

Existing Configuration					Proposed Configuration			
1	2	3	4	Cabinet #	1	2	3	4
	GSM/UMTS/LTE	GSM		Technology		GSM/UMTS/LTE	GSM	
	6102	S12000		Cabinet type		6102	S12000	
				CBU				
	2			DUW30		2		
	1			DUL20				
	1			DUG20		1		
				DUS41		1		
	2			RBS6601		2		
				dTRU/TRX				
				RU22 B4				
				RUS01 B2				
	6			RUS01 B4		6		
				RUS02 B2				

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

Scope of Work

Swap DUL with DUS41

ALPHA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [ ] Add antenna
- [x] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [ ] Remove TMA

- [x] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [ ] Consolidate coax cables
- [ ] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Swap a dummy antenna with L700 B12 passive antenna. Add RRUS at antenna. Use spare fiber for LTE 700.

BETA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [ ] Add antenna
- [x] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [ ] Remove TMA

- [x] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [ ] Consolidate coax cables
- [ ] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Swap a dummy antenna with L700 B12 passive antenna. Add RRUS at antenna. Use spare fiber for LTE 700.

GAMMA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [ ] Add antenna
- [x] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [ ] Remove TMA

- [x] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [ ] Consolidate coax cables
- [ ] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Swap a dummy antenna with L700 B12 passive antenna. Add RRUS at antenna. Use spare fiber for LTE 700.

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

Site ID	**CT11075C**	**Latitude**	41.16277
		Longitude	-73.37334
Site Name	Westport/ MP X 41	**Site Type**	Structure (Non-Building)
Address	2 Sunny Lane, Westport, CT 06880	**Site Class**	Self Support Tower
Market	Connecticut	**Landlord**	Verizon

Configuration
702Cu

Approvals	
Market RF	
Market Development	

RFDS Revision		**Date**
RFDS Final		

ALPHA (view from behind)

Existing Configuration					Proposed Configuration			
X	X	X	X	Mount	X	X	X	X
LTE		GSM/UMTS / UMTS		Technology	LTE	LTE	GSM/UMTS / UMTS	
B4		B2 / B4		Band	B4	B12	B2 / B4	
A		A / P		Active/Passive	A	P	A / P	
Quad pole	Dual pole	Quad pole	Dual pole	Ant. Type	Quad pole	Dualpole	Quad pole	Dual pole
AIR21 B4A/B2P	RR90_17_02DP	AIR21 B2A/B4P	RR90_17_02DP	Ant. Model	AIR21 B4A/B2P	LNX-6515DS-VTM	AIR21 B2A/B4P	RR90_17_02DP
Ericsson	EMS	Ericsson	EMS	Ant. Vendor	Ericsson	Commscope	Ericsson	EMS
110		110		Ant. Height	110	110	110	
30		30		Azimuth	30	30	30	
Yes		Yes / Yes		RET deployed	Yes	Yes	Yes / Yes	
3		3 / 3		E-Tilt	3	2	3 / 3	
0		0 / 0		M-Tilt	0	0	0 / 0	
		1		TMA #			1	
		dd B4		TMA Type			dd B4	
				RRU #		1		
				RRU Type		S11 B12		
		2(LMU) / 2	2	Used Coax #			2(LMU) / 2	2
		7/8" / 1-5/8"	1-5/8"	Coax Type			7/8" / 1-5/8"	1-5/8"
		350		Coax Length (ft)			350	
1		2		Fiber (CPRI) #	1	2	2	
				Splitter #				
				Combiner #				
				Combiner Type				

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

Scope of work

Swap a dummy antenna with L700 B12 passive antenna. Add RRUS at antenna. Use spare fiber for LTE 700.

BETA (view from behind)

Existing Configuration					Proposed Configuration			
X	X	X	X		X	X	X	X
LTE		GSM/UMTS / UMTS		Technology	LTE	LTE	GSM/UMTS / UMTS	
B4		B2 / B4		Band	B4	B12	B2 / B4	
A		A / P		Active/Passive	A	P	A / P	
Quad pole	Dual pole	Quad pole	Dual pole	Ant. Type	Quad pole	Dualpole	Quad pole	Dual pole
AIR21 B4A/B2P	RR90_17_02DP	AIR21 B2A/B4P	RR90_17_02DP	Ant. Model	AIR21 B4A/B2P	LNX-6515DS-VTM	AIR21 B2A/B4P	RR90_17_02DP
Ericsson	EMS	Ericsson	EMS	Ant. Vendor	Ericsson	Commscope	Ericsson	EMS
110		110		Ant. Height	110	110	110	
150		150		Azimuth	150	150	150	
Yes		Yes / Yes		RET deployed	Yes	Yes	Yes / Yes	
6		6 / 6		E-Tilt	6	2	6 / 6	
2		2 / 2		M-Tilt	2	0	2 / 2	
		1		TMA #			1	
		dd B4		TMA Type			dd B4	
				RRU #		1		
				RRU Type		S11 B12		
		2(LMU) / 2	2	Used Coax #			2(LMU) / 2	2
		7/8" / 1-5/8"	1-5/8"	Coax Type			7/8" / 1-5/8"	1-5/8"
		350		Coax Length (ft)			350	
1		2		Fiber (CPRI) #	1	2	2	
				Splitter #				
				Combiner #				
				Combiner Type				

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

Scope of work

Swap a dummy antenna with L700 B12 passive antenna. Add RRUS at antenna. Use spare fiber for LTE 700.

Network Modernization RFDS v3.0

Site ID	**CT11075C**	**Latitude**	41.16277
		Longitude	-73.37334
Site Name	Westport/ MP X 41	**Site Type**	Structure (Non-Building)
Address	2 Sunny Lane, Westport, CT 06880	**Site Class**	Self Support Tower
Market	Connecticut	**Landlord**	Verizon

Configuration
702Cu

Approvals	
Market RF	
Market Development	

RFDS Revision		**Date**
RFDS Final		

GAMMA (view from behind)

Existing Configuration					Proposed Configuration			
X	X	X	X		X	X	X	X
LTE		GSM/UMTS / UMTS		Technology	LTE	LTE	GSM/UMTS / UMTS	
B4		B2 / B4		Band	B4	B12	B2 / B4	
A		A / P		Active/Passive	A	P	A / P	
Quad pole	Dual pole	Quad pole	Dual pole	Ant. Type	Quad pole	Dualpole	Quad pole	Dual pole
AIR21 B4A/B2P	RR90_17_02DP	AIR21 B2A/B4P	RR90_17_02DP	Ant. Model	AIR21 B4A/B2P	LNX-6515DS-VTM	AIR21 B2A/B4P	RR90_17_02DP
Ericsson	EMS	Ericsson	EMS	Ant. Vendor	Ericsson	Commscope	Ericsson	EMS
110		110		Ant. Height	110	110	110	
270		270		Azimuth	270	270	270	
Yes		Yes / Yes		RET deployed	Yes	Yes	Yes / Yes	
2		2 / 2		E-Tilt	2	2	2 / 2	
0		0 / 0		M-Tilt	0	0	0 / 0	
		1 dd B4		TMA # / TMA Type			1 dd B4	
				RRU # / RRU Type		1 S11 B12		
		2(LMU) 7/8" / 2 1-5/8"	2 1-5/8"	Used Coax # / Coax Type			2(LMU) 7/8" / 2 1-5/8"	2 1-5/8"
		350		Coax Length (ft)			350	
1		2		Fiber (CPRI) #	1	2	2	
				Splitter #				
				Combiner # / Combiner Type				

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

Scope of work

Swap a dummy antenna with L700 B12 passive antenna. Add RRUS at antenna. Use spare fiber for LTE 700.

DELTA (view from behind)

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

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

Scope of work

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6515DS-VTM

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

- Excellent choice to maximize both coverage and capacity in suburban and rural applications
- Fully compatible with Andrew remote electrical tilt system for greater OpEx savings
- Exceptional horizontal pattern roll-off and strong front-to-back ratio
- Extended bandwidth allows one antenna to serve multiple frequency allocations
- Great solution to maximize network coverage and capacity
- The RF connectors are designed for IP67 rating and the radome for IP56 rating
- The values presented on this datasheet have been calculated based on N-P-BASTA White Paper version 9.6 by the NGMN Alliance

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Gain by all Beam Tilts, average, dBi	16.6	16.9
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3
Gain by Beam Tilt, average, dBi	0 ° | 16.6 4 ° | 16.6 8 ° | 16.4	0 ° | 17.0 4 ° | 17.0 8 ° | 16.8
Beamwidth, Horizontal, degrees	65	64
Beamwidth, Horizontal Tolerance, degrees	±1	±0.9
Beamwidth, Vertical, degrees	9.7	8.6
Beamwidth, Vertical Tolerance, degrees	±0.6	±0.4
Beam Tilt, degrees	0–8	0–8
USLS, dB	18	18
Front-to-Back Total Power at 180° ± 30°, dB	25	23
CPR at Boresight, dB	24	27
CPR at Sector, dB	15	13
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°
Impedance	50 ohm	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol®
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	698 – 896 MHz
Number of Ports, all types	2

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum

Product Specifications

LNX-6515DS-VTM

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

Dimensions

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

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	LNX-6515DS-R2M
Model with Factory Installed AISG 2.0 Actuator	LNX-6515DS-A1M
RET System	Teletilt®

Regulatory Compliance/Certifications

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

Included Products

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

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

RRUS 11

Frequency (AT&T)
- ✓ Band 12 (Lower 700 MHz)
- ✓ Band 4 (AWS, 17/2100 MHz) — 2Q2011

RF Characteristics
- ✓ Output power: 2x30 Watts
- ✓ 2x2 MIMO Capable
- ✓ IBW of 20 MHz
- ✓ Rx Sens.: Better than -105 dBm (5 MHz)

RET/TMA Support
- ✓ AISG 2.0 Compatible
- ✓ Via RET Port and Centre Conductor
- ✓ Cascading
- ✓ 30 VDC Bias

Environmental
- ✓ Self Convection
- ✓ Temperature -40 to 131 F

Power
- ✓ Input voltage: -48 VDC or AC (exemption)
- ✓ Fuse size: 13 – 32 A
  - Recommended: 25 A
- ✓ Power Consumption:
  - Typical 200 Watts
  - Max 310 Watts
  - Excl. RET and TMA load

RRUS 11 Mechanics

Wall and pole mounting brackets
- Reused from RRUW and RRU22
- Vertical Mount Only

Clearing distances:
- Above >= 16 in.
- Below >= 12 in.
- Side >= 0 mm

DC connector
- Bayonet
- Screw terminals in connector plug
- Supported outer cable diameter: 6-18 mm

CPRI connector
- LCD with proprietary cover
- Separate cover available from 1Q2011

Size & Weight
- Band 4: 44 lbs
- Band 12: 50 lbs
- 17.8" x 17.3" x 7.2" incl. sun shield

ERICSSON

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: CT11075C

Westport/ MP X 41
2 Sunny Lane
Westport, CT 06880

March 23, 2015

EBI Project Number: 6215001708

Site Compliance Summary	
Compliance Status:	COMPLIANT
Site total MPE% of FCC general public allowable limit:	74.12 %

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March 23, 2015

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

Emissions Analysis for Site: **CT11075C – Westport/ MP X 41**

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **2 Sunny Lane, Westport, CT**, for the purpose of determining whether the emissions from the Proposed T-Mobile Antenna Installation located on this property are within specified federal limits.

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

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

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

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

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

Additional details can be found in FCC OET 65.

CALCULATIONS

Calculations were done for the proposed T-Mobile Wireless antenna facility located at **2 Sunny Lane, Westport, CT**, using the equipment information listed below. All calculations were performed per the specifications under FCC OET 65. Since T-Mobile is proposing highly focused directional panel antennas, which project most of the emitted energy out toward the horizon, all calculations were performed assuming a lobe representing the maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was focused at the base of the tower. For this report the sample point is the top of a 6 foot person standing at the base of the tower.

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

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

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

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

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

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

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

7) The antennas used in this modeling are the **Ericsson AIR21 B4A/B2P** and the **EMS RR90-17-02DP** for 1900 MHz (PCS) and 2100 MHz (AWS) channels and the **Commscope LNX-6515DS-VTM** for 700 MHz channels. This is based on feedback from the carrier with regards to anticipated antenna selection. The **Ericsson AIR21 B4A/B2P** has a maximum gain of **15.9 dBd** at its main lobe. The **EMS RR90-17-02DP** has a maximum gain of **14.4 dBd** at its main lobe The **Commscope LNX-6515DS-VTM** has a maximum gain of **14.6 dBd** at its main lobe. The maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was used for all calculations. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

8) The antenna mounting height centerline of the proposed antennas is **110 feet** above ground level (AGL).

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

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

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T-Mobile Site Inventory and Power Data

Sector:	A	Sector:	B	Sector:	C
Antenna #:	1	Antenna #:	1	Antenna #:	1
Make / Model:	Ericsson AIR21 B4A/B2P	Make / Model:	Ericsson AIR21 B4A/B2P	Make / Model:	Ericsson AIR21 B4A/B2P
Gain:	15.9 dBd	Gain:	15.9 dBd	Gain:	15.9 dBd
Height (AGL):	110	Height (AGL):	110	Height (AGL):	110
Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)
Channel Count	2	Channel Count	2	# PCS Channels:	2
Total TX Power:	120	Total TX Power:	120	# AWS Channels:	120
ERP (W):	4,668.54	ERP (W):	4,668.54	ERP (W):	4,668.54
Antenna A1 MPE%	1.55	Antenna B1 MPE%	1.55	Antenna C1 MPE%	1.55
Antenna #:	2	Antenna #:	2	Antenna #:	2
Make / Model:	Ericsson AIR21 B4A/B2P	Make / Model:	Ericsson AIR21 B4A/B2P	Make / Model:	Ericsson AIR21 B4A/B2P
Gain:	15.9 dBd	Gain:	15.9 dBd	Gain:	15.9 dBd
Height (AGL):	110	Height (AGL):	110	Height (AGL):	110
Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)
Channel Count	4	Channel Count	4	Channel Count	4
Total TX Power:	120	Total TX Power:	120	Total TX Power:	120
ERP (W):	4,668.54	ERP (W):	4,668.54	ERP (W):	4,668.54
Antenna A2 MPE%	1.55	Antenna B2 MPE%	1.55	Antenna C2 MPE%	1.55
Antenna #:	3	Antenna #:	3	Antenna #:	3
Make / Model:	Commscope LNX-6515DS-VTM	Make / Model:	Commscope LNX-6515DS-VTM	Make / Model:	Commscope LNX-6515DS-VTM
Gain:	14.6 dBd	Gain:	14.6 dBd	Gain:	14.6 dBd
Height (AGL):	110	Height (AGL):	110	Height (AGL):	110
Frequency Bands	700 MHz	Frequency Bands	700 MHz	Frequency Bands	700 MHz
Channel Count	1	Channel Count	1	Channel Count	1
Total TX Power:	30	Total TX Power:	30	Total TX Power:	30
ERP (W):	865.21	ERP (W):	865.21	ERP (W):	865.21
Antenna A3 MPE%	0.62	Antenna B3 MPE%	0.62	Antenna C3 MPE%	0.62
Antenna #:	4	Antenna #:	4	Antenna #:	4
Make / Model:	EMS RR90-17-02DP (Dormant)	Make / Model:	EMS RR90-17-02DP (Dormant)	Make / Model:	EMS RR90-17-02DP (Dormant)
Gain:	14.4 dBd	Gain:	14.4 dBd	Gain:	14.4 dBd
Height (AGL):	110	Height (AGL):	110	Height (AGL):	110
Frequency Bands	1900 MHz (PCS)	Frequency Bands	1900 MHz (PCS)	Frequency Bands	1900 MHz (PCS)
Channel Count	0	Channel Count	0	Channel Count	0
Total TX Power:	0	Total TX Power:	0	Total TX Power:	0
ERP (W):	0.00	ERP (W):	0.00	ERP (W):	0.00
Antenna A4 MPE%	0.00	Antenna B4 MPE%	0.00	Antenna C4 MPE%	0.00

Site Composite MPE%	
Carrier	**MPE%**
T-Mobile	**11.16**
Clearwire	1.29 %
Nextel	3.67 %
Verizon Wireless	27.37 %
Sprint	5.82 %
AT&T	24.81 %
Site Total MPE %:	**74.12 %**

T-Mobile Sector 1 Total:	3.72 %
T-Mobile Sector 2 Total:	3.72 %
T-Mobile Sector 3 Total:	3.72 %
Site Total:	74.12 %

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Summary

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

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

T-Mobile Sector	Power Density Value (%)
Sector 1:	3.72 %
Sector 2:	3.72 %
Sector 3 :	3.72 %
T-Mobile Total:	11.16 %
Site Total:	74.12 %
Site Compliance Status:	**COMPLIANT**

The anticipated composite MPE value for this site assuming all carriers present is **74.12%** 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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