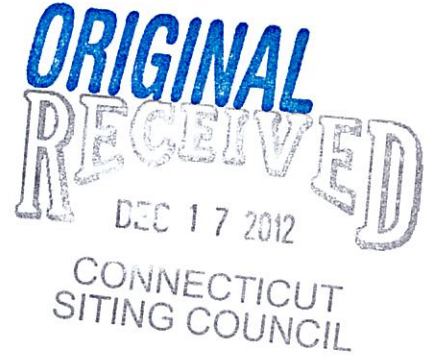




December 13, 2012

VIA OVERNIGHT DELIVERY

Ms. Linda Roberts, Executive Director  
Connecticut Siting Council  
Ten Franklin Square  
New Britain, CT 06051



RE: AT&T Mobility – Notice of Exempt Modification  
123 Palmer Road, Chaplin, CT (a.k.a. Palmer Road, Lot 54)

Dear Ms. Roberts:

This letter and attachments are submitted on behalf of AT&T Mobility (“AT&T”). AT&T is enhancing the capabilities of its wireless system in Connecticut by implementing LTE technology. In order to do so, AT&T will modify antenna and equipment configurations at a number of existing sites. Please accept this letter and attachments as notification, pursuant to R.C.S.A. Section 16-50j-73, of construction which constitutes an exempt modification pursuant to R.C.S.A. Section 16-50j-72(b)(2). In compliance with R.C.S.A. Section 16-50j-73, a copy of this letter and attachments is being sent to the First Selectman of Chaplin.

AT&T plans to modify the existing facility at 123 Palmer Road, Chaplin (a.k.a. Palmer Road, Lot 54), owned by AT&T Towers (coordinates 41°47’4.3”N, -72°08’8.7”W). Attached are drawings depicting the planned changes, and documentation of the structural sufficiency of the tower to accommodate the revised antenna configuration. Also included is a power density calculation reflecting the modification to AT&T’s operations at the site.

The changes to the facility do not constitute a modification as defined in Connecticut General Statutes (“C.G.S.”) Section 16-50i(d) because the general physical characteristics of the facility will not be significantly changed. Rather, the planned changes to the facility fall squarely within those activities explicitly provided for in R.C.S.A. Section 16-50j-72(b)(2).

1. AT&T proposes to add three (3) new antennas, six (6) RRU's and one (1) surge arrester. Additionally, AT&T will install one (1) fiber cable and two (2) DC control cables within a 3" flex conduit inside the monopole.

2. The proposed changes will not extend the site boundaries. AT&T will install additional equipment in its existing equipment shelter. Thus, there will be no effect on the site compound.

3. The proposed changes will not increase the noise level at the existing facility by six decibels or more. The incremental effect of the proposed changes will be negligible.

4. The changes to the facility will not increase the calculated "worst case" power density for the combined operations at the site to a level at or above the applicable standard for uncontrolled environments as calculated for a mixed frequency site. As indicated in the attached power density calculations, AT&T's operations at the site will result in a power density of 2.16%; the combined site operations will result in a total power density of 29.58%.

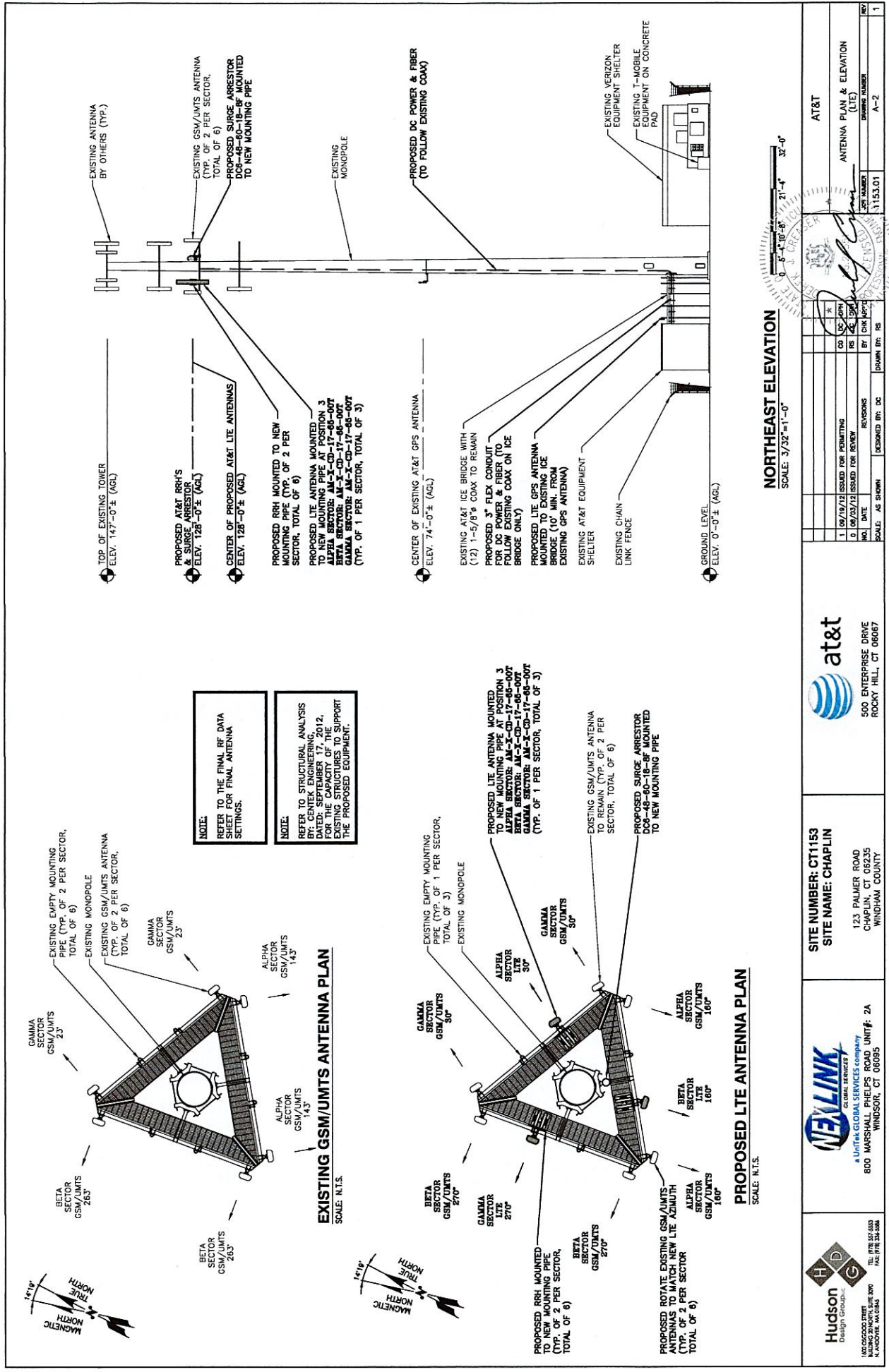
Please feel free to call me with any questions or concerns regarding this matter.  
Thank you for your consideration.

Respectfully submitted,  
AT&T Mobility

By: \_\_\_\_\_  
Eric Dahl, Consultant  
[edahl@comcast.net](mailto:edahl@comcast.net)  
860-227-1975

cc: Honorable William H. Rose, IV, First Selectman, Town of Chaplin

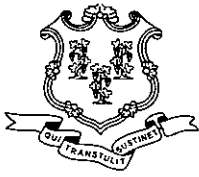
Attachments











STATE OF CONNECTICUT  
CONNECTICUT SITING COUNCIL

Ten Franklin Square, New Britain, CT 06051

Phone: (860) 827-2935 Fax: (860) 827-2950

E-Mail: [siting.council@ct.gov](mailto:siting.council@ct.gov)

[www.ct.gov/csc](http://www.ct.gov/csc)

December 17, 2012

The Honorable William H. Rose, IV  
First Selectman  
Town of Chaplin  
P. O. Box 286  
Chaplin, CT 06235-0286

RE: **EM-AT&T-024-121217** – AT&T Mobility notice of intent to modify an existing telecommunications facility located at 123 Palmer Road, Chaplin, Connecticut.

Dear First Selectman Rose:

The Connecticut Siting Council (Council) received a request to modify an existing telecommunications facility, pursuant to Regulations of Connecticut State Agencies Section 16-50j-72, a copy of which has already been provided to you.

If you have any questions or comments regarding the proposal, please call me or inform the Council by January 4, 2013.

Thank you for your cooperation and consideration.

Very truly yours,

Linda Roberts  
Executive Director

LR/cm

c: Demian Sorrentino, Zoning Enforcement Officer, Town of Chaplin

## *Structural Analysis Report*

*147-ft Existing EEL Monopole*

*Proposed AT&T Mobility  
Antenna Upgrade*

*AT&T Site Ref: CT1153*

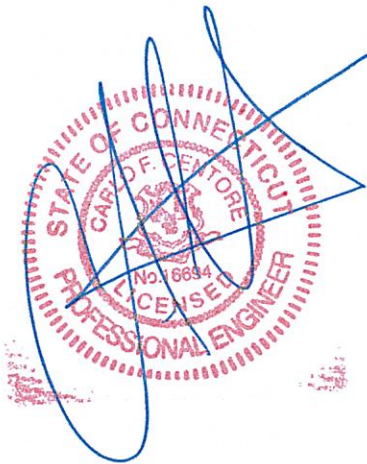
*Verizon Wireless Site Ref: Chaplin South*

*123 Palmer Road  
Chaplin, CT*

*Centek Project No. 12044.CO5*

*~~Date: September 17, 2012~~*

*Rev 1: December 10, 2012*



**Prepared for:**

*AT&T Mobility  
500 Enterprise Drive, Suite 3A  
Rocky Hill, CT 06067*

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- ANTENNA AND APPURTENANCE SUMMARY.
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- TOWER CAPACITY.
- FOUNDATION AND ANCHORS.
- CONCLUSION.

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- GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM.

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- ANTENNA CUT SHEETS.



## Introduction

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

The host tower is a 147-ft, three-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Inc (EEI)—job no: 12120, dated November 12, 2003. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned EEI design report. Antenna and appurtenance information were obtained from a previous structural report prepared by Centek job no.; 11074.CO18 dated October 18, 2011.

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

AT&T Mobility proposes the installation of three (3) panel antennas, six (6) Remote Radio Units (RRU's) and one (1) surge arrestor mounted to the existing low profile platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

## Antenna and Appurtenance Summary

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

- VERIZON (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 and three (3) RRH's mounted on an existing low profile platform with a RAD center elevation of 149-ft above grade.  
Coax Cables: Twelve (12) 1-5/8"  $\varnothing$  coax cables running on the inside of the existing monopole, six (6) 1-5/8"  $\varnothing$  coax cables banded to the exterior of the existing monopole and one (1) 1-1/4"  $\varnothing$  fiber cable banded to the exterior of the existing monopole.
- Sprint (Existing):  
Antennas: Four (4) Decibel DB950F85E-M and two (2) Decibel DB950G40E-M panel antennas mounted to one (1) low profile platform with a RAD center elevation of 138-ft above grade level.  
Coax Cables: Six (6) 1 5/8"  $\varnothing$  coax cables running on the interior of monopole.
- T-Mobile (Existing):  
Antennas: Three (3) EMS RR90-17-02DP panel antennas and three (3) 10"x8"x5" TMA's mounted to one (1) low profile platform with a RAD center elevation of 118-ft above grade level.  
Coax Cables: Six (6) 1 5/8"  $\varnothing$  coax cables running on the interior of the monopole.
- AT&T (Existing):  
GPS: One (1) GPS antenna mounted on a 4-ft standoff arm with a RAD center elevation of 74-ft above grade level.  
Coax Cables: One (1) 1/2"  $\varnothing$  coax cable running on the exterior of monopole.

- **Sprint (Existing):**  
GPS: One (1) GPS antenna mounted on a 4-ft standoff arm with a RAD center elevation of 62-ft above grade level.  
Coax Cables: One (1) 1/2" Ø coax cable running on the exterior of monopole.
- **AT&T (Existing to Remain):**  
Antennas: Six (6) Powerwave 7770 panel antennas, six (6) Powerwave LGP21401 TMA's, six (6) Powerwave LGP21901 Diplexers and three (3) PolyPahser DAS-DFDM-06 Bias-T mounted on one (1) low profile platform at a RAD center elevation of 128-ft above grade level.  
Coax Cables: Twelve (12) 1 5/8" Ø coax cables running on the interior of monopole.
- **AT&T (PROPOSED):**  
Antennas: Three (3) KWM AM-X-CD-17-65-00T-RET panel antennas, six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted on an existing low profile platform with a RAD center elevation of 128-ft above grade.  
Coax Cables: One (1) fiber cable and two (2) dc control cables banded to the exterior of the existing monopole.

### Primary Assumptions Used in the Analysis

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



## Analysis

The existing tower was analyzed using a comprehensive computer program entitled RISATower. 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<sup>1</sup> and the wind speed data available in the TIA/EIA-222-F-96 Standard. The higher of the two wind speeds is utilized in preparation on the tower analysis.

## Tower Loading

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

|                   |                                                                                                                                                                                                                           |                                                                                                 |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Basic Wind Speed: | Windham; v = 85 mph (fastest mile)                                                                                                                                                                                        | [Section 16 of TIA/EIA-222-F-96]                                                                |
|                   | Chaplin; v = 105 mph (3 second gust) equivalent to v = 85 mph (fastest mile)                                                                                                                                              | [Appendix K of the 2005 CT Building Code Supplement]                                            |
|                   | <i>TIA/EIA and Appendix K wind speed are equal.</i>                                                                                                                                                                       |                                                                                                 |
| Load Cases:       | <u>Load Case 1</u> ; 85 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.                                                                                                  | [Section 2.3.16 of TIA/EIA-222-F-96]                                                            |
|                   | <u>Load Case 2</u> ; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed. | [Section 2.3.16 of TIA/EIA-222-F-96]                                                            |
|                   | <u>Load Case 3</u> ; Seismic – not checked                                                                                                                                                                                | [Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type |

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<sup>1</sup> 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 RISATower. 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 RISATower "Section Capacity Table", this tower was found to be at **85.8%** of its total capacity.

| Tower Section   | Elevation     | Stress Ratio<br>(percentage of capacity) | Result      |
|-----------------|---------------|------------------------------------------|-------------|
| Pole Shaft (L2) | 47.92'-94.54' | 85.8%                                    | <b>PASS</b> |

## Foundation and Anchors

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

Review of the foundation and anchor design consisted of verification of applied loads obtained from the tower design calculations and code checks of allowable stresses:

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

| Location | Vector      | Proposed Reactions |
|----------|-------------|--------------------|
| Base     | Shear       | 29 kips            |
|          | Compression | 35 kips            |
|          | Moment      | 3074 kip-ft        |

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

| Tower Component | Design Limit | Stress Ratio<br>(percentage of capacity) | Result      |
|-----------------|--------------|------------------------------------------|-------------|
| Anchor Bolts    | Compression  | 76.3%                                    | <b>PASS</b> |
| Base Plate      | Bending      | 96.5%                                    | <b>PASS</b> |



**CEN TEK** Engineering, Inc.  
Structural Analysis – 147' EEI Monopole  
AT&T Antenna Upgrade – CT1153  
Chaplin, CT  
Rev 1~ December 10, 2012

- The tower base foundation was found to be within allowable limits.

| Foundation                             | Design Limit       | IBC 2003/2005<br>CT State Building<br>Code Section<br>3108.4.2 (FS) <sup>(1)</sup> | Proposed<br>Loading<br>(FS) <sup>(1)</sup> | Result      |
|----------------------------------------|--------------------|------------------------------------------------------------------------------------|--------------------------------------------|-------------|
| Reinforced<br>Concrete Pad<br>and Pier | OTM <sup>(2)</sup> | 2.0                                                                                | 2.55                                       | <b>PASS</b> |

Note 1: FS denotes Factor of Safety.

Note 2: OTM denotes Overturning Moment

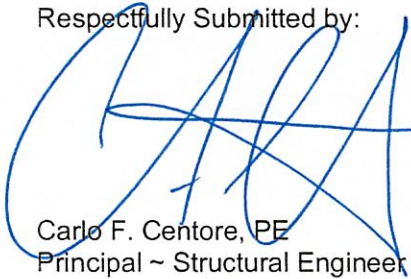
### Conclusion

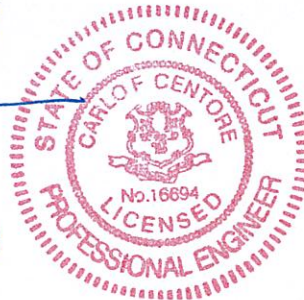
This analysis shows that the subject tower is adequate to support the proposed modified antenna configuration.

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

  
Carlo F. Centore, PE  
Principal ~ Structural Engineer



Prepared by:

  
Timothy J. Lynn, EIT  
Structural Engineer

Standard Conditions for Furnishing of  
Professional Engineering Services on  
Existing Structures

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

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

## GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

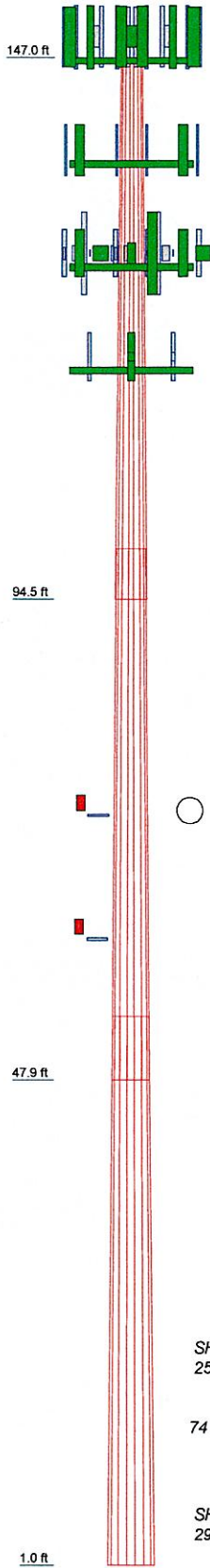
*tnxTower* is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, *tnxTower*, formerly RISATower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

### *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.



|         |             |                 |                |                    |              |              |            |
|---------|-------------|-----------------|----------------|--------------------|--------------|--------------|------------|
| 1       | 52,460      | 18              | 0.250          | 4,917              | 23,500       | 35,130       | 4.1        |
| 2       | 51,540      | 18              | 0.313          | 6,167              | 33,540       | 44,850       | 6.8        |
| 3       | 53,084      | 18              | 0.375          | 42,872             | 54,500       |              | 10.4       |
| Section | Length (ft) | Number of Sides | Thickness (in) | Socket Length (ft) | Top Dia (in) | Bot Dia (in) | Grade      |
|         |             |                 |                |                    |              |              | Weight (K) |
|         |             |                 |                |                    |              |              | 21.3       |



## DESIGNED APPURTENANCE LOADING

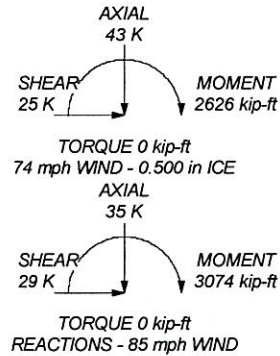
| TYPE                                              | ELEVATION | TYPE                                                   | ELEVATION |
|---------------------------------------------------|-----------|--------------------------------------------------------|-----------|
| LPA-80063/6CF (Verizon - Reserved)                | 149       | (2) LGP21401 TMA (ATI Existing)                        | 128       |
| LPA-171063-12CF (Verizon - Reserved)              | 149       | (2) LGP21401 TMA (ATI Existing)                        | 128       |
| BXA-70063/6CF (Verizon - Reserved)                | 149       | (2) LGP21401 TMA (ATI Existing)                        | 128       |
| BXA-70063/6CF (Verizon - Reserved)                | 149       | (2) LGP21901 Diplexer (ATI Existing)                   | 128       |
| LPA-171063-12CF (Verizon - Reserved)              | 149       | (2) LGP21901 Diplexer (ATI Existing)                   | 128       |
| LPA-80063/6CF (Verizon - Reserved)                | 149       | (2) LGP21901 Diplexer (ATI Existing)                   | 128       |
| LPA-80063/6CF (Verizon - Reserved)                | 149       | DAS-HY-DFDM-06 BIAS-T (ATI Existing)                   | 128       |
| LPA-171063-12CF (Verizon - Reserved)              | 149       | DAS-HY-DFDM-06 BIAS-T (ATI Existing)                   | 128       |
| LPA-171063-12CF (Verizon - Reserved)              | 149       | DAS-HY-DFDM-06 BIAS-T (ATI Existing)                   | 128       |
| BXA-70063/6CF (Verizon - Reserved)                | 149       | AM-X-CD-17-65-00T-RET (ATI - Proposed)                 | 128       |
| LPA-171063-12CF (Verizon - Reserved)              | 149       | AM-X-CD-17-65-00T-RET (ATI - Proposed)                 | 128       |
| LPA-80063/6CF (Verizon - Reserved)                | 149       | AM-X-CD-17-65-00T-RET (ATI - Proposed)                 | 128       |
| LPA-80063/6CF (Verizon - Reserved)                | 149       | (2) RRUS-11 (ATI - Proposed)                           | 128       |
| LPA-171063-12CF (Verizon - Reserved)              | 149       | (2) RRUS-11 (ATI - Proposed)                           | 128       |
| BXA-70063/6CF (Verizon - Reserved)                | 149       | (2) RRUS-11 (ATI - Proposed)                           | 128       |
| BXA-70063/6CF (Verizon - Reserved)                | 149       | (2) RRUS-11 (ATI - Proposed)                           | 128       |
| LPA-171063-12CF (Verizon - Reserved)              | 149       | DC6-48-60-18-8F Surge Arrestor (ATI - Proposed)        | 128       |
| LPA-80063/6CF (Verizon - Reserved)                | 149       | EEL 12-ft Low Profile Platform (ATI Existing)          | 127       |
| RRH (Verizon - Reserved)                          | 149       | TMA 10"x8"x5" (T-Mobile Existing)                      | 118       |
| RRH (Verizon - Reserved)                          | 149       | RR90-17-02DP (T-Mobile Existing)                       | 118       |
| RRH (Verizon - Reserved)                          | 149       | RR90-17-02DP (T-Mobile Existing)                       | 118       |
| EEL 14-ft Low Profile Platform (Verizon Existing) | 147       | RR90-17-02DP (T-Mobile Existing)                       | 118       |
| (2) DB950F85E-M (Sprint Existing)                 | 138       | TMA 10"x8"x5" (T-Mobile Existing)                      | 118       |
| (2) DB950F85E-M (Sprint Existing)                 | 138       | TMA 10"x8"x5" (T-Mobile Existing)                      | 118       |
| (2) DB950G40E-M (Sprint Existing)                 | 138       | Andrew 12'-6" Low Profile Platform (T-Mobile Existing) | 117       |
| EEL 12-ft Low Profile Platform (Sprint Existing)  | 137       | GPS (ATI Existing)                                     | 74        |
| (2) 7770.00 (ATI Existing)                        | 128       | 4-ft Standoff (ATI Existing)                           | 73.5      |
| (2) 7770.00 (ATI Existing)                        | 128       | GPS (Sprint Existing)                                  | 62        |
| (2) 7770.00 (ATI Existing)                        | 128       | 4-ft Standoff (Sprint Existing)                        | 61.5      |

## MATERIAL STRENGTH

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

## TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 85.8%



**Centek Engineering Inc.**

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

Job: **12044.CO5 - CT1153**

Project: **147' EEI Monopole - 123 Palmer Road Chaplin, CT**

Client: **AT&T Mobility** Drawn by: **TJL** App'd:

Code: **TIA/EIA-222-F** Date: **12/10/12** Scale: **NTS**

Path: **J:\Users\1204400\WPCOS-AT&T\CT1153\Rev 11\Calcs\ERS Files\147' Monopole - Chaplin CT.dwg** Dwg No. **E-1**

|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 1 of 28           |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

## Tower Input Data

There is a pole section.

This tower is designed using the TIA/EIA-222-F standard.

The following design criteria apply:

Basic wind speed of 85 mph.

Nominal ice thickness of 0.500 in.

Ice density of 56 pcf.

A wind speed of 74 mph is used in combination with ice.

Temperature drop of 50 °F.

Deflections calculated using a wind speed of 50 mph.

Weld together tower sections have flange connections..

Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..

Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..

Welds are fabricated with ER-70S-6 electrodes..

A non-linear (P-delta) analysis was used.

Pressures are calculated at each section.

Stress ratio used in pole design is 1.333.

Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

## Options

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

## Tapered Pole Section Geometry

| Section | Elevation<br>ft | Section<br>Length<br>ft | Splice<br>Length<br>ft | Number<br>of<br>Sides | Top<br>Diameter<br>in | Bottom<br>Diameter<br>in | Wall<br>Thickness<br>in | Bend<br>Radius<br>in | Pole Grade          |
|---------|-----------------|-------------------------|------------------------|-----------------------|-----------------------|--------------------------|-------------------------|----------------------|---------------------|
| L1      | 147.000-94.540  | 52.460                  | 4.917                  | 18                    | 23.500                | 35.130                   | 0.250                   | 1.000                | A572-65<br>(65 ksi) |
| L2      | 94.540-47.917   | 51.540                  | 6.167                  | 18                    | 33.540                | 44.850                   | 0.313                   | 1.250                | A572-65<br>(65 ksi) |
| L3      | 47.917-1.000    | 53.084                  |                        | 18                    | 42.872                | 54.500                   | 0.375                   | 1.500                | A572-65<br>(65 ksi) |



|                                                                                                                                                        |         |                                                 |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|---------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page<br>2 of 28           |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by<br>TJL        |

### Tapered Pole Properties

| Section | Tip Dia.<br>in | Area<br>in <sup>2</sup> | I<br>in <sup>4</sup> | r<br>in | C<br>in | I/C<br>in <sup>3</sup> | J<br>in <sup>4</sup> | Iu/Q<br>in <sup>3</sup> | w<br>in | w/t    |
|---------|----------------|-------------------------|----------------------|---------|---------|------------------------|----------------------|-------------------------|---------|--------|
| L1      | 23.863         | 18.449                  | 1259.950             | 8.254   | 11.938  | 105.541                | 2521.558             | 9.226                   | 3.696   | 14.784 |
|         | 35.672         | 27.677                  | 4254.160             | 12.382  | 17.846  | 238.381                | 8513.918             | 13.841                  | 5.743   | 22.972 |
| L2      | 35.153         | 32.957                  | 4597.110             | 11.796  | 17.038  | 269.811                | 9200.270             | 16.482                  | 5.353   | 17.13  |
|         | 45.542         | 44.176                  | 11070.619            | 15.811  | 22.784  | 485.899                | 22155.805            | 22.092                  | 7.344   | 23.5   |
| L3      | 44.905         | 50.582                  | 11540.941            | 15.086  | 21.779  | 529.916                | 23097.068            | 25.296                  | 6.885   | 18.361 |
|         | 55.341         | 64.422                  | 23843.465            | 19.214  | 27.686  | 861.210                | 47718.304            | 32.217                  | 8.932   | 23.819 |

| Tower<br>Elevation       | Gusset<br>Area<br>(per face) | Gusset<br>Thickness | Gusset Grade | Adjust. Factor<br>A <sub>f</sub> | Adjust. Factor<br>A <sub>r</sub> | Weight Mult. | Double Angle<br>Stitch Bolt<br>Spacing<br>Diagonals<br>in | Double Angle<br>Stitch Bolt<br>Spacing<br>Horizontals<br>in |
|--------------------------|------------------------------|---------------------|--------------|----------------------------------|----------------------------------|--------------|-----------------------------------------------------------|-------------------------------------------------------------|
| ft                       | ft <sup>2</sup>              | in                  |              |                                  |                                  |              |                                                           |                                                             |
| L1<br>147.000-94.54<br>0 |                              |                     |              | 1                                | 1                                | 1            |                                                           |                                                             |
| L2<br>94.540-47.917      |                              |                     |              | 1                                | 1                                | 1            |                                                           |                                                             |
| L3<br>47.917-1.000       |                              |                     |              | 1                                | 1                                | 1            |                                                           |                                                             |

### Feed Line/Linear Appurtenances - Entered As Area

| Description                              | Face<br>or<br>Leg | Allow<br>Shield | Component<br>Type     | Placement<br>ft | Total<br>Number |          | C <sub>A,A</sub><br>ft <sup>2</sup> /ft | Weight<br>klf |
|------------------------------------------|-------------------|-----------------|-----------------------|-----------------|-----------------|----------|-----------------------------------------|---------------|
| 1 5/8<br>(Verizon Existing)              | C                 | No              | Inside Pole           | 147.000 - 2.000 | 12              | No Ice   | 0.000                                   | 0.001         |
| 1 5/8<br>(Sprint Existing)               | C                 | No              | Inside Pole           | 138.000 - 2.000 | 6               | 1/2" Ice | 0.000                                   | 0.001         |
| 1 5/8<br>(AT&T Existing)                 | C                 | No              | Inside Pole           | 128.000 - 2.000 | 12              | 1/2" Ice | 0.000                                   | 0.001         |
| 1 5/8<br>(T-Mobile Existing)             | C                 | No              | Inside Pole           | 118.000 - 2.000 | 6               | 1/2" Ice | 0.000                                   | 0.001         |
| 1/2<br>(AT&T Existing)                   | C                 | No              | CaAa (Out Of<br>Face) | 74.000 - 2.000  | 1               | 1/2" Ice | 0.000                                   | 0.001         |
| 1/2<br>(Sprint Existing)                 | C                 | No              | CaAa (Out Of<br>Face) | 62.000 - 2.000  | 1               | 1/2" Ice | 0.058                                   | 0.000         |
| 1 5/8<br>(Verizon Existing)              | C                 | No              | CaAa (Out Of<br>Face) | 147.000 - 2.000 | 1               | 1/2" Ice | 0.158                                   | 0.001         |
| 1 5/8<br>(Verizon Existing)              | C                 | No              | CaAa (Out Of<br>Face) | 147.000 - 2.000 | 5               | 1/2" Ice | 0.158                                   | 0.001         |
| RG6-Fiber<br>(AT&T - Proposed)           | C                 | No              | CaAa (Out Of<br>Face) | 93.000 - 4.000  | 1               | 1/2" Ice | 0.198                                   | 0.003         |
| #8 AWG Copper Wre<br>(AT&T - Proposed)   | C                 | No              | CaAa (Out Of<br>Face) | 93.000 - 4.000  | 2               | 1/2" Ice | 0.298                                   | 0.001         |
| HYBRIFLEX 1-1/4"<br>(Verizon - Reserved) | C                 | No              | CaAa (Out Of<br>Face) | 107.750 - 1.000 | 1               | 1/2" Ice | 0.000                                   | 0.003         |
|                                          |                   |                 |                       |                 |                 | 1/2" Ice | 0.050                                   | 0.001         |
|                                          |                   |                 |                       |                 |                 | 1/2" Ice | 0.150                                   | 0.002         |
|                                          |                   |                 |                       |                 |                 | 1/2" Ice | 0.013                                   | 0.000         |
|                                          |                   |                 |                       |                 |                 | 1/2" Ice | 0.113                                   | 0.000         |
|                                          |                   |                 |                       |                 |                 | 1/2" Ice | 0.154                                   | 0.001         |
|                                          |                   |                 |                       |                 |                 | 1/2" Ice | 0.254                                   | 0.003         |



|                                                                                                                                                        |         |                                                 |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|---------------------------|
| <b>inxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page<br>3 of 28           |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by<br>TJL        |

### Feed Line/Linear Appurtenances Section Areas

| Tower Section | Tower Elevation<br>ft | Face | $A_R$<br>ft <sup>2</sup> | $A_F$<br>ft <sup>2</sup> | $C_{AA}$<br>In Face<br>ft <sup>2</sup> | $C_{AA}$<br>Out Face<br>ft <sup>2</sup> | Weight<br>K |
|---------------|-----------------------|------|--------------------------|--------------------------|----------------------------------------|-----------------------------------------|-------------|
| L1            | 147.000-94.540        | A    | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | B    | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | C    | 0.000                    | 0.000                    | 0.000                                  | 12.421                                  | 1.834       |
| L2            | 94.540-47.917         | A    | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | B    | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | C    | 0.000                    | 0.000                    | 0.000                                  | 22.153                                  | 2.157       |
| L3            | 47.917-1.000          | A    | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | B    | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | C    | 0.000                    | 0.000                    | 0.000                                  | 24.967                                  | 2.138       |

### Feed Line/Linear Appurtenances Section Areas - With Ice

| Tower Section | Tower Elevation<br>ft | Face or Leg | Ice Thickness<br>in | $A_R$<br>ft <sup>2</sup> | $A_F$<br>ft <sup>2</sup> | $C_{AA}$<br>In Face<br>ft <sup>2</sup> | $C_{AA}$<br>Out Face<br>ft <sup>2</sup> | Weight<br>K |
|---------------|-----------------------|-------------|---------------------|--------------------------|--------------------------|----------------------------------------|-----------------------------------------|-------------|
| L1            | 147.000-94.540        | A           | 0.500               | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | B           |                     | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | C           |                     | 0.000                    | 0.000                    | 0.000                                  | 18.988                                  | 2.326       |
| L2            | 94.540-47.917         | A           | 0.500               | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | B           |                     | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | C           |                     | 0.000                    | 0.000                    | 0.000                                  | 49.020                                  | 2.726       |
| L3            | 47.917-1.000          | A           | 0.500               | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | B           |                     | 0.000                    | 0.000                    | 0.000                                  | 0.000                                   | 0.000       |
|               |                       | C           |                     | 0.000                    | 0.000                    | 0.000                                  | 56.610                                  | 2.734       |

### Discrete Tower Loads

| Description                                          | Face or Leg | Offset Type | Offsets:<br>Horz<br>Lateral<br>Vert<br>ft<br>ft<br>ft | Azimuth Adjustment<br>° | Placement<br>ft | $C_{AA}$<br>Front<br>ft <sup>2</sup> | $C_{AA}$<br>Side<br>ft <sup>2</sup> | Weight<br>K    |
|------------------------------------------------------|-------------|-------------|-------------------------------------------------------|-------------------------|-----------------|--------------------------------------|-------------------------------------|----------------|
| EEI 14-ft Low Profile Platform<br>(Verizon Existing) | C           | None        |                                                       | 0.000                   | 147.000         | No Ice<br>1/2" Ice                   | 16.500<br>20.000                    | 1.550<br>1.800 |
| (2) DB950F85E-M<br>(Sprint Existing)                 | A           | From Face   | 3.500<br>0.000<br>0.000                               | 0.000                   | 138.000         | No Ice<br>1/2" Ice                   | 2.778<br>3.146                      | 0.012<br>0.036 |
| (2) DB950F85E-M<br>(Sprint Existing)                 | B           | From Face   | 3.500<br>0.000<br>0.000                               | 0.000                   | 138.000         | No Ice<br>1/2" Ice                   | 2.778<br>3.146                      | 0.012<br>0.036 |
| (2) DB950G40E-M<br>(Sprint Existing)                 | C           | From Face   | 3.500<br>0.000<br>0.000                               | 0.000                   | 138.000         | No Ice<br>1/2" Ice                   | 6.417<br>6.881                      | 0.019<br>0.061 |
| EEI 12-ft Low Profile Platform<br>(Sprint Existing)  | C           | None        |                                                       | 0.000                   | 137.000         | No Ice<br>1/2" Ice                   | 15.000<br>18.400                    | 1.500<br>1.750 |
| (2) 7770.00<br>(AT&T Existing)                       | A           | From Face   | 3.500<br>0.000                                        | 0.000                   | 128.000         | No Ice<br>1/2" Ice                   | 5.882<br>6.314                      | 0.035<br>0.068 |

|                                                                                                                                                        |         |                                                 |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|---------------------------|
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|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by<br>TJL        |

| Description                                          | Face<br>or<br>Leg | Offset<br>Type | Offsets:<br>Horz<br>Lateral<br>Vert<br>ft<br>ft<br>ft | Azimuth<br>Adjustment<br>° | Placement<br>ft |                    | C <sub>AA</sub><br>Front<br>ft <sup>2</sup> | C <sub>AA</sub><br>Side<br>ft <sup>2</sup> | Weight<br>K    |
|------------------------------------------------------|-------------------|----------------|-------------------------------------------------------|----------------------------|-----------------|--------------------|---------------------------------------------|--------------------------------------------|----------------|
| (2) 7770.00<br>(AT&T Existing)                       | B                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 5.882<br>6.314                              | 2.928<br>3.273                             | 0.035<br>0.068 |
| (2) 7770.00<br>(AT&T Existing)                       | C                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 5.882<br>6.314                              | 2.928<br>3.273                             | 0.035<br>0.068 |
| (2) LGP21401 TMA<br>(AT&T Existing)                  | A                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 0.953<br>1.093                              | 0.367<br>0.480                             | 0.018<br>0.023 |
| (2) LGP21401 TMA<br>(AT&T Existing)                  | B                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 0.953<br>1.093                              | 0.367<br>0.480                             | 0.018<br>0.023 |
| (2) LGP21401 TMA<br>(AT&T Existing)                  | C                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 0.953<br>1.093                              | 0.367<br>0.480                             | 0.018<br>0.023 |
| (2) LGP21901 Diplexer<br>(AT&T Existing)             | A                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 0.233<br>0.302                              | 0.117<br>0.166                             | 0.006<br>0.008 |
| (2) LGP21901 Diplexer<br>(AT&T Existing)             | B                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 0.233<br>0.302                              | 0.117<br>0.166                             | 0.006<br>0.008 |
| (2) LGP21901 Diplexer<br>(AT&T Existing)             | C                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 0.233<br>0.302                              | 0.117<br>0.166                             | 0.006<br>0.008 |
| DAS-HY-DFDM-06 BIAS-T<br>(AT&T Existing)             | A                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 0.102<br>0.161                              | 0.136<br>0.199                             | 0.080<br>0.081 |
| DAS-HY-DFDM-06 BIAS-T<br>(AT&T Existing)             | B                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 0.102<br>0.161                              | 0.136<br>0.199                             | 0.080<br>0.081 |
| DAS-HY-DFDM-06 BIAS-T<br>(AT&T Existing)             | C                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 0.102<br>0.161                              | 0.136<br>0.199                             | 0.080<br>0.081 |
| EEI 12-ft Low Profile<br>Platform<br>(AT&T Existing) | C                 | None           |                                                       | 0.000                      | 127.000         | No Ice<br>1/2" Ice | 15.000<br>18.400                            | 15.000<br>18.400                           | 1.500<br>1.750 |
| RR90-17-02DP<br>(T-Mobile Existing)                  | A                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 118.000         | No Ice<br>1/2" Ice | 4.356<br>4.775                              | 1.974<br>2.312                             | 0.018<br>0.040 |
| RR90-17-02DP<br>(T-Mobile Existing)                  | B                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 118.000         | No Ice<br>1/2" Ice | 4.356<br>4.775                              | 1.974<br>2.312                             | 0.018<br>0.040 |
| RR90-17-02DP<br>(T-Mobile Existing)                  | C                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 118.000         | No Ice<br>1/2" Ice | 4.356<br>4.775                              | 1.974<br>2.312                             | 0.018<br>0.040 |
| TMA 10"x8"x5"<br>(T-Mobile Existing)                 | A                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 118.000         | No Ice<br>1/2" Ice | 0.778<br>0.899                              | 0.486<br>0.588                             | 0.020<br>0.026 |
| TMA 10"x8"x5"<br>(T-Mobile Existing)                 | B                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 118.000         | No Ice<br>1/2" Ice | 0.778<br>0.899                              | 0.486<br>0.588                             | 0.020<br>0.026 |
| TMA 10"x8"x5"<br>(T-Mobile Existing)                 | C                 | From Face      | 0.000<br>3.500<br>0.000<br>0.000                      | 0.000                      | 118.000         | No Ice<br>1/2" Ice | 0.778<br>0.899                              | 0.486<br>0.588                             | 0.020<br>0.026 |
| Andrew 12'-6" Low Profile<br>Platform                | C                 | None           |                                                       | 0.000                      | 117.000         | No Ice<br>1/2" Ice | 14.450<br>19.000                            | 14.450<br>19.000                           | 1.300<br>1.690 |

|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
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|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Description          | Face<br>or<br>Leg | Offset<br>Type | Offsets:<br>Horz<br>Lateral<br>Vert<br>ft<br>ft<br>ft | Azimuth<br>Adjustment<br>° | Placement<br>ft |          | C <sub>A,A</sub><br>Front<br>ft <sup>2</sup> | C <sub>A,A</sub><br>Side<br>ft <sup>2</sup> | Weight<br>K |
|----------------------|-------------------|----------------|-------------------------------------------------------|----------------------------|-----------------|----------|----------------------------------------------|---------------------------------------------|-------------|
| (T-Mobile Existing)  |                   |                |                                                       |                            |                 |          |                                              |                                             |             |
| GPS                  | A                 | From Face      | 4.000                                                 | 0.000                      | 74.000          | No Ice   | 1.000                                        | 1.000                                       | 0.010       |
| (AT&T Existing)      |                   |                | 0.000                                                 |                            |                 | 1/2" Ice | 1.500                                        | 1.500                                       | 0.015       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| 4-ft Standoff        | A                 | From Face      | 2.000                                                 | 0.000                      | 73.500          | No Ice   | 1.400                                        | 0.087                                       | 0.030       |
| (AT&T Existing)      |                   |                | 0.000                                                 |                            |                 | 1/2" Ice | 1.735                                        | 0.131                                       | 0.041       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| GPS                  | A                 | From Face      | 4.000                                                 | 0.000                      | 62.000          | No Ice   | 1.000                                        | 1.000                                       | 0.010       |
| (Sprint Existing)    |                   |                | 0.000                                                 |                            |                 | 1/2" Ice | 1.500                                        | 1.500                                       | 0.015       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| 4-ft Standoff        | A                 | From Face      | 2.000                                                 | 0.000                      | 61.500          | No Ice   | 1.400                                        | 0.087                                       | 0.030       |
| (Sprint Existing)    |                   |                | 0.000                                                 |                            |                 | 1/2" Ice | 1.735                                        | 0.131                                       | 0.041       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-80063/6CF        | A                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 10.308                                       | 9.005                                       | 0.027       |
| (Verizon - Reserved) |                   |                | 6.000                                                 |                            |                 | 1/2" Ice | 10.868                                       | 9.554                                       | 0.101       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-171063-12CF      | A                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 5.994                                        | 6.054                                       | 0.012       |
| (Verizon - Reserved) |                   |                | 4.000                                                 |                            |                 | 1/2" Ice | 6.462                                        | 6.523                                       | 0.055       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| BXA-70063/6CF        | A                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 7.731                                        | 4.158                                       | 0.017       |
| (Verizon - Reserved) |                   |                | 1.000                                                 |                            |                 | 1/2" Ice | 8.268                                        | 4.595                                       | 0.059       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| BXA-70063/6CF        | A                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 7.731                                        | 4.158                                       | 0.017       |
| (Verizon - Reserved) |                   |                | -1.000                                                |                            |                 | 1/2" Ice | 8.268                                        | 4.595                                       | 0.059       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-171063-12CF      | A                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 5.994                                        | 6.054                                       | 0.012       |
| (Verizon - Reserved) |                   |                | -4.000                                                |                            |                 | 1/2" Ice | 6.462                                        | 6.523                                       | 0.055       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-80063/6CF        | A                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 10.308                                       | 9.005                                       | 0.027       |
| (Verizon - Reserved) |                   |                | -6.000                                                |                            |                 | 1/2" Ice | 10.868                                       | 9.554                                       | 0.101       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-80063/6CF        | B                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 10.308                                       | 9.005                                       | 0.027       |
| (Verizon - Reserved) |                   |                | 6.000                                                 |                            |                 | 1/2" Ice | 10.868                                       | 9.554                                       | 0.101       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-171063-12CF      | B                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 5.994                                        | 6.054                                       | 0.012       |
| (Verizon - Reserved) |                   |                | 4.000                                                 |                            |                 | 1/2" Ice | 6.462                                        | 6.523                                       | 0.055       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| BXA-70063/6CF        | B                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 7.731                                        | 4.158                                       | 0.017       |
| (Verizon - Reserved) |                   |                | 1.000                                                 |                            |                 | 1/2" Ice | 8.268                                        | 4.595                                       | 0.059       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| BXA-70063/6CF        | B                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 7.731                                        | 4.158                                       | 0.017       |
| (Verizon - Reserved) |                   |                | -1.000                                                |                            |                 | 1/2" Ice | 8.268                                        | 4.595                                       | 0.059       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-171063-12CF      | B                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 5.994                                        | 6.054                                       | 0.012       |
| (Verizon - Reserved) |                   |                | -4.000                                                |                            |                 | 1/2" Ice | 6.462                                        | 6.523                                       | 0.055       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-80063/6CF        | B                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 10.308                                       | 9.005                                       | 0.027       |
| (Verizon - Reserved) |                   |                | -6.000                                                |                            |                 | 1/2" Ice | 10.868                                       | 9.554                                       | 0.101       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-80063/6CF        | C                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 10.308                                       | 9.005                                       | 0.027       |
| (Verizon - Reserved) |                   |                | 6.000                                                 |                            |                 | 1/2" Ice | 10.868                                       | 9.554                                       | 0.101       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| LPA-171063-12CF      | C                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 5.994                                        | 6.054                                       | 0.012       |
| (Verizon - Reserved) |                   |                | 4.000                                                 |                            |                 | 1/2" Ice | 6.462                                        | 6.523                                       | 0.055       |
|                      |                   |                | 0.000                                                 |                            |                 |          |                                              |                                             |             |
| BXA-70063/6CF        | C                 | From Face      | 3.000                                                 | 0.000                      | 149.000         | No Ice   | 7.731                                        | 4.158                                       | 0.017       |
| (Verizon - Reserved) |                   |                | 1.000                                                 |                            |                 | 1/2" Ice | 8.268                                        | 4.595                                       | 0.059       |



|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 6 of 28           |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Description                                            | Face or Leg | Offset Type | Offsets:<br>Horz<br>Lateral<br>Vert<br>ft<br>ft<br>ft | Azimuth<br>Adjustment<br>° | Placement<br>ft |                    | C <sub>A</sub> A <sub>A</sub><br>Front<br>ft <sup>2</sup> | C <sub>A</sub> A <sub>A</sub><br>Side<br>ft <sup>2</sup> | Weight<br>K    |
|--------------------------------------------------------|-------------|-------------|-------------------------------------------------------|----------------------------|-----------------|--------------------|-----------------------------------------------------------|----------------------------------------------------------|----------------|
| 0.000                                                  |             |             |                                                       |                            |                 |                    |                                                           |                                                          |                |
| BXA-70063/6CF<br>(Verizon - Reserved)                  | C           | From Face   | 3.000<br>-1.000<br>0.000                              | 0.000                      | 149.000         | No Ice<br>1/2" Ice | 7.731<br>8.268                                            | 4.158<br>4.595                                           | 0.017<br>0.059 |
| LPA-171063-12CF<br>(Verizon - Reserved)                | C           | From Face   | 3.000<br>-4.000<br>0.000                              | 0.000                      | 149.000         | No Ice<br>1/2" Ice | 5.994<br>6.462                                            | 6.054<br>6.523                                           | 0.012<br>0.055 |
| LPA-80063/6CF<br>(Verizon - Reserved)                  | C           | From Face   | 3.000<br>-6.000<br>0.000                              | 0.000                      | 149.000         | No Ice<br>1/2" Ice | 10.308<br>10.868                                          | 9.005<br>9.554                                           | 0.027<br>0.101 |
| RRH<br>(Verizon - Reserved)                            | A           | From Face   | 3.000<br>0.000<br>0.000                               | 0.000                      | 149.000         | No Ice<br>1/2" Ice | 2.917<br>3.161                                            | 2.188<br>2.412                                           | 0.050<br>0.072 |
| RRH<br>(Verizon - Reserved)                            | B           | From Face   | 3.000<br>0.000<br>0.000                               | 0.000                      | 149.000         | No Ice<br>1/2" Ice | 2.917<br>3.161                                            | 2.188<br>2.412                                           | 0.050<br>0.072 |
| RRH<br>(Verizon - Reserved)                            | C           | From Face   | 3.000<br>0.000<br>0.000                               | 0.000                      | 149.000         | No Ice<br>1/2" Ice | 2.917<br>3.161                                            | 2.188<br>2.412                                           | 0.050<br>0.072 |
| AM-X-CD-17-65-00T-RET<br>(AT&T - Proposed)             | A           | From Face   | 3.000<br>-2.000<br>0.000                              | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 11.311<br>11.927                                          | 6.800<br>7.384                                           | 0.060<br>0.121 |
| AM-X-CD-17-65-00T-RET<br>(AT&T - Proposed)             | B           | From Face   | 3.000<br>-2.000<br>0.000                              | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 11.311<br>11.927                                          | 6.800<br>7.384                                           | 0.060<br>0.121 |
| AM-X-CD-17-65-00T-RET<br>(AT&T - Proposed)             | C           | From Face   | 3.000<br>-2.000<br>0.000                              | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 11.311<br>11.927                                          | 6.800<br>7.384                                           | 0.060<br>0.121 |
| (2) RRUS-11<br>(AT&T - Proposed)                       | A           | From Face   | 1.000<br>-2.000<br>0.000                              | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 2.994<br>3.226                                            | 1.246<br>1.412                                           | 0.050<br>0.070 |
| (2) RRUS-11<br>(AT&T - Proposed)                       | B           | From Face   | 1.000<br>-2.000<br>0.000                              | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 2.994<br>3.226                                            | 1.246<br>1.412                                           | 0.050<br>0.070 |
| (2) RRUS-11<br>(AT&T - Proposed)                       | C           | From Face   | 1.000<br>-2.000<br>0.000                              | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 2.994<br>3.226                                            | 1.246<br>1.412                                           | 0.050<br>0.070 |
| DC6-48-60-18-8F Surge<br>Arrestor<br>(AT&T - Proposed) | C           | From Face   | 0.500<br>0.000<br>0.000                               | 0.000                      | 128.000         | No Ice<br>1/2" Ice | 2.228<br>2.447                                            | 2.228<br>2.447                                           | 0.020<br>0.039 |

### Tower Pressures - No Ice

$$G_H = 1.690$$

| Section<br>Elevation | z       | K <sub>Z</sub> | q <sub>z</sub> | A <sub>G</sub>  | F<br>a<br>c<br>e | A <sub>F</sub>  | A <sub>R</sub>  | A <sub>leg</sub> | Leg<br>% | C <sub>A</sub> A <sub>A</sub><br>In<br>Face<br>ft <sup>2</sup> | C <sub>A</sub> A <sub>A</sub><br>Out<br>Face<br>ft <sup>2</sup> |
|----------------------|---------|----------------|----------------|-----------------|------------------|-----------------|-----------------|------------------|----------|----------------------------------------------------------------|-----------------------------------------------------------------|
| ft                   | ft      |                | ksf            | ft <sup>2</sup> |                  | ft <sup>2</sup> | ft <sup>2</sup> | ft <sup>2</sup>  |          |                                                                |                                                                 |
| L1                   | 119.440 | 1.444          | 0.027          | 128.155         | A                | 0.000           | 128.155         | 128.155          | 100.00   | 0.000                                                          | 0.000                                                           |

|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 7 of 28           |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Section<br>Elevation | z      | K <sub>Z</sub> | q <sub>z</sub> | A <sub>G</sub>  | F<br>a<br>c<br>e | A <sub>F</sub>  | A <sub>R</sub>  | A <sub>leg</sub> | Leg<br>% | C <sub>A</sub> A <sub>A</sub><br>In<br>Face<br>ft <sup>2</sup> | C <sub>A</sub> A <sub>A</sub><br>Out<br>Face<br>ft <sup>2</sup> |
|----------------------|--------|----------------|----------------|-----------------|------------------|-----------------|-----------------|------------------|----------|----------------------------------------------------------------|-----------------------------------------------------------------|
| ft                   | ft     |                | ksf            | ft <sup>2</sup> |                  | ft <sup>2</sup> | ft <sup>2</sup> | ft <sup>2</sup>  |          |                                                                |                                                                 |
| 147.000-94.540       | 70.777 | 1.244          | 0.023          | 154.378         | B                | 0.000           | 128.155         | 154.378          | 100.00   | 0.000                                                          | 0.000                                                           |
| 0                    |        |                |                |                 | C                | 0.000           | 128.155         |                  | 100.00   | 0.000                                                          | 12.421                                                          |
| L2                   |        |                |                |                 | A                | 0.000           | 154.378         |                  | 100.00   | 0.000                                                          | 0.000                                                           |
| 94.540-47.917        | 23.789 | 1              | 0.019          | 192.990         | B                | 0.000           | 154.378         | 192.990          | 100.00   | 0.000                                                          | 0.000                                                           |
| L3                   |        |                |                |                 | C                | 0.000           | 154.378         |                  | 100.00   | 0.000                                                          | 22.153                                                          |
| A                    |        |                |                |                 | A                | 0.000           | 192.990         |                  | 100.00   | 0.000                                                          | 0.000                                                           |
| B                    |        |                |                |                 | B                | 0.000           | 192.990         |                  | 100.00   | 0.000                                                          | 0.000                                                           |
| C                    |        |                |                |                 | C                | 0.000           | 192.990         |                  | 100.00   | 0.000                                                          | 24.967                                                          |

### Tower Pressure - With Ice

$$G_H = 1.690$$

| Section<br>Elevation | z       | K <sub>Z</sub> | q <sub>z</sub> | t <sub>z</sub> | A <sub>G</sub>  | F<br>a<br>c<br>e | A <sub>F</sub>  | A <sub>R</sub>  | A <sub>leg</sub> | Leg<br>% | C <sub>A</sub> A <sub>A</sub><br>In<br>Face<br>ft <sup>2</sup> | C <sub>A</sub> A <sub>A</sub><br>Out<br>Face<br>ft <sup>2</sup> |
|----------------------|---------|----------------|----------------|----------------|-----------------|------------------|-----------------|-----------------|------------------|----------|----------------------------------------------------------------|-----------------------------------------------------------------|
| ft                   | ft      |                | ksf            | in             | ft <sup>2</sup> |                  | ft <sup>2</sup> | ft <sup>2</sup> | ft <sup>2</sup>  |          |                                                                |                                                                 |
| L1                   | 119.440 | 1.444          | 0.020          | 0.500          | 132.527         | A                | 0.000           | 132.527         | 132.527          | 100.00   | 0.000                                                          | 0.000                                                           |
| 147.000-94.540       |         |                |                |                |                 | B                | 0.000           | 132.527         |                  | 100.00   | 0.000                                                          | 0.000                                                           |
| C                    |         |                |                |                |                 | C                | 0.000           | 132.527         |                  | 100.00   | 0.000                                                          | 18.988                                                          |
| L2                   | 70.777  | 1.244          | 0.017          | 0.500          | 158.264         | A                | 0.000           | 158.264         | 158.264          | 100.00   | 0.000                                                          | 0.000                                                           |
| 94.540-47.917        |         |                |                |                |                 | B                | 0.000           | 158.264         |                  | 100.00   | 0.000                                                          | 0.000                                                           |
| C                    |         |                |                |                |                 | C                | 0.000           | 158.264         |                  | 100.00   | 0.000                                                          | 49.020                                                          |
| L3                   | 23.789  | 1              | 0.014          | 0.500          | 196.900         | A                | 0.000           | 196.900         | 196.900          | 100.00   | 0.000                                                          | 0.000                                                           |
| 47.917-1.000         |         |                |                |                |                 | B                | 0.000           | 196.900         |                  | 100.00   | 0.000                                                          | 0.000                                                           |
| C                    |         |                |                |                |                 | C                | 0.000           | 196.900         |                  | 100.00   | 0.000                                                          | 56.610                                                          |

### Tower Pressure - Service

$$G_H = 1.690$$

| Section<br>Elevation | z       | K <sub>Z</sub> | q <sub>z</sub> | A <sub>G</sub>  | F<br>a<br>c<br>e | A <sub>F</sub>  | A <sub>R</sub>  | A <sub>leg</sub> | Leg<br>% | C <sub>A</sub> A <sub>A</sub><br>In<br>Face<br>ft <sup>2</sup> | C <sub>A</sub> A <sub>A</sub><br>Out<br>Face<br>ft <sup>2</sup> |
|----------------------|---------|----------------|----------------|-----------------|------------------|-----------------|-----------------|------------------|----------|----------------------------------------------------------------|-----------------------------------------------------------------|
| ft                   | ft      |                | ksf            | ft <sup>2</sup> |                  | ft <sup>2</sup> | ft <sup>2</sup> | ft <sup>2</sup>  |          |                                                                |                                                                 |
| L1                   | 119.440 | 1.444          | 0.009          | 128.155         | A                | 0.000           | 128.155         | 128.155          | 100.00   | 0.000                                                          | 0.000                                                           |
| 147.000-94.540       |         |                |                |                 | B                | 0.000           | 128.155         |                  | 100.00   | 0.000                                                          | 0.000                                                           |
| C                    |         |                |                |                 | C                | 0.000           | 128.155         |                  | 100.00   | 0.000                                                          | 12.421                                                          |
| L2                   | 70.777  | 1.244          | 0.008          | 154.378         | A                | 0.000           | 154.378         | 154.378          | 100.00   | 0.000                                                          | 0.000                                                           |
| 94.540-47.917        |         |                |                |                 | B                | 0.000           | 154.378         |                  | 100.00   | 0.000                                                          | 0.000                                                           |
| C                    |         |                |                |                 | C                | 0.000           | 154.378         |                  | 100.00   | 0.000                                                          | 22.153                                                          |
| L3                   | 23.789  | 1              | 0.006          | 192.990         | A                | 0.000           | 192.990         | 192.990          | 100.00   | 0.000                                                          | 0.000                                                           |
| 47.917-1.000         |         |                |                |                 | B                | 0.000           | 192.990         |                  | 100.00   | 0.000                                                          | 0.000                                                           |
| C                    |         |                |                |                 | C                | 0.000           | 192.990         |                  | 100.00   | 0.000                                                          | 24.967                                                          |

### Tower Forces - No Ice - Wind Normal To Face

|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 8 of 28           |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F      | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|--------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K      | klf   |               |
| L1                   | 1.834         | 4.117          | A                | 1 | 0.65           | 1              | 1              | 1              | 128.155           | 4.312  | 0.082 | C             |
| 147.000-94.54        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |        |       |               |
| 0                    |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |        |       |               |
| L2                   | 2.157         | 6.764          | A                | 1 | 0.65           | 1              | 1              | 1              | 154.378           | 4.738  | 0.102 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |        |       |               |
| L3                   | 2.138         | 10.387         | A                | 1 | 0.65           | 1              | 1              | 1              | 192.990           | 4.757  | 0.101 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |        |       |               |
| Sum Weight:          | 6.129         | 21.268         |                  |   |                |                |                | OTM            | 949.689<br>kip-ft | 13.807 |       |               |

### Tower Forces - No Ice - Wind 45 To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F      | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|--------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K      | klf   |               |
| L1                   | 1.834         | 4.117          | A                | 1 | 0.65           | 1              | 1              | 1              | 128.155           | 4.312  | 0.082 | C             |
| 147.000-94.54        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |        |       |               |
| 0                    |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |        |       |               |
| L2                   | 2.157         | 6.764          | A                | 1 | 0.65           | 1              | 1              | 1              | 154.378           | 4.738  | 0.102 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |        |       |               |
| L3                   | 2.138         | 10.387         | A                | 1 | 0.65           | 1              | 1              | 1              | 192.990           | 4.757  | 0.101 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |        |       |               |
| Sum Weight:          | 6.129         | 21.268         |                  |   |                |                |                | OTM            | 949.689<br>kip-ft | 13.807 |       |               |

### Tower Forces - No Ice - Wind 60 To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F      | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|--------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K      | klf   |               |
| L1                   | 1.834         | 4.117          | A                | 1 | 0.65           | 1              | 1              | 1              | 128.155           | 4.312  | 0.082 | C             |
| 147.000-94.54        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |        |       |               |
| 0                    |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |        |       |               |
| L2                   | 2.157         | 6.764          | A                | 1 | 0.65           | 1              | 1              | 1              | 154.378           | 4.738  | 0.102 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |        |       |               |
| L3                   | 2.138         | 10.387         | A                | 1 | 0.65           | 1              | 1              | 1              | 192.990           | 4.757  | 0.101 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |        |       |               |
| Sum Weight:          | 6.129         | 21.268         |                  |   |                |                |                | OTM            | 949.689<br>kip-ft | 13.807 |       |               |



|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 9 of 28           |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

### Tower Forces - No Ice - Wind 90 To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F      | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|--------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K      | klf   |               |
| L1                   | 1.834         | 4.117          | A                | 1 | 0.65           | 1              | 1              | 1              | 128.155           | 4.312  | 0.082 | C             |
| 147.000-94.54        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |        |       |               |
| 0                    |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |        |       |               |
| L2                   | 2.157         | 6.764          | A                | 1 | 0.65           | 1              | 1              | 1              | 154.378           | 4.738  | 0.102 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |        |       |               |
| L3                   | 2.138         | 10.387         | A                | 1 | 0.65           | 1              | 1              | 1              | 192.990           | 4.757  | 0.101 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |        |       |               |
| Sum Weight:          | 6.129         | 21.268         |                  |   |                |                |                | OTM            | 949.689<br>kip-ft | 13.807 |       |               |

### Tower Forces - With Ice - Wind Normal To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F      | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|--------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K      | klf   |               |
| L1                   | 2.326         | 5.082          | A                | 1 | 0.65           | 1              | 1              | 1              | 132.527           | 3.552  | 0.068 | C             |
| 147.000-94.54        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 132.527           |        |       |               |
| 0                    |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 132.527           |        |       |               |
| L2                   | 2.726         | 7.922          | A                | 1 | 0.65           | 1              | 1              | 1              | 158.264           | 4.406  | 0.095 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 158.264           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 158.264           |        |       |               |
| L3                   | 2.734         | 11.831         | A                | 1 | 0.65           | 1              | 1              | 1              | 196.900           | 4.379  | 0.093 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 196.900           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 196.900           |        |       |               |
| Sum Weight:          | 7.786         | 24.834         |                  |   |                |                |                | OTM            | 827.886<br>kip-ft | 12.337 |       |               |

### Tower Forces - With Ice - Wind 45 To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F      | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|--------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K      | klf   |               |
| L1                   | 2.326         | 5.082          | A                | 1 | 0.65           | 1              | 1              | 1              | 132.527           | 3.552  | 0.068 | C             |
| 147.000-94.54        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 132.527           |        |       |               |
| 0                    |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 132.527           |        |       |               |
| L2                   | 2.726         | 7.922          | A                | 1 | 0.65           | 1              | 1              | 1              | 158.264           | 4.406  | 0.095 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 158.264           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 158.264           |        |       |               |
| L3                   | 2.734         | 11.831         | A                | 1 | 0.65           | 1              | 1              | 1              | 196.900           | 4.379  | 0.093 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 196.900           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 196.900           |        |       |               |
| Sum Weight:          | 7.786         | 24.834         |                  |   |                |                |                | OTM            | 827.886<br>kip-ft | 12.337 |       |               |

|                                                                                                                                                        |         |                                                 |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|---------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page<br>10 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by<br>TJL        |

### Tower Forces - With Ice - Wind 60 To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F      | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|--------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K      | klf   |               |
| L1                   | 2.326         | 5.082          | A                | 1 | 0.65           | 1              | 1              | 1              | 132.527           | 3.552  | 0.068 | C             |
| 147.000-94.54        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 132.527           |        |       |               |
| 0                    |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 132.527           |        |       |               |
| L2                   | 2.726         | 7.922          | A                | 1 | 0.65           | 1              | 1              | 1              | 158.264           | 4.406  | 0.095 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 158.264           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 158.264           |        |       |               |
| L3                   | 2.734         | 11.831         | A                | 1 | 0.65           | 1              | 1              | 1              | 196.900           | 4.379  | 0.093 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 196.900           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 196.900           |        |       |               |
| Sum Weight:          | 7.786         | 24.834         |                  |   |                |                |                | OTM            | 827.886<br>kip-ft | 12.337 |       |               |

### Tower Forces - With Ice - Wind 90 To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F      | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|--------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K      | klf   |               |
| L1                   | 2.326         | 5.082          | A                | 1 | 0.65           | 1              | 1              | 1              | 132.527           | 3.552  | 0.068 | C             |
| 147.000-94.54        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 132.527           |        |       |               |
| 0                    |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 132.527           |        |       |               |
| L2                   | 2.726         | 7.922          | A                | 1 | 0.65           | 1              | 1              | 1              | 158.264           | 4.406  | 0.095 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 158.264           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 158.264           |        |       |               |
| L3                   | 2.734         | 11.831         | A                | 1 | 0.65           | 1              | 1              | 1              | 196.900           | 4.379  | 0.093 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 196.900           |        |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 196.900           |        |       |               |
| Sum Weight:          | 7.786         | 24.834         |                  |   |                |                |                | OTM            | 827.886<br>kip-ft | 12.337 |       |               |

### Tower Forces - Service - Wind Normal To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>  | F     | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-----------------|-------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup> | K     | klf   |               |
| L1                   | 1.834         | 4.117          | A                | 1 | 0.65           | 1              | 1              | 1              | 128.155         | 1.492 | 0.028 | C             |
| 147.000-94.54        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 128.155         |       |       |               |
| 0                    |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 128.155         |       |       |               |
| L2                   | 2.157         | 6.764          | A                | 1 | 0.65           | 1              | 1              | 1              | 154.378         | 1.639 | 0.035 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 154.378         |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 154.378         |       |       |               |
| L3                   | 2.138         | 10.387         | A                | 1 | 0.65           | 1              | 1              | 1              | 192.990         | 1.646 | 0.035 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 192.990         |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 192.990         |       |       |               |
| Sum Weight:          | 6.129         | 21.268         |                  |   |                |                |                | OTM            | 328.612         | 4.777 |       |               |

|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 11 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>  | F | w   | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-----------------|---|-----|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup> | K | klf |               |
|                      |               |                |                  |   |                |                |                |                | kip-ft          |   |     |               |

### Tower Forces - Service - Wind 45 To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F     | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|-------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K     | klf   |               |
| L1                   | 1.834         | 4.117          | A                | 1 | 0.65           | 1              | 1              | 1              | 128.155           | 1.492 | 0.028 | C             |
| 147.000-94.540       |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |       |       |               |
| L2                   | 2.157         | 6.764          | A                | 1 | 0.65           | 1              | 1              | 1              | 154.378           | 1.639 | 0.035 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |       |       |               |
| L3                   | 2.138         | 10.387         | A                | 1 | 0.65           | 1              | 1              | 1              | 192.990           | 1.646 | 0.035 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |       |       |               |
| Sum Weight:          | 6.129         | 21.268         |                  |   |                |                |                | OTM            | 328.612<br>kip-ft | 4.777 |       |               |

### Tower Forces - Service - Wind 60 To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F     | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|-------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K     | klf   |               |
| L1                   | 1.834         | 4.117          | A                | 1 | 0.65           | 1              | 1              | 1              | 128.155           | 1.492 | 0.028 | C             |
| 147.000-94.540       |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 128.155           |       |       |               |
| L2                   | 2.157         | 6.764          | A                | 1 | 0.65           | 1              | 1              | 1              | 154.378           | 1.639 | 0.035 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |       |       |               |
| L3                   | 2.138         | 10.387         | A                | 1 | 0.65           | 1              | 1              | 1              | 192.990           | 1.646 | 0.035 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |       |       |               |
| Sum Weight:          | 6.129         | 21.268         |                  |   |                |                |                | OTM            | 328.612<br>kip-ft | 4.777 |       |               |

### Tower Forces - Service - Wind 90 To Face

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>  | F     | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-----------------|-------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup> | K     | klf   |               |
| L1                   | 1.834         | 4.117          | A                | 1 | 0.65           | 1              | 1              | 1              | 128.155         | 1.492 | 0.028 | C             |
| 147.000-94.540       |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 128.155         |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 128.155         |       |       |               |



|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 12 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Section<br>Elevation | Add<br>Weight | Self<br>Weight | F<br>a<br>c<br>e | e | C <sub>F</sub> | R <sub>R</sub> | D <sub>F</sub> | D <sub>R</sub> | A <sub>E</sub>    | F     | w     | Ctrl.<br>Face |
|----------------------|---------------|----------------|------------------|---|----------------|----------------|----------------|----------------|-------------------|-------|-------|---------------|
| ft                   | K             | K              |                  |   |                |                |                |                | ft <sup>2</sup>   | K     | klf   |               |
| L2                   | 2.157         | 6.764          | A                | 1 | 0.65           | 1              | 1              | 1              | 154.378           | 1.639 | 0.035 | C             |
| 94.540-47.917        |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 154.378           |       |       |               |
| L3                   | 2.138         | 10.387         | A                | 1 | 0.65           | 1              | 1              | 1              | 192.990           | 1.646 | 0.035 | C             |
| 47.917-1.000         |               |                | B                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |       |       |               |
|                      |               |                | C                | 1 | 0.65           | 1              | 1              | 1              | 192.990           |       |       |               |
| Sum Weight:          | 6.129         | 21.268         |                  |   |                |                |                | OTM            | 328.612<br>kip-ft | 4.777 |       |               |

### Force Totals

| Load<br>Case             | Vertical<br>Forces | Sum of<br>Forces<br>X<br>K | Sum of<br>Forces<br>Z<br>K | Sum of<br>Overturning<br>Moments, M <sub>x</sub><br>kip-ft | Sum of<br>Overturning<br>Moments, M <sub>z</sub><br>kip-ft | Sum of Torques<br>kip-ft |
|--------------------------|--------------------|----------------------------|----------------------------|------------------------------------------------------------|------------------------------------------------------------|--------------------------|
| Leg Weight               | 21.268             |                            |                            |                                                            |                                                            |                          |
| Bracing Weight           | 0.000              |                            |                            |                                                            |                                                            |                          |
| Total Member Self-Weight | 21.268             |                            |                            | -0.071                                                     | 0.290                                                      |                          |
| Total Weight             | 35.107             |                            |                            | -0.071                                                     | 0.290                                                      |                          |
| Wind 0 deg - No Ice      |                    | -0.044                     | -28.603                    | -2982.791                                                  | 3.193                                                      | -0.399                   |
| Wind 30 deg - No Ice     |                    | 14.140                     | -24.749                    | -2581.731                                                  | -1469.913                                                  | -0.272                   |
| Wind 45 deg - No Ice     |                    | 20.020                     | -20.194                    | -2107.120                                                  | -2080.394                                                  | -0.178                   |
| Wind 60 deg - No Ice     |                    | 24.536                     | -14.264                    | -1488.917                                                  | -2549.079                                                  | -0.072                   |
| Wind 90 deg - No Ice     |                    | 28.356                     | 0.044                      | 2.832                                                      | -2945.144                                                  | 0.148                    |
| Wind 120 deg - No Ice    |                    | 24.579                     | 14.339                     | 1493.804                                                   | -2551.982                                                  | 0.328                    |
| Wind 135 deg - No Ice    |                    | 20.082                     | 20.256                     | 2111.084                                                   | -2084.499                                                  | 0.387                    |
| Wind 150 deg - No Ice    |                    | 14.216                     | 24.792                     | 2584.493                                                   | -1474.941                                                  | 0.420                    |
| Wind 180 deg - No Ice    |                    | 0.044                      | 28.603                     | 2982.650                                                   | -2.613                                                     | 0.399                    |
| Wind 210 deg - No Ice    |                    | -14.140                    | 24.749                     | 2581.590                                                   | 1470.493                                                   | 0.272                    |
| Wind 225 deg - No Ice    |                    | -20.020                    | 20.194                     | 2106.979                                                   | 2080.974                                                   | 0.178                    |
| Wind 240 deg - No Ice    |                    | -24.536                    | 14.264                     | 1488.776                                                   | 2549.660                                                   | 0.072                    |
| Wind 270 deg - No Ice    |                    | -28.356                    | -0.044                     | -2.974                                                     | 2945.724                                                   | -0.148                   |
| Wind 300 deg - No Ice    |                    | -24.579                    | -14.339                    | -1493.945                                                  | 2552.563                                                   | -0.328                   |
| Wind 315 deg - No Ice    |                    | -20.082                    | -20.256                    | -2111.226                                                  | 2085.079                                                   | -0.387                   |
| Wind 330 deg - No Ice    |                    | -14.216                    | -24.792                    | -2584.634                                                  | 1475.521                                                   | -0.420                   |
| Member Ice               | 3.567              |                            |                            |                                                            |                                                            |                          |
| Total Weight Ice         | 43.359             |                            |                            | 0.058                                                      | 0.412                                                      |                          |
| Wind 0 deg - Ice         |                    | -0.040                     | -24.709                    | -2521.918                                                  | 3.073                                                      | -0.449                   |
| Wind 30 deg - Ice        |                    | 12.229                     | -21.379                    | -2182.707                                                  | -1244.127                                                  | -0.370                   |
| Wind 45 deg - Ice        |                    | 17.314                     | -17.444                    | -1781.367                                                  | -1761.009                                                  | -0.290                   |
| Wind 60 deg - Ice        |                    | 21.220                     | -12.320                    | -1258.626                                                  | -2157.854                                                  | -0.191                   |
| Wind 90 deg - Ice        |                    | 24.526                     | 0.040                      | 2.719                                                      | -2493.275                                                  | 0.039                    |
| Wind 120 deg - Ice       |                    | 21.260                     | 12.389                     | 1263.350                                                   | -2160.515                                                  | 0.258                    |
| Wind 135 deg - Ice       |                    | 17.371                     | 17.500                     | 1785.245                                                   | -1764.773                                                  | 0.345                    |
| Wind 150 deg - Ice       |                    | 12.298                     | 21.419                     | 2185.483                                                   | -1248.736                                                  | 0.408                    |
| Wind 180 deg - Ice       |                    | 0.040                      | 24.709                     | 2522.033                                                   | -2.249                                                     | 0.449                    |
| Wind 210 deg - Ice       |                    | -12.229                    | 21.379                     | 2182.822                                                   | 1244.952                                                   | 0.370                    |
| Wind 225 deg - Ice       |                    | -17.314                    | 17.444                     | 1781.482                                                   | 1761.834                                                   | 0.290                    |
| Wind 240 deg - Ice       |                    | -21.220                    | 12.320                     | 1258.741                                                   | 2158.679                                                   | 0.191                    |
| Wind 270 deg - Ice       |                    | -24.526                    | -0.040                     | -2.604                                                     | 2494.100                                                   | -0.039                   |
| Wind 300 deg - Ice       |                    | -21.260                    | -12.389                    | -1263.235                                                  | 2161.340                                                   | -0.258                   |
| Wind 315 deg - Ice       |                    | -17.371                    | -17.500                    | -1785.130                                                  | 1765.598                                                   | -0.345                   |
| Wind 330 deg - Ice       |                    | -12.298                    | -21.419                    | -2185.368                                                  | 1249.561                                                   | -0.408                   |
| Total Weight             | 35.107             |                            |                            | -0.071                                                     | 0.290                                                      |                          |
| Wind 0 deg - Service     |                    | -0.015                     | -9.897                     | -1032.154                                                  | 1.295                                                      | -0.138                   |
| Wind 30 deg - Service    |                    | 4.893                      | -8.564                     | -893.379                                                   | -508.431                                                   | -0.094                   |

|                                                                                                                                                        |         |                                                 |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|---------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page<br>13 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by<br>TJL        |

| Load Case              | Vertical Forces<br>K | Sum of Forces<br>X<br>K | Sum of Forces<br>Z<br>K | Sum of Overturning Moments, $M_x$<br>kip-ft | Sum of Overturning Moments, $M_z$<br>kip-ft | Sum of Torques<br>kip-ft |
|------------------------|----------------------|-------------------------|-------------------------|---------------------------------------------|---------------------------------------------|--------------------------|
| Wind 45 deg - Service  |                      | 6.927                   | -6.988                  | -729.153                                    | -719.670                                    | -0.062                   |
| Wind 60 deg - Service  |                      | 8.490                   | -4.936                  | -515.242                                    | -881.845                                    | -0.025                   |
| Wind 90 deg - Service  |                      | 9.812                   | 0.015                   | 0.934                                       | -1018.891                                   | 0.051                    |
| Wind 120 deg - Service |                      | 8.505                   | 4.962                   | 516.841                                     | -882.849                                    | 0.113                    |
| Wind 135 deg - Service |                      | 6.949                   | 7.009                   | 730.433                                     | -721.090                                    | 0.134                    |
| Wind 150 deg - Service |                      | 4.919                   | 8.579                   | 894.242                                     | -510.170                                    | 0.145                    |
| Wind 180 deg - Service |                      | 0.015                   | 9.897                   | 1032.013                                    | -0.714                                      | 0.138                    |
| Wind 210 deg - Service |                      | -4.893                  | 8.564                   | 893.238                                     | 509.011                                     | 0.094                    |
| Wind 225 deg - Service |                      | -6.927                  | 6.988                   | 729.012                                     | 720.250                                     | 0.062                    |
| Wind 240 deg - Service |                      | -8.490                  | 4.936                   | 515.101                                     | 882.425                                     | 0.025                    |
| Wind 270 deg - Service |                      | -9.812                  | -0.015                  | -1.075                                      | 1019.472                                    | -0.051                   |
| Wind 300 deg - Service |                      | -8.505                  | -4.962                  | -516.982                                    | 883.429                                     | -0.113                   |
| Wind 315 deg - Service |                      | -6.949                  | -7.009                  | -730.574                                    | 721.671                                     | -0.134                   |
| Wind 330 deg - Service |                      | -4.919                  | -8.579                  | -894.383                                    | 510.751                                     | -0.145                   |

## Load Combinations

| Comb. No. | Description                |
|-----------|----------------------------|
| 1         | Dead Only                  |
| 2         | Dead+Wind 0 deg - No Ice   |
| 3         | Dead+Wind 30 deg - No Ice  |
| 4         | Dead+Wind 45 deg - No Ice  |
| 5         | Dead+Wind 60 deg - No Ice  |
| 6         | Dead+Wind 90 deg - No Ice  |
| 7         | Dead+Wind 120 deg - No Ice |
| 8         | Dead+Wind 135 deg - No Ice |
| 9         | Dead+Wind 150 deg - No Ice |
| 10        | Dead+Wind 180 deg - No Ice |
| 11        | Dead+Wind 210 deg - No Ice |
| 12        | Dead+Wind 225 deg - No Ice |
| 13        | Dead+Wind 240 deg - No Ice |
| 14        | Dead+Wind 270 deg - No Ice |
| 15        | Dead+Wind 300 deg - No Ice |
| 16        | Dead+Wind 315 deg - No Ice |
| 17        | Dead+Wind 330 deg - No Ice |
| 18        | Dead+Ice+Temp              |
| 19        | Dead+Wind 0 deg+Ice+Temp   |
| 20        | Dead+Wind 30 deg+Ice+Temp  |
| 21        | Dead+Wind 45 deg+Ice+Temp  |
| 22        | Dead+Wind 60 deg+Ice+Temp  |
| 23        | Dead+Wind 90 deg+Ice+Temp  |
| 24        | Dead+Wind 120 deg+Ice+Temp |
| 25        | Dead+Wind 135 deg+Ice+Temp |
| 26        | Dead+Wind 150 deg+Ice+Temp |
| 27        | Dead+Wind 180 deg+Ice+Temp |
| 28        | Dead+Wind 210 deg+Ice+Temp |
| 29        | Dead+Wind 225 deg+Ice+Temp |
| 30        | Dead+Wind 240 deg+Ice+Temp |
| 31        | Dead+Wind 270 deg+Ice+Temp |
| 32        | Dead+Wind 300 deg+Ice+Temp |
| 33        | Dead+Wind 315 deg+Ice+Temp |
| 34        | Dead+Wind 330 deg+Ice+Temp |
| 35        | Dead+Wind 0 deg - Service  |
| 36        | Dead+Wind 30 deg - Service |
| 37        | Dead+Wind 45 deg - Service |



|                                                                                                                                                        |                                                                   |                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | <b>Job</b><br>12044.CO5 - CT1153                                  | <b>Page</b><br>14 of 28          |
|                                                                                                                                                        | <b>Project</b><br>147' EEI Monopole - 123 Palmer Road Chaplin, CT | <b>Date</b><br>15:56:01 12/10/12 |
|                                                                                                                                                        | <b>Client</b><br>AT&T Mobility                                    | <b>Designed by</b><br>TJL        |

| Comb. No. | Description                 |
|-----------|-----------------------------|
| 38        | Dead+Wind 60 deg - Service  |
| 39        | Dead+Wind 90 deg - Service  |
| 40        | Dead+Wind 120 deg - Service |
| 41        | Dead+Wind 135 deg - Service |
| 42        | Dead+Wind 150 deg - Service |
| 43        | Dead+Wind 180 deg - Service |
| 44        | Dead+Wind 210 deg - Service |
| 45        | Dead+Wind 225 deg - Service |
| 46        | Dead+Wind 240 deg - Service |
| 47        | Dead+Wind 270 deg - Service |
| 48        | Dead+Wind 300 deg - Service |
| 49        | Dead+Wind 315 deg - Service |
| 50        | Dead+Wind 330 deg - Service |

### Maximum Member Forces

| Section No. | Elevation ft   | Component Type | Condition        | Gov. Load Comb. | Force K | Major Axis Moment kip-ft | Minor Axis Moment kip-ft |
|-------------|----------------|----------------|------------------|-----------------|---------|--------------------------|--------------------------|
| L1          | 147 - 94.54    | Pole           | Max Tension      | 1               | 0.000   | 0.000                    | 0.000                    |
|             |                |                | Max. Compression | 18              | -17.254 | 0.000                    | -0.296                   |
|             |                |                | Max. Mx          | 14              | -11.655 | 683.685                  | -0.071                   |
|             |                |                | Max. My          | 10              | -11.614 | -0.001                   | -695.571                 |
|             |                |                | Max. Vy          | 14              | -19.097 | 683.685                  | -0.071                   |
|             |                |                | Max. Vx          | 10              | 19.405  | -0.001                   | -695.571                 |
|             |                |                | Max. Torque      | 14              |         |                          | 0.373                    |
| L2          | 94.54 - 47.917 | Pole           | Max Tension      | 1               | 0.000   | 0.000                    | 0.000                    |
|             |                |                | Max. Compression | 18              | -27.351 | 0.412                    | -0.058                   |
|             |                |                | Max. Mx          | 14              | -20.574 | 1652.953                 | 0.695                    |
|             |                |                | Max. My          | 2               | -20.554 | 0.918                    | 1677.810                 |
|             |                |                | Max. Vy          | 14              | -23.668 | 1652.953                 | 0.695                    |
|             |                |                | Max. Vx          | 2               | -23.924 | 0.918                    | 1677.810                 |
|             |                |                | Max. Torque      | 27              |         |                          | -0.445                   |
| L3          | 47.917 - 1     | Pole           | Max Tension      | 1               | 0.000   | 0.000                    | 0.000                    |
|             |                |                | Max. Compression | 18              | -43.359 | 0.412                    | -0.058                   |
|             |                |                | Max. Mx          | 14              | -35.084 | 3036.027                 | 3.028                    |
|             |                |                | Max. My          | 2               | -35.084 | 3.254                    | 3074.273                 |
|             |                |                | Max. Vy          | 14              | -28.382 | 3036.027                 | 3.028                    |
|             |                |                | Max. Vx          | 2               | -28.629 | 3.254                    | 3074.273                 |
|             |                |                | Max. Torque      | 27              |         |                          | -0.445                   |

### Maximum Reactions

| Location | Condition           | Gov. Load Comb. | Vertical K | Horizontal, X K | Horizontal, Z K |
|----------|---------------------|-----------------|------------|-----------------|-----------------|
| Pole     | Max. Vert           | 18              | 43.359     | 0.000           | -0.000          |
|          | Max. H <sub>x</sub> | 14              | 35.107     | 28.354          | 0.044           |
|          | Max. H <sub>z</sub> | 2               | 35.107     | 0.044           | 28.601          |
|          | Max. M <sub>x</sub> | 2               | 3074.273   | 0.044           | 28.601          |
|          | Max. M <sub>z</sub> | 6               | 3035.429   | -28.354         | -0.044          |
|          | Max. Torsion        | 19              | 0.444      | 0.040           | 24.708          |
|          | Min. Vert           | 10              | 35.107     | -0.044          | -28.601         |
|          | Min. H <sub>x</sub> | 6               | 35.107     | -28.354         | -0.044          |
|          | Min. H <sub>z</sub> | 10              | 35.107     | -0.044          | -28.601         |



|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 15 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Location | Condition    | Gov.<br>Load<br>Comb. | Vertical<br>K | Horizontal, X<br>K | Horizontal, Z<br>K |
|----------|--------------|-----------------------|---------------|--------------------|--------------------|
|          | Min. $M_x$   | 10                    | -3074.131     | -0.044             | -28.601            |
|          | Min. $M_z$   | 14                    | -3036.027     | 28.354             | 0.044              |
|          | Min. Torsion | 27                    | -0.444        | -0.040             | -24.708            |

## Tower Mast Reaction Summary

| Load<br>Combination         | Vertical<br>K | Shear <sub>x</sub><br>K | Shear <sub>z</sub><br>K | Overturing<br>Moment, $M_x$<br>kip-ft | Overturing<br>Moment, $M_z$<br>kip-ft | Torque<br>kip-ft |
|-----------------------------|---------------|-------------------------|-------------------------|---------------------------------------|---------------------------------------|------------------|
| Dead Only                   | 35.107        | -0.000                  | 0.000                   | -0.071                                | 0.290                                 | 0.000            |
| Dead+Wind 0 deg - No Ice    | 35.107        | -0.044                  | -28.601                 | -3074.273                             | 3.254                                 | -0.394           |
| Dead+Wind 30 deg - No Ice   | 35.107        | 14.140                  | -24.749                 | -2661.156                             | -1515.073                             | -0.263           |
| Dead+Wind 45 deg - No Ice   | 35.107        | 20.020                  | -20.194                 | -2171.977                             | -2144.312                             | -0.170           |
| Dead+Wind 60 deg - No Ice   | 35.107        | 24.535                  | -14.264                 | -1534.775                             | -2627.410                             | -0.067           |
| Dead+Wind 90 deg - No Ice   | 35.107        | 28.354                  | 0.044                   | 2.883                                 | -3035.429                             | 0.142            |
| Dead+Wind 120 deg - No Ice  | 35.107        | 24.579                  | 14.339                  | 1539.746                              | -2630.362                             | 0.314            |
| Dead+Wind 135 deg - No Ice  | 35.107        | 20.082                  | 20.256                  | 2176.008                              | -2148.489                             | 0.372            |
| Dead+Wind 150 deg - No Ice  | 35.107        | 14.216                  | 24.792                  | 2663.963                              | -1520.190                             | 0.406            |
| Dead+Wind 180 deg - No Ice  | 35.107        | 0.044                   | 28.601                  | 3074.131                              | -2.656                                | 0.395            |
| Dead+Wind 210 deg - No Ice  | 35.107        | -14.140                 | 24.749                  | 2661.014                              | 1515.673                              | 0.277            |
| Dead+Wind 225 deg - No Ice  | 35.107        | -20.020                 | 20.194                  | 2171.834                              | 2144.912                              | 0.186            |
| Dead+Wind 240 deg - No Ice  | 35.107        | -24.535                 | 14.264                  | 1534.631                              | 2628.010                              | 0.080            |
| Dead+Wind 270 deg - No Ice  | 35.107        | -28.354                 | -0.044                  | -3.028                                | 3036.027                              | -0.143           |
| Dead+Wind 300 deg - No Ice  | 35.107        | -24.579                 | -14.339                 | -1539.891                             | 2630.959                              | -0.328           |
| Dead+Wind 315 deg - No Ice  | 35.107        | -20.082                 | -20.256                 | -2176.152                             | 2149.085                              | -0.388           |
| Dead+Wind 330 deg - No Ice  | 35.107        | -14.216                 | -24.792                 | -2664.107                             | 1520.787                              | -0.419           |
| Dead+Ice+Temp               | 43.359        | -0.000                  | 0.000                   | 0.058                                 | 0.412                                 | 0.000            |
| Dead+Wind 0 deg+Ice+Temp    | 43.359        | -0.040                  | -24.708                 | -2625.988                             | 3.154                                 | -0.444           |
| Dead+Wind 30 deg+Ice+Temp   | 43.359        | 12.229                  | -21.379                 | -2272.894                             | -1295.466                             | -0.365           |
| Dead+Wind 45 deg+Ice+Temp   | 43.359        | 17.314                  | -17.444                 | -1854.995                             | -1833.666                             | -0.288           |
| Dead+Wind 60 deg+Ice+Temp   | 43.359        | 21.220                  | -12.320                 | -1310.671                             | -2246.881                             | -0.193           |
| Dead+Wind 90 deg+Ice+Temp   | 43.359        | 24.526                  | 0.040                   | 2.793                                 | -2596.042                             | 0.029            |
| Dead+Wind 120 deg+Ice+Temp  | 43.359        | 21.260                  | 12.389                  | 1315.525                              | -2249.602                             | 0.243            |
| Dead+Wind 135 deg+Ice+Temp  | 43.359        | 17.371                  | 17.500                  | 1858.983                              | -1837.515                             | 0.329            |
| Dead+Wind 150 deg+Ice+Temp  | 43.359        | 12.298                  | 21.419                  | 2275.752                              | -1300.183                             | 0.395            |
| Dead+Wind 180 deg+Ice+Temp  | 43.359        | 0.040                   | 24.708                  | 2626.126                              | -2.295                                | 0.444            |
| Dead+Wind 210 deg+Ice+Temp  | 43.359        | -12.229                 | 21.379                  | 2273.032                              | 1296.326                              | 0.374            |
| Dead+Wind 225 deg+Ice+Temp  | 43.359        | -17.314                 | 17.444                  | 1855.134                              | 1834.526                              | 0.298            |
| Dead+Wind 240 deg+Ice+Temp  | 43.359        | -21.220                 | 12.320                  | 1310.809                              | 2247.741                              | 0.201            |
| Dead+Wind 270 deg+Ice+Temp  | 43.359        | -24.526                 | -0.040                  | -2.656                                | 2596.903                              | -0.029           |
| Dead+Wind 300 deg+Ice+Temp  | 43.359        | -21.260                 | -12.389                 | -1315.389                             | 2250.462                              | -0.252           |
| Dead+Wind 315 deg+Ice+Temp  | 43.359        | -17.371                 | -17.500                 | -1858.846                             | 1838.375                              | -0.339           |
| Dead+Wind 330 deg+Ice+Temp  | 43.359        | -12.298                 | -21.419                 | -2275.615                             | 1301.042                              | -0.403           |
| Dead+Wind 0 deg - Service   | 35.107        | -0.015                  | -9.896                  | -1065.074                             | 1.323                                 | -0.137           |
| Dead+Wind 30 deg - Service  | 35.107        | 4.893                   | -8.563                  | -921.880                              | -524.629                              | -0.093           |
| Dead+Wind 45 deg - Service  | 35.107        | 6.927                   | -6.987                  | -752.420                              | -742.592                              | -0.060           |
| Dead+Wind 60 deg - Service  | 35.107        | 8.489                   | -4.935                  | -531.689                              | -909.929                              | -0.024           |
| Dead+Wind 90 deg - Service  | 35.107        | 9.811                   | 0.015                   | 0.952                                 | -1051.334                             | 0.050            |
| Dead+Wind 120 deg - Service | 35.107        | 8.504                   | 4.961                   | 533.319                               | -910.952                              | 0.111            |
| Dead+Wind 135 deg - Service | 35.107        | 6.948                   | 7.008                   | 753.725                               | -744.039                              | 0.131            |
| Dead+Wind 150 deg - Service | 35.107        | 4.919                   | 8.578                   | 922.762                               | -526.401                              | 0.143            |
| Dead+Wind 180 deg - Service | 35.107        | 0.015                   | 9.896                   | 1064.933                              | -0.723                                | 0.137            |
| Dead+Wind 210 deg - Service | 35.107        | -4.893                  | 8.563                   | 921.739                               | 525.230                               | 0.094            |
| Dead+Wind 225 deg - Service | 35.107        | -6.927                  | 6.987                   | 752.279                               | 743.193                               | 0.062            |
| Dead+Wind 240 deg - Service | 35.107        | -8.489                  | 4.935                   | 531.547                               | 910.530                               | 0.026            |
| Dead+Wind 270 deg - Service | 35.107        | -9.811                  | -0.015                  | -1.094                                | 1051.934                              | -0.050           |
| Dead+Wind 300 deg - Service | 35.107        | -8.504                  | -4.961                  | -533.460                              | 911.552                               | -0.113           |

|                                                                                                                                                        |         |                                                 |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|---------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page<br>16 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by<br>TJL        |

| Load<br>Combination          | Vertical<br>K | Shear <sub>x</sub><br>K | Shear <sub>y</sub><br>K | Overturning<br>Moment, M <sub>x</sub><br>kip-ft | Overturning<br>Moment, M <sub>y</sub><br>kip-ft | Torque<br>kip-ft |
|------------------------------|---------------|-------------------------|-------------------------|-------------------------------------------------|-------------------------------------------------|------------------|
| Dead+ Wind 315 deg - Service | 35.107        | -6.948                  | -7.008                  | -753.867                                        | 744.639                                         | -0.133           |
| Dead+ Wind 330 deg - Service | 35.107        | -4.919                  | -8.578                  | -922.903                                        | 527.001                                         | -0.145           |

## Solution Summary

| Load<br>Comb. | Sum of Applied Forces |         |         | Sum of Reactions |         |         | % Error |
|---------------|-----------------------|---------|---------|------------------|---------|---------|---------|
|               | PX<br>K               | PY<br>K | PZ<br>K | PX<br>K          | PY<br>K | PZ<br>K |         |
| 1             | 0.000                 | -35.107 | 0.000   | 0.000            | 35.107  | 0.000   | 0.000%  |
| 2             | -0.044                | -35.107 | -28.603 | 0.044            | 35.107  | 28.601  | 0.004%  |
| 3             | 14.140                | -35.107 | -24.749 | -14.140          | 35.107  | 24.749  | 0.000%  |
| 4             | 20.020                | -35.107 | -20.194 | -20.020          | 35.107  | 20.194  | 0.000%  |
| 5             | 24.536                | -35.107 | -14.264 | -24.535          | 35.107  | 14.264  | 0.000%  |
| 6             | 28.356                | -35.107 | 0.044   | -28.354          | 35.107  | -0.044  | 0.004%  |
| 7             | 24.579                | -35.107 | 14.339  | -24.579          | 35.107  | -14.339 | 0.000%  |
| 8             | 20.082                | -35.107 | 20.256  | -20.082          | 35.107  | -20.256 | 0.000%  |
| 9             | 14.216                | -35.107 | 24.792  | -14.216          | 35.107  | -24.792 | 0.000%  |
| 10            | 0.044                 | -35.107 | 28.603  | -0.044           | 35.107  | -28.601 | 0.004%  |
| 11            | -14.140               | -35.107 | 24.749  | 14.140           | 35.107  | -24.749 | 0.000%  |
| 12            | -20.020               | -35.107 | 20.194  | 20.020           | 35.107  | -20.194 | 0.000%  |
| 13            | -24.536               | -35.107 | 14.264  | 24.535           | 35.107  | -14.264 | 0.000%  |
| 14            | -28.356               | -35.107 | -0.044  | 28.354           | 35.107  | 0.044   | 0.004%  |
| 15            | -24.579               | -35.107 | -14.339 | 24.579           | 35.107  | 14.339  | 0.000%  |
| 16            | -20.082               | -35.107 | -20.256 | 20.082           | 35.107  | 20.256  | 0.000%  |
| 17            | -14.216               | -35.107 | -24.792 | 14.216           | 35.107  | 24.792  | 0.000%  |
| 18            | 0.000                 | -43.359 | 0.000   | 0.000            | 43.359  | -0.000  | 0.000%  |
| 19            | -0.040                | -43.359 | -24.709 | 0.040            | 43.359  | 24.708  | 0.001%  |
| 20            | 12.229                | -43.359 | -21.379 | -12.229          | 43.359  | 21.379  | 0.000%  |
| 21            | 17.314                | -43.359 | -17.444 | -17.314          | 43.359  | 17.444  | 0.000%  |
| 22            | 21.220                | -43.359 | -12.320 | -21.220          | 43.359  | 12.320  | 0.000%  |
| 23            | 24.526                | -43.359 | 0.040   | -24.526          | 43.359  | -0.040  | 0.001%  |
| 24            | 21.260                | -43.359 | 12.389  | -21.260          | 43.359  | -12.389 | 0.000%  |
| 25            | 17.371                | -43.359 | 17.500  | -17.371          | 43.359  | -17.500 | 0.000%  |
| 26            | 12.298                | -43.359 | 21.419  | -12.298          | 43.359  | -21.419 | 0.000%  |
| 27            | 0.040                 | -43.359 | 24.709  | -0.040           | 43.359  | -24.708 | 0.001%  |
| 28            | -12.229               | -43.359 | 21.379  | 12.229           | 43.359  | -21.379 | 0.000%  |
| 29            | -17.314               | -43.359 | 17.444  | 17.314           | 43.359  | -17.444 | 0.000%  |
| 30            | -21.220               | -43.359 | 12.320  | 21.220           | 43.359  | -12.320 | 0.000%  |
| 31            | -24.526               | -43.359 | -0.040  | 24.526           | 43.359  | 0.040   | 0.001%  |
| 32            | -21.260               | -43.359 | -12.389 | 21.260           | 43.359  | 12.389  | 0.000%  |
| 33            | -17.371               | -43.359 | -17.500 | 17.371           | 43.359  | 17.500  | 0.000%  |
| 34            | -12.298               | -43.359 | -21.419 | 12.298           | 43.359  | 21.419  | 0.000%  |
| 35            | -0.015                | -35.107 | -9.897  | 0.015            | 35.107  | 9.896   | 0.002%  |
| 36            | 4.893                 | -35.107 | -8.564  | -4.893           | 35.107  | 8.563   | 0.002%  |
| 37            | 6.927                 | -35.107 | -6.988  | -6.927           | 35.107  | 6.987   | 0.002%  |
| 38            | 8.490                 | -35.107 | -4.936  | -8.489           | 35.107  | 4.935   | 0.002%  |
| 39            | 9.812                 | -35.107 | 0.015   | -9.811           | 35.107  | -0.015  | 0.002%  |
| 40            | 8.505                 | -35.107 | 4.962   | -8.504           | 35.107  | -4.961  | 0.002%  |
| 41            | 6.949                 | -35.107 | 7.009   | -6.948           | 35.107  | -7.008  | 0.002%  |
| 42            | 4.919                 | -35.107 | 8.579   | -4.919           | 35.107  | -8.578  | 0.002%  |
| 43            | 0.015                 | -35.107 | 9.897   | -0.015           | 35.107  | -9.896  | 0.002%  |
| 44            | -4.893                | -35.107 | 8.564   | 4.893            | 35.107  | -8.563  | 0.002%  |
| 45            | -6.927                | -35.107 | 6.988   | 6.927            | 35.107  | -6.987  | 0.002%  |
| 46            | -8.490                | -35.107 | 4.936   | 8.489            | 35.107  | -4.935  | 0.002%  |
| 47            | -9.812                | -35.107 | -0.015  | 9.811            | 35.107  | 0.015   | 0.002%  |
| 48            | -8.505                | -35.107 | -4.962  | 8.504            | 35.107  | 4.961   | 0.002%  |
| 49            | -6.949                | -35.107 | -7.009  | 6.948            | 35.107  | 7.008   | 0.002%  |
| 50            | -4.919                | -35.107 | -8.579  | 4.919            | 35.107  | 8.578   | 0.002%  |



|                                                                                                                                                        |         |                                                 |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|---------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page<br>17 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by<br>TJL        |

## Non-Linear Convergence Results

| Load<br>Combination | Converged? | Number<br>of Cycles | Displacement<br>Tolerance | Force<br>Tolerance |
|---------------------|------------|---------------------|---------------------------|--------------------|
| 1                   | Yes        | 6                   | 0.00000001                | 0.00000001         |
| 2                   | Yes        | 12                  | 0.00005063                | 0.00010268         |
| 3                   | Yes        | 15                  | 0.00000001                | 0.00006380         |
| 4                   | Yes        | 15                  | 0.00000001                | 0.00007278         |
| 5                   | Yes        | 15                  | 0.00000001                | 0.00006339         |
| 6                   | Yes        | 12                  | 0.00005072                | 0.00010226         |
| 7                   | Yes        | 15                  | 0.00000001                | 0.00006401         |
| 8                   | Yes        | 15                  | 0.00000001                | 0.00007288         |
| 9                   | Yes        | 15                  | 0.00000001                | 0.00006363         |
| 10                  | Yes        | 12                  | 0.00005062                | 0.00010218         |
| 11                  | Yes        | 15                  | 0.00000001                | 0.00006392         |
| 12                  | Yes        | 15                  | 0.00000001                | 0.00007281         |
| 13                  | Yes        | 15                  | 0.00000001                | 0.00006370         |
| 14                  | Yes        | 12                  | 0.00005072                | 0.00010172         |
| 15                  | Yes        | 15                  | 0.00000001                | 0.00006332         |
| 16                  | Yes        | 15                  | 0.00000001                | 0.00007293         |
| 17                  | Yes        | 15                  | 0.00000001                | 0.00006435         |
| 18                  | Yes        | 6                   | 0.00000001                | 0.00000001         |
| 19                  | Yes        | 13                  | 0.00000001                | 0.00012962         |
| 20                  | Yes        | 15                  | 0.00000001                | 0.00006991         |
| 21                  | Yes        | 15                  | 0.00000001                | 0.00007989         |
| 22                  | Yes        | 15                  | 0.00000001                | 0.00006977         |
| 23                  | Yes        | 13                  | 0.00000001                | 0.00012837         |
| 24                  | Yes        | 15                  | 0.00000001                | 0.00007026         |
| 25                  | Yes        | 15                  | 0.00000001                | 0.00008007         |
| 26                  | Yes        | 15                  | 0.00000001                | 0.00006993         |
| 27                  | Yes        | 13                  | 0.00000001                | 0.00012959         |
| 28                  | Yes        | 15                  | 0.00000001                | 0.00007025         |
| 29                  | Yes        | 15                  | 0.00000001                | 0.00007999         |
| 30                  | Yes        | 15                  | 0.00000001                | 0.00006991         |
| 31                  | Yes        | 13                  | 0.00000001                | 0.00012837         |
| 32                  | Yes        | 15                  | 0.00000001                | 0.00006973         |
| 33                  | Yes        | 15                  | 0.00000001                | 0.00008010         |
| 34                  | Yes        | 15                  | 0.00000001                | 0.00007055         |
| 35                  | Yes        | 12                  | 0.00000001                | 0.00004957         |
| 36                  | Yes        | 12                  | 0.00000001                | 0.00007807         |
| 37                  | Yes        | 12                  | 0.00000001                | 0.00008504         |
| 38                  | Yes        | 12                  | 0.00000001                | 0.00007648         |
| 39                  | Yes        | 12                  | 0.00000001                | 0.00004892         |
| 40                  | Yes        | 12                  | 0.00000001                | 0.00007906         |
| 41                  | Yes        | 12                  | 0.00000001                | 0.00008525         |
| 42                  | Yes        | 12                  | 0.00000001                | 0.00007690         |
| 43                  | Yes        | 12                  | 0.00000001                | 0.00004956         |
| 44                  | Yes        | 12                  | 0.00000001                | 0.00007861         |
| 45                  | Yes        | 12                  | 0.00000001                | 0.00008516         |
| 46                  | Yes        | 12                  | 0.00000001                | 0.00007793         |
| 47                  | Yes        | 12                  | 0.00000001                | 0.00004894         |
| 48                  | Yes        | 12                  | 0.00000001                | 0.00007579         |
| 49                  | Yes        | 12                  | 0.00000001                | 0.00008545         |
| 50                  | Yes        | 12                  | 0.00000001                | 0.00008022         |



|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 18 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

### Maximum Tower Deflections - Service Wind

| Section No. | Elevation<br>ft | Horz.<br>Deflection<br>in | Gov.<br>Load<br>Comb. | Tilt<br>° | Twist<br>° |
|-------------|-----------------|---------------------------|-----------------------|-----------|------------|
| L1          | 147 - 94.54     | 30.847                    | 43                    | 1.890     | 0.001      |
| L2          | 99.457 - 47.917 | 13.891                    | 35                    | 1.380     | 0.000      |
| L3          | 54.084 - 1      | 3.907                     | 35                    | 0.681     | 0.000      |

### Critical Deflections and Radius of Curvature - Service Wind

| Elevation<br>ft | Appurtenance                       | Gov.<br>Load<br>Comb. | Deflection<br>in | Tilt<br>° | Twist<br>° | Radius of<br>Curvature<br>ft |
|-----------------|------------------------------------|-----------------------|------------------|-----------|------------|------------------------------|
| 149.000         | LPA-80063/6CF                      | 43                    | 30.847           | 1.890     | 0.001      | 32464                        |
| 147.000         | EEI 14-ft Low Profile Platform     | 43                    | 30.847           | 1.890     | 0.001      | 32464                        |
| 138.000         | (2) DB950F85E-M                    | 43                    | 27.395           | 1.806     | 0.001      | 18036                        |
| 137.000         | EEI 12-ft Low Profile Platform     | 43                    | 27.014           | 1.797     | 0.001      | 16232                        |
| 128.000         | (2) 7770.00                        | 43                    | 23.625           | 1.709     | 0.001      | 8542                         |
| 127.000         | EEI 12-ft Low Profile Platform     | 43                    | 23.255           | 1.699     | 0.001      | 8115                         |
| 118.000         | RR90-17-02DP                       | 43                    | 19.996           | 1.605     | 0.001      | 5596                         |
| 117.000         | Andrew 12'-6" Low Profile Platform | 35                    | 19.643           | 1.594     | 0.001      | 5409                         |
| 74.000          | GPS                                | 35                    | 7.380            | 0.994     | 0.000      | 3341                         |
| 73.500          | 4-ft Standoff                      | 35                    | 7.275            | 0.986     | 0.000      | 3339                         |
| 62.000          | GPS                                | 35                    | 5.115            | 0.803     | 0.000      | 3308                         |
| 61.500          | 4-ft Standoff                      | 35                    | 5.032            | 0.795     | 0.000      | 3307                         |

### Maximum Tower Deflections - Design Wind

| Section No. | Elevation<br>ft | Horz.<br>Deflection<br>in | Gov.<br>Load<br>Comb. | Tilt<br>° | Twist<br>° |
|-------------|-----------------|---------------------------|-----------------------|-----------|------------|
| L1          | 147 - 94.54     | 88.897                    | 10                    | 5.449     | 0.003      |
| L2          | 99.457 - 47.917 | 40.061                    | 2                     | 3.980     | 0.001      |
| L3          | 54.084 - 1      | 11.272                    | 2                     | 1.965     | 0.000      |

### Critical Deflections and Radius of Curvature - Design Wind

| Elevation<br>ft | Appurtenance                       | Gov.<br>Load<br>Comb. | Deflection<br>in | Tilt<br>° | Twist<br>° | Radius of<br>Curvature<br>ft |
|-----------------|------------------------------------|-----------------------|------------------|-----------|------------|------------------------------|
| 149.000         | LPA-80063/6CF                      | 10                    | 88.897           | 5.449     | 0.003      | 11431                        |
| 147.000         | EEI 14-ft Low Profile Platform     | 10                    | 88.897           | 5.449     | 0.003      | 11431                        |
| 138.000         | (2) DB950F85E-M                    | 10                    | 78.957           | 5.207     | 0.002      | 6350                         |
| 137.000         | EEI 12-ft Low Profile Platform     | 10                    | 77.859           | 5.179     | 0.002      | 5714                         |
| 128.000         | (2) 7770.00                        | 10                    | 68.101           | 4.928     | 0.002      | 3006                         |
| 127.000         | EEI 12-ft Low Profile Platform     | 10                    | 67.034           | 4.899     | 0.002      | 2855                         |
| 118.000         | RR90-17-02DP                       | 2                     | 57.649           | 4.628     | 0.002      | 1967                         |
| 117.000         | Andrew 12'-6" Low Profile Platform | 2                     | 56.634           | 4.597     | 0.002      | 1901                         |
| 74.000          | GPS                                | 2                     | 21.291           | 2.867     | 0.001      | 1164                         |
| 73.500          | 4-ft Standoff                      | 2                     | 20.989           | 2.844     | 0.001      | 1164                         |

|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 19 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Elevation | Appurtenance  | Gov. Load | Deflection | Tilt  | Twist | Radius of Curvature |
|-----------|---------------|-----------|------------|-------|-------|---------------------|
| ft        |               | Comb.     | in         | °     | °     | ft                  |
| 62.000    | GPS           | 2         | 14.758     | 2.316 | 0.001 | 1150                |
| 61.500    | 4-ft Standoff | 2         | 14.519     | 2.293 | 0.001 | 1150                |

## Compression Checks

## Pole Design Data

| Section No. | Elevation         | Size                | L      | L <sub>u</sub> | Kl/r | F <sub>a</sub> | A               | Actual P | Allow. P <sub>a</sub> | Ratio P/P <sub>a</sub> |
|-------------|-------------------|---------------------|--------|----------------|------|----------------|-----------------|----------|-----------------------|------------------------|
|             | ft                |                     | ft     | ft             |      | ksi            | in <sup>2</sup> | K        | K                     |                        |
| L1          | 147 - 144.498     | TP35.13x23.5x0.25   | 52.460 | 0.000          | 0.0  | 39.000         | 18.889          | -1.560   | 736.673               | 0.002                  |
|             | 144.498 - 141.995 |                     |        |                |      | 39.000         | 19.329          | -1.791   | 753.840               | 0.002                  |
|             | 141.995 - 139.493 |                     |        |                |      | 39.000         | 19.769          | -2.028   | 771.007               | 0.003                  |
|             | 139.493 - 136.991 |                     |        |                |      | 39.000         | 20.210          | -3.660   | 788.174               | 0.005                  |
|             | 136.991 - 134.489 |                     |        |                |      | 39.000         | 20.650          | -3.910   | 805.341               | 0.005                  |
|             | 134.489 - 131.986 |                     |        |                |      | 39.000         | 21.090          | -4.166   | 822.509               | 0.005                  |
|             | 131.986 - 129.484 |                     |        |                |      | 39.000         | 21.530          | -4.427   | 839.676               | 0.005                  |
|             | 129.484 - 126.982 |                     |        |                |      | 39.000         | 21.970          | -6.909   | 856.843               | 0.008                  |
|             | 126.982 - 124.48  |                     |        |                |      | 39.000         | 22.410          | -7.185   | 874.010               | 0.008                  |
|             | 124.48 - 121.977  |                     |        |                |      | 39.000         | 22.851          | -7.468   | 891.177               | 0.008                  |
|             | 121.977 - 119.475 |                     |        |                |      | 39.000         | 23.291          | -7.758   | 908.344               | 0.009                  |
|             | 119.475 - 116.973 |                     |        |                |      | 39.000         | 23.731          | -9.364   | 925.511               | 0.010                  |
|             | 116.973 - 114.471 |                     |        |                |      | 39.000         | 24.171          | -9.667   | 942.678               | 0.010                  |
|             | 114.471 - 111.968 |                     |        |                |      | 39.000         | 24.611          | -9.977   | 959.845               | 0.010                  |
|             | 111.968 - 109.466 |                     |        |                |      | 39.000         | 25.052          | -10.293  | 977.012               | 0.011                  |
|             | 109.466 - 106.964 |                     |        |                |      | 39.000         | 25.492          | -10.615  | 994.179               | 0.011                  |
|             | 106.964 - 104.462 |                     |        |                |      | 39.000         | 25.932          | -10.942  | 1011.350              | 0.011                  |
|             | 104.462 - 101.959 |                     |        |                |      | 39.000         | 26.372          | -11.275  | 1028.510              | 0.011                  |
|             | 101.959 - 99.457  |                     |        |                |      | 39.000         | 26.812          | -11.614  | 1045.680              | 0.011                  |
|             | 99.457 - 94.54    |                     |        |                |      | 39.000         | 27.677          | -5.784   | 1079.410              | 0.005                  |
| L2          | 94.54 - 92.2924   | TP44.85x33.54x0.313 | 51.540 | 0.000          | 0.0  | 39.000         | 34.028          | -7.025   | 1327.080              | 0.005                  |
|             | 92.2924 - 90.0449 |                     |        |                |      | 39.000         | 34.517          | -13.198  | 1346.160              | 0.010                  |
|             | 90.0449 - 87.7973 |                     |        |                |      | 39.000         | 35.006          | -13.589  | 1365.240              | 0.010                  |
|             |                   |                     |        |                |      | 39.000         | 35.495          | -13.984  | 1384.320              | 0.010                  |
|             |                   |                     |        |                |      |                |                 |          |                       |                        |

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| Section No. | Elevation         | Size                | L      | L <sub>u</sub> | Kl/r | F <sub>a</sub> | A               | Actual P | Allow. P <sub>a</sub> | Ratio P        |
|-------------|-------------------|---------------------|--------|----------------|------|----------------|-----------------|----------|-----------------------|----------------|
|             | ft                |                     | ft     | ft             |      | ksi            | in <sup>2</sup> | K        | K                     | P <sub>a</sub> |
|             | 87.7973 - 85.5498 |                     |        |                |      | 39.000         | 35.985          | -14.384  | 1403.400              | 0.010          |
|             | 85.5498 - 83.3022 |                     |        |                |      | 39.000         | 36.474          | -14.789  | 1422.470              | 0.010          |
|             | 83.3022 - 81.0547 |                     |        |                |      | 39.000         | 36.963          | -15.199  | 1441.550              | 0.011          |
|             | 81.0547 - 78.8071 |                     |        |                |      | 39.000         | 37.452          | -15.614  | 1460.630              | 0.011          |
|             | 78.8071 - 76.5596 |                     |        |                |      | 39.000         | 37.941          | -16.033  | 1479.710              | 0.011          |
|             | 76.5596 - 74.312  |                     |        |                |      | 39.000         | 38.431          | -16.457  | 1498.790              | 0.011          |
|             | 74.312 - 72.0644  |                     |        |                |      | 39.000         | 38.920          | -16.922  | 1517.870              | 0.011          |
|             | 72.0644 - 69.8169 |                     |        |                |      | 39.000         | 39.409          | -17.356  | 1536.950              | 0.011          |
|             | 69.8169 - 67.5693 |                     |        |                |      | 39.000         | 39.898          | -17.794  | 1556.030              | 0.011          |
|             | 67.5693 - 65.3218 |                     |        |                |      | 39.000         | 40.387          | -18.236  | 1575.110              | 0.012          |
|             | 65.3218 - 63.0742 |                     |        |                |      | 39.000         | 40.876          | -18.683  | 1594.180              | 0.012          |
|             | 63.0742 - 60.8267 |                     |        |                |      | 39.000         | 41.366          | -19.172  | 1613.260              | 0.012          |
|             | 60.8267 - 58.5791 |                     |        |                |      | 39.000         | 41.855          | -19.628  | 1632.340              | 0.012          |
|             | 58.5791 - 56.3316 |                     |        |                |      | 39.000         | 42.344          | -20.089  | 1651.420              | 0.012          |
|             | 56.3316 - 54.084  |                     |        |                |      | 39.000         | 42.833          | -20.554  | 1670.500              | 0.012          |
| L3          | 54.084 - 47.917   | TP54.5x42.872x0.375 | 53.084 | 0.000          | 0.0  | 39.000         | 44.176          | -10.551  | 1722.850              | 0.006          |
|             | 47.917 - 45.4477  |                     |        |                |      | 39.000         | 52.190          | -12.307  | 2035.400              | 0.006          |
|             | 45.4477 - 42.9784 |                     |        |                |      | 39.000         | 52.833          | -23.455  | 2060.500              | 0.011          |
|             | 42.9784 - 40.5091 |                     |        |                |      | 39.000         | 53.477          | -24.051  | 2085.610              | 0.012          |
|             | 40.5091 - 38.0397 |                     |        |                |      | 39.000         | 54.121          | -24.652  | 2110.720              | 0.012          |
|             | 38.0397 - 35.5704 |                     |        |                |      | 39.000         | 54.765          | -25.260  | 2135.830              | 0.012          |
|             | 35.5704 - 33.1011 |                     |        |                |      | 39.000         | 55.409          | -25.874  | 2160.940              | 0.012          |
|             | 33.1011 - 30.6318 |                     |        |                |      | 39.000         | 56.053          | -26.493  | 2186.050              | 0.012          |
|             | 30.6318 - 28.1625 |                     |        |                |      | 39.000         | 56.696          | -27.119  | 2211.160              | 0.012          |
|             | 28.1625 - 25.6932 |                     |        |                |      | 39.000         | 57.340          | -27.750  | 2236.270              | 0.012          |
|             | 25.6932 - 23.2238 |                     |        |                |      | 39.000         | 57.984          | -28.387  | 2261.380              | 0.013          |
|             | 23.2238 - 20.7545 |                     |        |                |      | 39.000         | 58.628          | -29.030  | 2286.490              | 0.013          |
|             | 20.7545 - 18.2852 |                     |        |                |      | 39.000         | 59.272          | -29.680  | 2311.600              | 0.013          |
|             | 18.2852 - 15.8159 |                     |        |                |      | 39.000         | 59.916          | -30.334  | 2336.710              | 0.013          |
|             | 15.8159 - 13.3466 |                     |        |                |      | 39.000         | 60.559          | -30.995  | 2361.810              | 0.013          |
|             |                   |                     |        |                |      | 39.000         | 61.203          | -31.662  | 2386.920              | 0.013          |



|                                                                                                                                                        |                                                            |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job                                                        | Page                      |
|                                                                                                                                                        | 12044.CO5 - CT1153                                         | 21 of 28                  |
|                                                                                                                                                        | Project<br>147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client<br>AT&T Mobility                                    | Designed by<br>TJL        |

| Section No. | Elevation<br>ft   | Size | L<br>ft | L <sub>u</sub><br>ft | KI/r | F <sub>a</sub><br>ksi | A<br>in <sup>2</sup> | Actual<br>P<br>K | Allow.<br>P <sub>a</sub><br>K | Ratio<br>P<br>P <sub>a</sub> |
|-------------|-------------------|------|---------|----------------------|------|-----------------------|----------------------|------------------|-------------------------------|------------------------------|
|             | 13.3466 - 10.8773 |      |         |                      |      | 39.000                | 61.847               | -32.335          | 2412.030                      | 0.013                        |
|             | 10.8773 - 8.40795 |      |         |                      |      | 39.000                | 62.491               | -33.013          | 2437.140                      | 0.014                        |
|             | 8.40795 - 5.93863 |      |         |                      |      | 39.000                | 63.135               | -33.697          | 2462.250                      | 0.014                        |
|             | 5.93863 - 3.46932 |      |         |                      |      | 39.000                | 63.778               | -34.388          | 2487.360                      | 0.014                        |
|             | 3.46932 - 1       |      |         |                      |      | 39.000                | 64.422               | -35.084          | 2512.470                      | 0.014                        |

### Pole Bending Design Data

| Section No. | Elevation<br>ft   | Size                | Actual<br>M <sub>x</sub><br>kip-ft | Actual<br>f <sub>bx</sub><br>ksi | Allow.<br>F <sub>bx</sub><br>ksi | Ratio<br>f <sub>bx</sub><br>F <sub>bx</sub> | Actual<br>M <sub>y</sub><br>kip-ft | Actual<br>f <sub>by</sub><br>ksi | Allow.<br>F <sub>by</sub><br>ksi | Ratio<br>f <sub>by</sub><br>F <sub>by</sub> |
|-------------|-------------------|---------------------|------------------------------------|----------------------------------|----------------------------------|---------------------------------------------|------------------------------------|----------------------------------|----------------------------------|---------------------------------------------|
| L1          | 147 - 144.498     | TP35.13x23.5x0.25   | 32.371                             | 3.510                            | 39.000                           | 0.090                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 144.498 - 141.995 |                     | 52.029                             | 5.386                            | 39.000                           | 0.138                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 141.995 - 139.493 |                     | 72.194                             | 7.143                            | 39.000                           | 0.183                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 139.493 - 136.991 |                     | 94.289                             | 8.926                            | 39.000                           | 0.229                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 136.991 - 134.489 |                     | 120.929                            | 10.962                           | 39.000                           | 0.281                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 134.489 - 131.986 |                     | 148.093                            | 12.868                           | 39.000                           | 0.330                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 131.986 - 129.484 |                     | 175.787                            | 14.653                           | 39.000                           | 0.376                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 129.484 - 126.982 |                     | 207.617                            | 16.617                           | 39.000                           | 0.426                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 126.982 - 124.48  |                     | 247.162                            | 19.009                           | 39.000                           | 0.487                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 124.48 - 121.977  |                     | 287.247                            | 21.245                           | 39.000                           | 0.545                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 121.977 - 119.475 |                     | 327.873                            | 23.339                           | 39.000                           | 0.598                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 119.475 - 116.973 |                     | 369.601                            | 25.338                           | 39.000                           | 0.650                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 116.973 - 114.471 |                     | 414.509                            | 27.387                           | 39.000                           | 0.702                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 114.471 - 111.968 |                     | 459.966                            | 29.308                           | 39.000                           | 0.752                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 111.968 - 109.466 |                     | 505.973                            | 31.113                           | 39.000                           | 0.798                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 109.466 - 106.964 |                     | 552.534                            | 32.808                           | 39.000                           | 0.841                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 106.964 - 104.462 |                     | 599.652                            | 34.403                           | 39.000                           | 0.882                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 104.462 - 101.959 |                     | 647.330                            | 35.904                           | 39.000                           | 0.921                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 101.959 - 99.457  |                     | 695.571                            | 37.319                           | 39.000                           | 0.957                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
| L2          | 99.457 - 94.54    | TP44.85x33.54x0.313 | 361.998                            | 18.223                           | 39.000                           | 0.467                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             | 94.54 - 92.2924   |                     | 430.188                            | 17.943                           | 39.000                           | 0.460                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |
|             |                   |                     | 837.175                            | 33.931                           | 39.000                           | 0.870                                       | 0.000                              | 0.000                            | 39.000                           | 0.000                                       |

|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 22 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Section No. | Elevation<br>ft | Size                | Actual<br>$M_x$<br>kip-ft | Actual<br>$f_{bx}$<br>ksi | Allow.<br>$F_{bx}$<br>ksi | Ratio<br>$\frac{f_{bx}}{F_{bx}}$ | Actual<br>$M_y$<br>kip-ft | Actual<br>$f_{by}$<br>ksi | Allow.<br>$F_{by}$<br>ksi | Ratio<br>$\frac{f_{by}}{F_{by}}$ |
|-------------|-----------------|---------------------|---------------------------|---------------------------|---------------------------|----------------------------------|---------------------------|---------------------------|---------------------------|----------------------------------|
|             | 92.2924 -       |                     | 882.642                   | 34.777                    | 39.000                    | 0.892                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 90.0449         |                     |                           |                           |                           |                                  |                           |                           |                           |                                  |
|             | 90.0449 -       |                     | 928.600                   | 35.582                    | 39.000                    | 0.912                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 87.7973         |                     |                           |                           |                           |                                  |                           |                           |                           |                                  |
|             | 87.7973 -       |                     | 975.050                   | 36.348                    | 39.000                    | 0.932                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 85.5498         |                     |                           |                           |                           |                                  |                           |                           |                           |                                  |
|             | 85.5498 -       |                     | 1021.98                   | 37.079                    | 39.000                    | 0.951                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 83.3022         |                     | 3                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 83.3022 -       |                     | 1069.40                   | 37.775                    | 39.000                    | 0.969                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 81.0547         |                     | 0                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 81.0547 -       |                     | 1117.30                   | 38.438                    | 39.000                    | 0.986                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 78.8071         |                     | 8                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 78.8071 -       |                     | 1165.70                   | 39.071                    | 39.000                    | 1.002                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 76.5596         |                     | 0                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 76.5596 -       |                     | 1214.57                   | 39.676                    | 39.000                    | 1.017                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 74.312          |                     | 5                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 74.312 -        |                     | 1263.95                   | 40.253                    | 39.000                    | 1.032                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 72.0644         |                     | 8                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 72.0644 -       |                     | 1313.93                   | 40.809                    | 39.000                    | 1.046                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 69.8169         |                     | 3                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 69.8169 -       |                     | 1364.40                   | 41.339                    | 39.000                    | 1.060                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 67.5693         |                     | 0                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 67.5693 -       |                     | 1415.34                   | 41.846                    | 39.000                    | 1.073                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 65.3218         |                     | 2                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 65.3218 -       |                     | 1466.77                   | 42.331                    | 39.000                    | 1.085                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 63.0742         |                     | 5                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 63.0742 -       |                     | 1518.80                   | 42.798                    | 39.000                    | 1.097                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 60.8267         |                     | 0                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 60.8267 -       |                     | 1571.31                   | 43.245                    | 39.000                    | 1.109                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 58.5791         |                     | 7                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 58.5791 -       |                     | 1624.32                   | 43.673                    | 39.000                    | 1.120                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 56.3316         |                     | 5                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 56.3316 -       |                     | 1677.80                   | 44.083                    | 39.000                    | 1.130                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 54.084          |                     | 8                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 54.084 -        |                     | 852.333                   | 21.050                    | 39.000                    | 0.540                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 47.917          |                     |                           |                           |                           |                                  |                           |                           |                           |                                  |
| L3          | 54.084 -        | TP54.5x42.872x0.375 | 975.008                   | 20.734                    | 39.000                    | 0.532                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 47.917          |                     |                           |                           |                           |                                  |                           |                           |                           |                                  |
|             | 47.917 -        |                     | 1888.30                   | 39.179                    | 39.000                    | 1.005                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 45.4477         |                     | 8                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 45.4477 -       |                     | 1949.78                   | 39.482                    | 39.000                    | 1.012                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 42.9784         |                     | 3                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 42.9784 -       |                     | 2011.77                   | 39.770                    | 39.000                    | 1.020                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 40.5091         |                     | 5                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 40.5091 -       |                     | 2074.27                   | 40.044                    | 39.000                    | 1.027                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 38.0397         |                     | 5                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 38.0397 -       |                     | 2137.29                   | 40.303                    | 39.000                    | 1.033                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 35.5704         |                     | 2                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 35.5704 -       |                     | 2200.82                   | 40.549                    | 39.000                    | 1.040                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 33.1011         |                     | 5                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 33.1011 -       |                     | 2264.86                   | 40.783                    | 39.000                    | 1.046                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 30.6318         |                     | 7                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 30.6318 -       |                     | 2329.43                   | 41.006                    | 39.000                    | 1.051                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 28.1625         |                     | 3                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 28.1625 -       |                     | 2394.52                   | 41.217                    | 39.000                    | 1.057                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 25.6932         |                     | 5                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 25.6932 -       |                     | 2460.13                   | 41.418                    | 39.000                    | 1.062                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 23.2238         |                     | 3                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 23.2238 -       |                     | 2526.25                   | 41.609                    | 39.000                    | 1.067                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 20.7545         |                     | 8                         |                           |                           |                                  |                           |                           |                           |                                  |

|                                                                                                                                                        |                                                            |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job                                                        | Page                      |
|                                                                                                                                                        | 12044.CO5 - CT1153                                         | 23 of 28                  |
|                                                                                                                                                        | Project<br>147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client<br>AT&T Mobility                                    | Designed by<br>TJL        |

| Section No. | Elevation<br>ft | Size | Actual<br>$M_x$<br>kip-ft | Actual<br>$f_{bx}$<br>ksi | Allow.<br>$F_{bx}$<br>ksi | Ratio<br>$\frac{f_{bx}}{F_{bx}}$ | Actual<br>$M_y$<br>kip-ft | Actual<br>$f_{by}$<br>ksi | Allow.<br>$F_{by}$<br>ksi | Ratio<br>$\frac{f_{by}}{F_{by}}$ |
|-------------|-----------------|------|---------------------------|---------------------------|---------------------------|----------------------------------|---------------------------|---------------------------|---------------------------|----------------------------------|
|             | 20.7545 -       |      | 2592.91                   | 41.791                    | 39.000                    | 1.072                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 18.2852         |      | 7                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 18.2852 -       |      | 2660.09                   | 41.963                    | 39.000                    | 1.076                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 15.8159         |      | 2                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 15.8159 -       |      | 2727.80                   | 42.128                    | 39.000                    | 1.080                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 13.3466         |      | 0                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 13.3466 -       |      | 2796.03                   | 42.284                    | 39.000                    | 1.084                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 10.8773         |      | 3                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 10.8773 -       |      | 2864.80                   | 42.432                    | 39.000                    | 1.088                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 8.40795         |      | 0                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 8.40795 -       |      | 2934.09                   | 42.574                    | 39.000                    | 1.092                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 5.93863         |      | 2                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 5.93863 -       |      | 3003.91                   | 42.709                    | 39.000                    | 1.095                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             | 3.46932         |      | 7                         |                           |                           |                                  |                           |                           |                           |                                  |
|             | 3.46932 - 1     |      | 3074.27                   | 42.837                    | 39.000                    | 1.098                            | 0.000                     | 0.000                     | 39.000                    | 0.000                            |
|             |                 |      | 5                         |                           |                           |                                  |                           |                           |                           |                                  |

### Pole Shear Design Data

| Section No. | Elevation<br>ft | Size              | Actual<br>$V$<br>K | Actual<br>$f_v$<br>ksi | Allow.<br>$F_v$<br>ksi | Ratio<br>$\frac{f_v}{F_v}$ | Actual<br>$T$<br>kip-ft | Actual<br>$f_{vt}$<br>ksi | Allow.<br>$F_{vt}$<br>ksi | Ratio<br>$\frac{f_{vt}}{F_{vt}}$ |
|-------------|-----------------|-------------------|--------------------|------------------------|------------------------|----------------------------|-------------------------|---------------------------|---------------------------|----------------------------------|
| L1          | 147 - 144.498   | TP35.13x23.5x0.25 | 7.756              | 0.411                  | 26.000                 | 0.032                      | 0.009                   | 0.000                     | 26.000                    | 0.000                            |
|             | 144.498 -       |                   | 7.957              | 0.412                  | 26.000                 | 0.032                      | 0.008                   | 0.000                     | 26.000                    | 0.000                            |
|             | 141.995         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 141.995 -       |                   | 8.161              | 0.413                  | 26.000                 | 0.032                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 139.493         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 139.493 -       |                   | 10.544             | 0.522                  | 26.000                 | 0.041                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 136.991         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 136.991 -       |                   | 10.752             | 0.521                  | 26.000                 | 0.041                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 134.489         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 134.489 -       |                   | 10.963             | 0.520                  | 26.000                 | 0.041                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 131.986         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 131.986 -       |                   | 11.177             | 0.519                  | 26.000                 | 0.041                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 129.484         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 129.484 -       |                   | 15.701             | 0.715                  | 26.000                 | 0.056                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 126.982         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 126.982 -       |                   | 15.916             | 0.710                  | 26.000                 | 0.056                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 124.48          |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 124.48 -        |                   | 16.133             | 0.706                  | 26.000                 | 0.055                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 121.977         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 121.977 -       |                   | 16.351             | 0.702                  | 26.000                 | 0.055                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 119.475         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 119.475 -       |                   | 17.846             | 0.752                  | 26.000                 | 0.059                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 116.973         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 116.973 -       |                   | 18.065             | 0.747                  | 26.000                 | 0.059                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 114.471         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 114.471 -       |                   | 18.285             | 0.743                  | 26.000                 | 0.058                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 111.968         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 111.968 -       |                   | 18.507             | 0.739                  | 26.000                 | 0.058                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 109.466         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 109.466 -       |                   | 18.730             | 0.735                  | 26.000                 | 0.057                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 106.964         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 106.964 -       |                   | 18.953             | 0.731                  | 26.000                 | 0.057                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |
|             | 104.462         |                   |                    |                        |                        |                            |                         |                           |                           |                                  |
|             | 104.462 -       |                   | 19.179             | 0.727                  | 26.000                 | 0.057                      | 0.000                   | 0.000                     | 26.000                    | 0.000                            |



|                                                                                                                                                        |                                                            |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job                                                        | Page                      |
|                                                                                                                                                        | 12044.CO5 - CT1153                                         | 24 of 28                  |
|                                                                                                                                                        | Project<br>147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client<br>AT&T Mobility                                    | Designed by<br>TJL        |

| Section No. | Elevation<br>ft   | Size                | Actual<br>V<br>K | Actual<br>f <sub>v</sub><br>ksi | Allow.<br>F <sub>v</sub><br>ksi | Ratio<br>$\frac{f_v}{F_v}$ | Actual<br>T<br>kip-ft | Actual<br>f <sub>vt</sub><br>ksi | Allow.<br>F <sub>vt</sub><br>ksi | Ratio<br>$\frac{f_{vt}}{F_{vt}}$ |
|-------------|-------------------|---------------------|------------------|---------------------------------|---------------------------------|----------------------------|-----------------------|----------------------------------|----------------------------------|----------------------------------|
|             | 101.959           |                     |                  |                                 |                                 |                            |                       |                                  |                                  |                                  |
|             | 101.959 - 99.457  |                     | 19.405           | 0.724                           | 26.000                          | 0.057                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
| L2          | 99.457 - 94.54    | TP44.85x33.54x0.313 | 9.228            | 0.333                           | 26.000                          | 0.026                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 94.54 - 92.2924   |                     | 10.692           | 0.314                           | 26.000                          | 0.024                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 92.2924 - 90.0449 |                     | 20.136           | 0.583                           | 26.000                          | 0.046                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 90.0449 - 87.7973 |                     | 20.353           | 0.581                           | 26.000                          | 0.045                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 87.7973 - 85.5498 |                     | 20.570           | 0.580                           | 26.000                          | 0.045                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 85.5498 - 83.3022 |                     | 20.787           | 0.578                           | 26.000                          | 0.045                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 83.3022 - 81.0547 |                     | 21.004           | 0.576                           | 26.000                          | 0.045                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 81.0547 - 78.8071 |                     | 21.221           | 0.574                           | 26.000                          | 0.045                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 78.8071 - 76.5596 |                     | 21.437           | 0.572                           | 26.000                          | 0.045                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 76.5596 - 74.312  |                     | 21.654           | 0.571                           | 26.000                          | 0.044                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 74.312 - 72.0644  |                     | 21.870           | 0.569                           | 26.000                          | 0.044                      | 0.000                 | 0.000                            | 26.000                           | 0.000                            |
|             | 72.0644 - 69.8169 |                     | 22.144           | 0.569                           | 26.000                          | 0.044                      | 0.202                 | 0.003                            | 26.000                           | 0.000                            |
|             | 69.8169 - 67.5693 |                     | 22.361           | 0.567                           | 26.000                          | 0.044                      | 0.201                 | 0.003                            | 26.000                           | 0.000                            |
|             | 67.5693 - 65.3218 |                     | 22.577           | 0.566                           | 26.000                          | 0.044                      | 0.201                 | 0.003                            | 26.000                           | 0.000                            |
|             | 65.3218 - 63.0742 |                     | 22.793           | 0.564                           | 26.000                          | 0.043                      | 0.201                 | 0.003                            | 26.000                           | 0.000                            |
|             | 63.0742 - 60.8267 |                     | 23.008           | 0.563                           | 26.000                          | 0.043                      | 0.201                 | 0.003                            | 26.000                           | 0.000                            |
|             | 60.8267 - 58.5791 |                     | 23.279           | 0.563                           | 26.000                          | 0.043                      | 0.395                 | 0.005                            | 26.000                           | 0.000                            |
|             | 58.5791 - 56.3316 |                     | 23.494           | 0.561                           | 26.000                          | 0.043                      | 0.394                 | 0.005                            | 26.000                           | 0.000                            |
|             | 56.3316 - 54.084  |                     | 23.709           | 0.560                           | 26.000                          | 0.043                      | 0.394                 | 0.005                            | 26.000                           | 0.000                            |
|             | 54.084 - 47.917   |                     | 23.924           | 0.559                           | 26.000                          | 0.043                      | 0.394                 | 0.005                            | 26.000                           | 0.000                            |
| L3          | 47.917 - 45.4477  | TP54.5x42.872x0.375 | 11.657           | 0.264                           | 26.000                          | 0.020                      | 0.184                 | 0.002                            | 26.000                           | 0.000                            |
|             | 45.4477 - 42.9784 |                     | 12.957           | 0.248                           | 26.000                          | 0.019                      | 0.210                 | 0.002                            | 26.000                           | 0.000                            |
|             | 42.9784 - 40.5091 |                     | 24.814           | 0.470                           | 26.000                          | 0.036                      | 0.394                 | 0.004                            | 26.000                           | 0.000                            |
|             | 40.5091 - 38.0397 |                     | 25.021           | 0.468                           | 26.000                          | 0.036                      | 0.394                 | 0.004                            | 26.000                           | 0.000                            |
|             | 38.0397 - 35.5704 |                     | 25.229           | 0.466                           | 26.000                          | 0.036                      | 0.394                 | 0.004                            | 26.000                           | 0.000                            |
|             | 35.5704 - 33.1011 |                     | 25.438           | 0.464                           | 26.000                          | 0.036                      | 0.394                 | 0.004                            | 26.000                           | 0.000                            |
|             | 33.1011 - 30.6318 |                     | 25.647           | 0.463                           | 26.000                          | 0.036                      | 0.394                 | 0.004                            | 26.000                           | 0.000                            |
|             | 30.6318 -         |                     | 25.856           | 0.461                           | 26.000                          | 0.035                      | 0.394                 | 0.004                            | 26.000                           | 0.000                            |
|             |                   |                     | 26.066           | 0.460                           | 26.000                          | 0.035                      | 0.394                 | 0.003                            | 26.000                           | 0.000                            |
|             |                   |                     | 26.277           | 0.458                           | 26.000                          | 0.035                      | 0.394                 | 0.003                            | 26.000                           | 0.000                            |

|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 25 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Section No. | Elevation<br>ft   | Size | Actual<br>$V$<br>K | Actual<br>$f_v$<br>ksi | Allow.<br>$F_v$<br>ksi | Ratio<br>$\frac{f_v}{F_v}$ | Actual<br>$T$<br>kip-ft | Actual<br>$f_t$<br>ksi | Allow.<br>$F_t$<br>ksi | Ratio<br>$\frac{f_t}{F_t}$ |
|-------------|-------------------|------|--------------------|------------------------|------------------------|----------------------------|-------------------------|------------------------|------------------------|----------------------------|
|             | 28.1625           |      |                    |                        |                        |                            |                         |                        |                        |                            |
|             | 28.1625 - 25.6932 |      | 26.488             | 0.457                  | 26.000                 | 0.035                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 25.6932 - 23.2238 |      | 26.700             | 0.455                  | 26.000                 | 0.035                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 23.2238 - 20.7545 |      | 26.912             | 0.454                  | 26.000                 | 0.035                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 20.7545 - 18.2852 |      | 27.125             | 0.453                  | 26.000                 | 0.035                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 18.2852 - 15.8159 |      | 27.338             | 0.451                  | 26.000                 | 0.035                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 15.8159 - 13.3466 |      | 27.552             | 0.450                  | 26.000                 | 0.035                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 13.3466 - 10.8773 |      | 27.766             | 0.449                  | 26.000                 | 0.035                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 10.8773 - 8.40795 |      | 27.981             | 0.448                  | 26.000                 | 0.034                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 8.40795 - 5.93863 |      | 28.196             | 0.447                  | 26.000                 | 0.034                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 5.93863 - 3.46932 |      | 28.412             | 0.445                  | 26.000                 | 0.034                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |
|             | 3.46932 - 1       |      | 28.629             | 0.444                  | 26.000                 | 0.034                      | 0.394                   | 0.003                  | 26.000                 | 0.000                      |

### Pole Interaction Design Data

| Section No. | Elevation<br>ft   | Ratio<br>$P$<br>$P_a$ | Ratio<br>$f_{bx}$<br>$F_{bx}$ | Ratio<br>$f_{by}$<br>$F_{by}$ | Ratio<br>$f_v$<br>$F_v$ | Ratio<br>$f_t$<br>$F_t$ | Comb.<br>Stress<br>Ratio | Allow.<br>Stress<br>Ratio | Criteria  |
|-------------|-------------------|-----------------------|-------------------------------|-------------------------------|-------------------------|-------------------------|--------------------------|---------------------------|-----------|
| L1          | 147 - 144.498     | 0.002                 | 0.090                         | 0.000                         | 0.032                   | 0.000                   | 0.092                    | 1.333                     | H1-3+VT ✓ |
|             | 144.498 - 141.995 | 0.002                 | 0.138                         | 0.000                         | 0.032                   | 0.000                   | 0.141                    | 1.333                     | H1-3+VT ✓ |
|             | 141.995 - 139.493 | 0.003                 | 0.183                         | 0.000                         | 0.032                   | 0.000                   | 0.186                    | 1.333                     | H1-3+VT ✓ |
|             | 139.493 - 136.991 | 0.005                 | 0.229                         | 0.000                         | 0.041                   | 0.000                   | 0.234                    | 1.333                     | H1-3+VT ✓ |
|             | 136.991 - 134.489 | 0.005                 | 0.281                         | 0.000                         | 0.041                   | 0.000                   | 0.286                    | 1.333                     | H1-3+VT ✓ |
|             | 134.489 - 131.986 | 0.005                 | 0.330                         | 0.000                         | 0.041                   | 0.000                   | 0.335                    | 1.333                     | H1-3+VT ✓ |
|             | 131.986 - 129.484 | 0.005                 | 0.376                         | 0.000                         | 0.041                   | 0.000                   | 0.381                    | 1.333                     | H1-3+VT ✓ |
|             | 129.484 - 126.982 | 0.008                 | 0.426                         | 0.000                         | 0.056                   | 0.000                   | 0.435                    | 1.333                     | H1-3+VT ✓ |
|             | 126.982 - 124.48  | 0.008                 | 0.487                         | 0.000                         | 0.056                   | 0.000                   | 0.496                    | 1.333                     | H1-3+VT ✓ |
|             | 124.48 - 121.977  | 0.008                 | 0.545                         | 0.000                         | 0.055                   | 0.000                   | 0.554                    | 1.333                     | H1-3+VT ✓ |
|             | 121.977 - 119.475 | 0.009                 | 0.598                         | 0.000                         | 0.055                   | 0.000                   | 0.608                    | 1.333                     | H1-3+VT ✓ |
|             | 119.475 - 116.973 | 0.010                 | 0.650                         | 0.000                         | 0.059                   | 0.000                   | 0.661                    | 1.333                     | H1-3+VT ✓ |

|                                                                                                                                                        |         |                                                 |             |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job     | 12044.CO5 - CT1153                              | Page        | 26 of 28          |
|                                                                                                                                                        | Project | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date        | 15:56:01 12/10/12 |
|                                                                                                                                                        | Client  | AT&T Mobility                                   | Designed by | TJL               |

| Section No. | Elevation<br>ft   | Ratio<br>$\frac{P}{P_a}$ | Ratio<br>$\frac{f_{bx}}{F_{bx}}$ | Ratio<br>$\frac{f_{by}}{F_{by}}$ | Ratio<br>$\frac{f_v}{F_v}$ | Ratio<br>$\frac{f_{vt}}{F_{vt}}$ | Comb.<br>Stress<br>Ratio | Allow.<br>Stress<br>Ratio | Criteria  |
|-------------|-------------------|--------------------------|----------------------------------|----------------------------------|----------------------------|----------------------------------|--------------------------|---------------------------|-----------|
|             | 116.973 - 114.471 | 0.010                    | 0.702                            | 0.000                            | 0.059                      | 0.000                            | 0.713                    | 1.333                     | H1-3+VT ✓ |
|             | 114.471 - 111.968 | 0.010                    | 0.752                            | 0.000                            | 0.058                      | 0.000                            | 0.763                    | 1.333                     | H1-3+VT ✓ |
|             | 111.968 - 109.466 | 0.011                    | 0.798                            | 0.000                            | 0.058                      | 0.000                            | 0.809                    | 1.333                     | H1-3+VT ✓ |
|             | 109.466 - 106.964 | 0.011                    | 0.841                            | 0.000                            | 0.057                      | 0.000                            | 0.853                    | 1.333                     | H1-3+VT ✓ |
|             | 106.964 - 104.462 | 0.011                    | 0.882                            | 0.000                            | 0.057                      | 0.000                            | 0.894                    | 1.333                     | H1-3+VT ✓ |
|             | 104.462 - 101.959 | 0.011                    | 0.921                            | 0.000                            | 0.057                      | 0.000                            | 0.932                    | 1.333                     | H1-3+VT ✓ |
|             | 101.959 - 99.457  | 0.011                    | 0.957                            | 0.000                            | 0.057                      | 0.000                            | 0.969                    | 1.333                     | H1-3+VT ✓ |
|             | 99.457 - 94.54    | 0.005                    | 0.467                            | 0.000                            | 0.026                      | 0.000                            | 0.473                    | 1.333                     | H1-3+VT ✓ |
| L2          | 99.457 - 94.54    | 0.005                    | 0.460                            | 0.000                            | 0.024                      | 0.000                            | 0.466                    | 1.333                     | H1-3+VT ✓ |
|             | 94.54 - 92.2924   | 0.010                    | 0.870                            | 0.000                            | 0.046                      | 0.000                            | 0.880                    | 1.333                     | H1-3+VT ✓ |
|             | 92.2924 - 90.0449 | 0.010                    | 0.892                            | 0.000                            | 0.045                      | 0.000                            | 0.902                    | 1.333                     | H1-3+VT ✓ |
|             | 90.0449 - 87.7973 | 0.010                    | 0.912                            | 0.000                            | 0.045                      | 0.000                            | 0.923                    | 1.333                     | H1-3+VT ✓ |
|             | 87.7973 - 85.5498 | 0.010                    | 0.932                            | 0.000                            | 0.045                      | 0.000                            | 0.943                    | 1.333                     | H1-3+VT ✓ |
|             | 85.5498 - 83.3022 | 0.010                    | 0.951                            | 0.000                            | 0.045                      | 0.000                            | 0.962                    | 1.333                     | H1-3+VT ✓ |
|             | 83.3022 - 81.0547 | 0.011                    | 0.969                            | 0.000                            | 0.045                      | 0.000                            | 0.980                    | 1.333                     | H1-3+VT ✓ |
|             | 81.0547 - 78.8071 | 0.011                    | 0.986                            | 0.000                            | 0.045                      | 0.000                            | 0.997                    | 1.333                     | H1-3+VT ✓ |
|             | 78.8071 - 76.5596 | 0.011                    | 1.002                            | 0.000                            | 0.044                      | 0.000                            | 1.013                    | 1.333                     | H1-3+VT ✓ |
|             | 76.5596 - 74.312  | 0.011                    | 1.017                            | 0.000                            | 0.044                      | 0.000                            | 1.029                    | 1.333                     | H1-3+VT ✓ |
|             | 74.312 - 72.0644  | 0.011                    | 1.032                            | 0.000                            | 0.044                      | 0.000                            | 1.044                    | 1.333                     | H1-3+VT ✓ |
|             | 72.0644 - 69.8169 | 0.011                    | 1.046                            | 0.000                            | 0.044                      | 0.000                            | 1.058                    | 1.333                     | H1-3+VT ✓ |
|             | 69.8169 - 67.5693 | 0.011                    | 1.060                            | 0.000                            | 0.044                      | 0.000                            | 1.072                    | 1.333                     | H1-3+VT ✓ |
|             | 67.5693 - 65.3218 | 0.012                    | 1.073                            | 0.000                            | 0.043                      | 0.000                            | 1.085                    | 1.333                     | H1-3+VT ✓ |
|             | 65.3218 - 63.0742 | 0.012                    | 1.085                            | 0.000                            | 0.043                      | 0.000                            | 1.098                    | 1.333                     | H1-3+VT ✓ |
|             | 63.0742 - 60.8267 | 0.012                    | 1.097                            | 0.000                            | 0.043                      | 0.000                            | 1.110                    | 1.333                     | H1-3+VT ✓ |
|             | 60.8267 - 58.5791 | 0.012                    | 1.109                            | 0.000                            | 0.043                      | 0.000                            | 1.121                    | 1.333                     | H1-3+VT ✓ |
|             | 58.5791 - 56.3316 | 0.012                    | 1.120                            | 0.000                            | 0.043                      | 0.000                            | 1.132                    | 1.333                     | H1-3+VT ✓ |



|                                                                                                                                                        |                                                            |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------|
| <b>tnxTower</b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | Job                                                        | Page                      |
|                                                                                                                                                        | 12044.CO5 - CT1153                                         | 27 of 28                  |
|                                                                                                                                                        | Project<br>147' EEI Monopole - 123 Palmer Road Chaplin, CT | Date<br>15:56:01 12/10/12 |
|                                                                                                                                                        | Client<br>AT&T Mobility                                    | Designed by<br>TJL        |

| Section No. | Elevation<br>ft   | Ratio<br>$\frac{P}{P_a}$ | Ratio<br>$\frac{f_{bx}}{F_{bx}}$ | Ratio<br>$\frac{f_{by}}{F_{by}}$ | Ratio<br>$\frac{f_v}{F_v}$ | Ratio<br>$\frac{f_{vt}}{F_{vt}}$ | Comb.<br>Stress<br>Ratio | Allow.<br>Stress<br>Ratio | Criteria  |
|-------------|-------------------|--------------------------|----------------------------------|----------------------------------|----------------------------|----------------------------------|--------------------------|---------------------------|-----------|
| L3          | 56.3316 - 54.084  | 0.012                    | 1.130                            | 0.000                            | 0.043                      | 0.000                            | 1.143                    | 1.333                     | H1-3+VT ✓ |
|             | 54.084 - 47.917   | 0.006                    | 0.540                            | 0.000                            | 0.020                      | 0.000                            | 0.546                    | 1.333                     | H1-3+VT ✓ |
|             | 54.084 - 47.917   | 0.006                    | 0.532                            | 0.000                            | 0.019                      | 0.000                            | 0.538                    | 1.333                     | H1-3+VT ✓ |
|             | 47.917 - 45.4477  | 0.011                    | 1.005                            | 0.000                            | 0.036                      | 0.000                            | 1.016                    | 1.333                     | H1-3+VT ✓ |
|             | 45.4477 - 42.9784 | 0.012                    | 1.012                            | 0.000                            | 0.036                      | 0.000                            | 1.024                    | 1.333                     | H1-3+VT ✓ |
|             | 42.9784 - 40.5091 | 0.012                    | 1.020                            | 0.000                            | 0.036                      | 0.000                            | 1.032                    | 1.333                     | H1-3+VT ✓ |
|             | 40.5091 - 38.0397 | 0.012                    | 1.027                            | 0.000                            | 0.036                      | 0.000                            | 1.039                    | 1.333                     | H1-3+VT ✓ |
|             | 38.0397 - 35.5704 | 0.012                    | 1.033                            | 0.000                            | 0.036                      | 0.000                            | 1.046                    | 1.333                     | H1-3+VT ✓ |
|             | 35.5704 - 33.1011 | 0.012                    | 1.040                            | 0.000                            | 0.035                      | 0.000                            | 1.052                    | 1.333                     | H1-3+VT ✓ |
|             | 33.1011 - 30.6318 | 0.012                    | 1.046                            | 0.000                            | 0.035                      | 0.000                            | 1.058                    | 1.333                     | H1-3+VT ✓ |
|             | 30.6318 - 28.1625 | 0.012                    | 1.051                            | 0.000                            | 0.035                      | 0.000                            | 1.064                    | 1.333                     | H1-3+VT ✓ |
|             | 28.1625 - 25.6932 | 0.013                    | 1.057                            | 0.000                            | 0.035                      | 0.000                            | 1.070                    | 1.333                     | H1-3+VT ✓ |
|             | 25.6932 - 23.2238 | 0.013                    | 1.062                            | 0.000                            | 0.035                      | 0.000                            | 1.075                    | 1.333                     | H1-3+VT ✓ |
|             | 23.2238 - 20.7545 | 0.013                    | 1.067                            | 0.000                            | 0.035                      | 0.000                            | 1.080                    | 1.333                     | H1-3+VT ✓ |
|             | 20.7545 - 18.2852 | 0.013                    | 1.072                            | 0.000                            | 0.035                      | 0.000                            | 1.085                    | 1.333                     | H1-3+VT ✓ |
|             | 18.2852 - 15.8159 | 0.013                    | 1.076                            | 0.000                            | 0.035                      | 0.000                            | 1.089                    | 1.333                     | H1-3+VT ✓ |
|             | 15.8159 - 13.3466 | 0.013                    | 1.080                            | 0.000                            | 0.035                      | 0.000                            | 1.094                    | 1.333                     | H1-3+VT ✓ |
|             | 13.3466 - 10.8773 | 0.013                    | 1.084                            | 0.000                            | 0.035                      | 0.000                            | 1.098                    | 1.333                     | H1-3+VT ✓ |
|             | 10.8773 - 8.40795 | 0.014                    | 1.088                            | 0.000                            | 0.034                      | 0.000                            | 1.102                    | 1.333                     | H1-3+VT ✓ |
|             | 8.40795 - 5.93863 | 0.014                    | 1.092                            | 0.000                            | 0.034                      | 0.000                            | 1.106                    | 1.333                     | H1-3+VT ✓ |
|             | 5.93863 - 3.46932 | 0.014                    | 1.095                            | 0.000                            | 0.034                      | 0.000                            | 1.109                    | 1.333                     | H1-3+VT ✓ |
|             | 3.46932 - 1       | 0.014                    | 1.098                            | 0.000                            | 0.034                      | 0.000                            | 1.113                    | 1.333                     | H1-3+VT ✓ |

## Section Capacity Table

|                                                                                                                                                               |                |                                                 |                    |                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------|--------------------|-------------------|
| <b><i>tnxTower</i></b><br><br><b>Centek Engineering Inc.</b><br>63-2 North Branford Rd.<br>Branford, CT 06405<br>Phone: (203) 488-0580<br>FAX: (203) 488-8587 | <b>Job</b>     | 12044.CO5 - CT1153                              | <b>Page</b>        | 28 of 28          |
|                                                                                                                                                               | <b>Project</b> | 147' EEI Monopole - 123 Palmer Road Chaplin, CT | <b>Date</b>        | 15:56:01 12/10/12 |
|                                                                                                                                                               | <b>Client</b>  | AT&T Mobility                                   | <b>Designed by</b> | TJL               |

| Section No. | Elevation ft   | Component Type | Size                | Critical Element | P K     | SF*P <sub>allow</sub> K | % Capacity      | Pass Fail        |
|-------------|----------------|----------------|---------------------|------------------|---------|-------------------------|-----------------|------------------|
| L1          | 147 - 94.54    | Pole           | TP35.13x23.5x0.25   | 1                | -11.614 | 1393.891                | 72.7            | Pass             |
| L2          | 94.54 - 47.917 | Pole           | TP44.85x33.54x0.313 | 2                | -20.554 | 2226.776                | 85.8            | Pass             |
| L3          | 47.917 - 1     | Pole           | TP54.5x42.872x0.375 | 3                | -35.084 | 3349.122                | 83.5            | Pass             |
|             |                |                |                     |                  |         |                         | Summary         |                  |
|             |                |                |                     |                  |         |                         | Pole (L2)       | 85.8 Pass        |
|             |                |                |                     |                  |         |                         | <b>RATING =</b> | <b>85.8 Pass</b> |

**Anchor Bolt and Base Plate Analysis:****Input Data:**Tower Reactions:

|                     |                    |                        |
|---------------------|--------------------|------------------------|
| Overturing Moment = | OM := 3074-ft-kips | (Input From RisaTower) |
| Shear Force =       | Shear := 29-kips   | (Input From RisaTower) |
| Axial Force =       | Axial := 35-kips   | (Input From RisaTower) |

Anchor Bolt Data:

|                            |                           |              |
|----------------------------|---------------------------|--------------|
| Use ASTM A615 Grade 75     |                           |              |
| Number of Anchor Bolts =   | N := 16                   | (User Input) |
| Diameter of Bolt Circle =  | D <sub>bc</sub> := 63-in  | (User Input) |
| Bolt "Column" Distance =   | l := 3-in                 | (User Input) |
| Bolt Ultimate Strength =   | F <sub>u</sub> := 100-ksi | (User Input) |
| Bolt Yield Strength =      | F <sub>y</sub> := 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 = | F <sub>ybp</sub> := 60-ksi   | (User Input) |
| Base Plate Thickness = | t <sub>bp</sub> := 1.75-in   | (User Input) |
| Base Plate Diameter =  | D <sub>bp</sub> := 69-in     | (User Input) |
| Outer Pole Diameter =  | D <sub>pole</sub> := 54.5-in | (User Input) |



### Geometric Layout Data:

#### Distance from Bolts to Centroid of Pole:

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

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

$$d_i := \begin{cases} \leftarrow 2 \cdot \left( \frac{i}{N} \right) & d_1 = 12.05\text{-in} & d_7 = 12.05\text{-in} \\ d \leftarrow R_{bc} \cdot \sin(\ ) & d_2 = 22.27\text{-in} & d_8 = 0.00\text{-in} \\ & d_3 = 29.10\text{-in} & d_9 = -12.05\text{-in} \\ & d_4 = 31.50\text{-in} & d_{10} = -22.27\text{-in} \\ & d_5 = 29.10\text{-in} & d_{11} = -29.10\text{-in} \\ & d_6 = 22.27\text{-in} & \text{etc.} \end{cases}$$

#### Critical Distances For Bending in Plate:

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

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

|                         |                            |
|-------------------------|----------------------------|
| $MA_1 = 0.00\text{-in}$ | $MA_7 = 0.00\text{-in}$    |
| $MA_2 = 0.00\text{-in}$ | $MA_8 = 0.00\text{-in}$    |
| $MA_3 = 1.85\text{-in}$ | $MA_9 = 0.00\text{-in}$    |
| $MA_4 = 4.25\text{-in}$ | $MA_{10} = 0.00\text{-in}$ |
| $MA_5 = 1.85\text{-in}$ | $MA_{11} = 0.00\text{-in}$ |
| $MA_6 = 0.00\text{-in}$ | etc                        |

Effective Width of Baseplate for Bending =

$$W_{eff} := .9 \cdot 2 \cdot \sqrt{\left( \frac{D_{bp}}{2} \right)^2 - \left( \frac{D_{pole}}{2} \right)^2} = 38.1\text{-in}$$

### Anchor Bolt Analysis:

#### Calculated Anchor Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 7938 \cdot \text{in}^2$$

Gross Area of Bolt =

$$A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot \text{in}^2$$

Net Area of Bolt =

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

Net Diameter =

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

Radius of Gyration of Bolt =

$$r := \frac{D_n}{4} = 0.508 \cdot \text{in}$$

Section Modulus of Bolt =

$$S_x := \frac{D_n^3}{32} = 0.826 \cdot \text{in}^3$$

#### Check Anchor Bolt Tension Force:

Maximum Tensile Force =

$$T_{\text{Max}} := \text{OM} \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 144.2 \cdot \text{kips}$$

Allowable Tensile Force =

$$T_{\text{ALL.Gross}} := 1.333 \cdot (0.33 \cdot A_g \cdot F_u) = 174.9 \cdot \text{kips} \quad (1.333 \text{ increase allowed per TIA/EIA})$$

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

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} = 0.74 \quad \text{Bolts are "upset bolts". Use net area per AISC}$$

Condition1 =

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

Condition1 = "OK"

#### Check Anchor Bolt Bending Stress:

Maximum Bending Moment =

$$M_x := \left( \frac{\text{Shear}}{N} \right) \cdot l = 0.453 \cdot \text{ft} \cdot \text{kips}$$

Maximum Bending Stress =

$$f_{bx} := \frac{M_x}{S_x} = 6.6 \cdot \text{ksi}$$

Allowable Bending Stress =

$$F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 60 \cdot \text{ksi} \quad (1.333 \text{ increase allowed per TIA/EIA})$$

Check Combined Stress Requirement:

Per ASCE Manual 72: "If the clearance between the base plate and concrete does not exceed two times the bolt diameter a bending stress analysis of the bolts is NOT normally required."

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{l_p} + \frac{Axial}{N} = 148.6 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 45.7 \text{ ksi}$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 60 \text{ ksi} \quad (1.333 \text{ increase allowed per TIA/EIA})$$

Combined Stress % of Capacity =

$$\left( \frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = 0.763$$

Condition 2 =

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

Condition2 = "OK"



Subject:

ANCHOR BOLT AND BASEPLATE ANALYSIS

Location:

Chaplin, CT

Rev. 1: 12/10/12

Prepared by: T.J.L. Checked by: C.F.C.  
 Job No. 12044.CO5

### Base Plate Analysis:

Force from Bolts =  $C_i := \frac{OM \cdot d_i}{l_p}$

$C_1 = 56.0 \cdot \text{kips}$

$C_7 = 56.0 \cdot \text{kips}$

$C_2 = 103.5 \cdot \text{kips}$

$C_8 = 0.0 \cdot \text{kips}$

$C_3 = 135.2 \cdot \text{kips}$

$C_9 = -56.0 \cdot \text{kips}$

$C_4 = 146.4 \cdot \text{kips}$

$C_{10} = -103.5 \cdot \text{kips}$

$C_5 = 135.2 \cdot \text{kips}$

$C_{11} = -135.2 \cdot \text{kips}$

$C_6 = 103.5 \cdot \text{kips}$

etc.

Maximum Bending Stress in Plate =  $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{(W_{eff} t_{bp}^2)} = 57.8 \cdot \text{ksi}$

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

Plate Bending Stress % of Capacity =  $\frac{f_{bp}}{F_{bp}} = 0.965$

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

Condition3 = "Ok"

**Standard Monopole Foundation:****Input Data:**Tower Data

|                      |                          |                             |
|----------------------|--------------------------|-----------------------------|
| Overturning Moment = | OM := 3074-ft-kips       | (User Input from RISATower) |
| Shear Force =        | Shear := 29-kip          | (User Input from RISATower) |
| Axial Force =        | Axial := 35-kip          | (User Input from RISATower) |
| Tower Height =       | H <sub>t</sub> := 147-ft | (User Input)                |

Footing Data:

|                                 |                            |              |
|---------------------------------|----------------------------|--------------|
| Overall Depth of Footing =      | D <sub>f</sub> := 5.5-ft   | (User Input) |
| Length of Pier =                | L <sub>p</sub> := 1.5-ft   | (User Input) |
| Extension of Pier Above Grade = | L <sub>pag</sub> := 0.5-ft | (User Input) |
| Diameter of Pier =              | d <sub>p</sub> := 7.0-ft   | (User Input) |
| Thickness of Footing =          | T <sub>f</sub> := 4.5-ft   | (User Input) |
| Width of Footing =              | W <sub>f</sub> := 27.0-ft  | (User Input) |

Anchor Bolt Data:

|                                         |                                |              |
|-----------------------------------------|--------------------------------|--------------|
| Length of Anchor Bolts =                | L <sub>st</sub> := 72.0-in     | (User Input) |
| Projection of Anchor Bolts Above Pier = | A <sub>BP</sub> := 12.00-in    | (User Input) |
| Anchor Bolt Diameter =                  | d <sub>anchor</sub> := 2.25-in | (User Input) |
| Base Plate Bolt Circle =                | MP := 63.00-in                 | (User Input) |

Material Properties:

|                                            |                              |                                     |
|--------------------------------------------|------------------------------|-------------------------------------|
| Concrete Compressive Strength =            | f <sub>c</sub> := 3000-psi   | (User Input)                        |
| Steel Reinforcement Yield Strength =       | f <sub>y</sub> := 60000-psi  | (User Input)                        |
| Anchor Bolt Yield Strength =               | f <sub>ya</sub> := 75000-psi | (User Input)                        |
| Internal Friction Angle of Soil =          | s := 10-deg                  | (User Input)                        |
| Allowable Soil Bearing Capacity =          | q <sub>s</sub> := 6000-psf   | (User Input)                        |
| Unit Weight of Soil =                      | soil := 100-pcf              | (User Input)                        |
| Unit Weight of Concrete =                  | 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 = | := 0.45                      | (User Input)                        |

Pier Reinforcement:

|                                 |                              |              |              |
|---------------------------------|------------------------------|--------------|--------------|
| Bar Size =                      | BS <sub>pier</sub> := 8      | (User Input) |              |
| Bar Diameter =                  | d <sub>bpier</sub> := 1.0-in | (User Input) |              |
| Number of Bars =                | NB <sub>pier</sub> := 44     | (User Input) |              |
| Clear Cover of Reinforcement =  | Cvr <sub>pier</sub> := 3-in  | (User Input) |              |
| Reinforcement Location Factor = | pier := 1.0                  | (User Input) | (ACI 12.2.4) |
| Coating Factor =                | pier := 1.0                  | (User Input) | (ACI 12.2.4) |
| Concrete Strength Factor =      | pier := 1.0                  | (User Input) | (ACI 12.2.4) |
| Reinforcement Size Factor =     | pier := 1.0                  | (User Input) | (ACI 12.2.4) |
| Diameter of Tie =               | d <sub>Tie</sub> := 4-in     | (User Input) |              |

Pad Reinforcement:

|                                 |                              |              |                 |
|---------------------------------|------------------------------|--------------|-----------------|
| Bar Size =                      | BS <sub>top</sub> := 8       | (User Input) | (Top of Pad)    |
| Bar Diameter =                  | d <sub>btop</sub> := 1.00-in | (User Input) | (Top of Pad)    |
| Number of Bars =                | NB <sub>top</sub> := 40      | (User Input) | (Top of Pad)    |
| Bar Size =                      | BS <sub>bot</sub> := 8       | (User Input) | (Bottom of Pad) |
| Bar Diameter =                  | d <sub>bbot</sub> := 1.00-in | (User Input) | (Bottom of Pad) |
| Number of Bars =                | NB <sub>bot</sub> := 40      | (User Input) | (Bottom of Pad) |
| Clear Cover of Reinforcement =  | Cvr <sub>pad</sub> := 3.0-in | (User Input) |                 |
| Reinforcement Location Factor = | pad := 1.0                   | (User Input) | (ACI 12.2.4)    |
| Coating Factor =                | pad := 1.0                   | (User Input) | (ACI 12.2.4)    |
| Concrete Strength Factor =      | pad := 1.0                   | (User Input) | (ACI 12.2.4)    |
| Reinforcement Size Factor =     | pad := 1.0                   | (User Input) | (ACI 12.2.4)    |

**Calculated Factors:**

|                                        |                                                                                                                                                                                                                                        |         |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Pier Reinforcement Bar Area =          | $A_{bpier} := \frac{d_{bpier}^2}{4} = 0.785 \cdot \text{in}^2$                                                                                                                                                                         |         |
| Pad Top Reinforcement Bar Area =       | $A_{btop} := \frac{d_{btop}^2}{4} = 0.785 \cdot \text{in}^2$                                                                                                                                                                           |         |
| Pad Bottom Reinforcement Bar Area =    | $A_{bbot} := \frac{d_{bbot}^2}{4} = 0.785 \cdot \text{in}^2$                                                                                                                                                                           |         |
| Coefficient of Lateral Soil Pressure = | $K_p := \frac{1 + \sin\left(\frac{s}{s}\right)}{1 - \sin\left(\frac{s}{s}\right)} = 1.42$                                                                                                                                              |         |
| Load Factor =                          | $LF := \begin{cases} 1.333 & \text{if } H_t \leq 700\text{-ft} \\ 1.7 & \text{if } H_t \geq 1200\text{-ft} \\ 1.333 + \left( \frac{H_t - 700\text{ft}}{1200\text{ft} - 700\text{ft}} \right) \cdot 0.4 & \text{otherwise} \end{cases}$ | = 1.333 |



### Stability of Footing:

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Adjusted Concrete Unit Weight =     | $c := \text{if}(\text{Bouyancy} = 1, \text{conc} - 62.4\text{pcf}, \text{conc}) = 150\text{-pcf}$                                                                                                                                                                                                                                                                                                                                                                                                    |
| Adjusted Soil Unit Weight =         | $s := \text{if}(\text{Bouyancy} = 1, \text{soil} - 62.4\text{pcf}, \text{soil}) = 100\text{-pcf}$                                                                                                                                                                                                                                                                                                                                                                                                    |
| Passive Pressure =                  | $P_{pn} := K_p \cdot s \cdot n + c \cdot 2 \cdot \sqrt{K_p} = 0\text{-ksf}$<br>$P_{pt} := K_p \cdot s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = 0.142\text{-ksf}$<br>$P_{top} := \text{if}(n < (D_f - T_f), P_{pt}, P_{pn}) = 0.142\text{-ksf}$<br>$P_{bot} := K_p \cdot s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 0.781\text{-ksf}$<br>$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 0.462\text{-ksf}$<br>$T_p := \text{if}(n < (D_f - T_f), T_f, (D_f - n)) = 4.5$<br>$A_p := W_f T_p = 121.5$ |
| Ultimate Shear =                    | $S_u := P_{ave} \cdot A_p = 56.083\text{-kip}$                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Weight of Concrete Pad =            | $WT_c := \left[ (W_f^2 \cdot T_f) + d_p^2 L_p \right] \cdot c = 503.1\text{-kip}$                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Weight of Soil Above Footing =      | $WT_{s1} := \left[ W_f^2 \cdot (L_p - L_{pag} - n) + d_p^2 \cdot (L_p - L_{pag} - n) \right] \cdot s = 68\text{-kip}$                                                                                                                                                                                                                                                                                                                                                                                |
| Weight of Soil Wedge at Back Face = | $WT_{s2} := \left[ \frac{(D_f - T_f)^2 \cdot \tan(s)}{2} \cdot W_f \right] \cdot s = 0.238\text{-kip}$                                                                                                                                                                                                                                                                                                                                                                                               |
| Total Weight =                      | $WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 606.1\text{-kip}$                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Resisting Moment =                  | $M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + WT_{s2} \cdot \left[ W_f + \frac{(D_f - T_f) \cdot \tan(s)}{3} \right] = 8273\text{-kip-ft}$                                                                                                                                                                                                                                                                                                                                      |
| Overtuning Moment =                 | $M_{ot} := OM + \text{Shear} \cdot (L_p + T_f) = 3248\text{-kip-ft}$                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Factor of Safety Actual =           | $FS := \frac{M_r}{M_{ot}} = 2.55$                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Factor of Safety Required =         | $FS_{req} := 2$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                     | $\text{OverTurning\_Moment\_Check} := \text{if}(FS \geq FS_{req}, \text{"Okay"}, \text{"No Good"})$                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                     | <b>OverTurning_Moment_Check = "Okay"</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

**Shear Capacity in Pier:**

Shear Resistance of Pier =

$$S_p := \frac{P_{ave} \cdot A_p + \cdot WT_{tot}}{FS_{req}} = 164.414 \cdot \text{kips}$$

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

$$\text{Shear\_Check} = \text{"Okay"}$$

**Bearing Pressure Caused by Footing:**

Area of the Mat =

$$A_{mat} := W_f^2 = 729$$

Section Modulus of Mat =

$$S := \frac{W_f^3}{6} = 3280.5 \cdot \text{ft}^3$$

Maximum Pressure in Mat =

$$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.822 \cdot \text{ksf}$$

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

$$\text{Max\_Pressure\_Check} = \text{"Okay"}$$

Minimum Pressure in Mat =

$$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.159 \cdot \text{ksf}$$

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

$$\text{Min\_Pressure\_Check} = \text{"No Good"}$$

Distance to Resultant of Pressure Distribution =

$$X_p := \frac{\frac{P_{max}}{P_{max} - P_{min}} \cdot \frac{1}{3}}{\frac{W_f}{W_f}} = 8.279$$

Distance to Kern =

$$X_k := \frac{W_f}{6} = 4.5$$

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

Eccentricity =

$$e := \frac{M_{ot}}{WT_{tot}} = 5.359$$

Adjusted Soil Pressure =

$$P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \left( \frac{W_f}{2} - e \right)} = 1.838 \cdot \text{ksf}$$

$$q_{adj} := \text{if}(P_{min} < 0, P_a, P_{max}) = 1.838 \cdot \text{ksf}$$

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

$$\text{Pressure\_Check} = \text{"Okay"}$$

### Concrete Bearing Capacity:

Strength Reduction Factor =

$$\phi_c := 0.65 \quad (\text{ACI } 9.3.2.2)$$

Bearing Strength Between Pier and Pad =

$$P_b := \phi_c \cdot 0.85 \cdot f_c \cdot \frac{d_p^2}{4} = 9.185 \times 10^3 \cdot \text{kips} \quad (\text{ACI } 10.14)$$

$$\text{Bearing\_Check} := \text{if}(P_b > \text{LF} \cdot \text{Axial}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Bearing\_Check} = \text{"Okay"}$$

### Shear Strength of Concrete:

Beam Shear:

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

$$\phi_c := 0.85 \quad (\text{ACI } 9.3.2.5)$$

$$d := T_f - \text{Cvr}_{\text{pad}} - d_{\text{bbot}}$$

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

$$d_2 := d_1 - d$$

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

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

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

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

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

$$\text{Beam\_Shear\_Check} = \text{"Okay"}$$

Punching Shear:

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

Critical Perimeter of Punching Shear =

$$b_o := (d_p + d) \cdot \pi = 35.1$$

Area Included Inside Perimeter =

$$A_{bo} := \frac{(d_p + d)^2 \cdot \pi}{4} = 97.9$$

Area Outside of Perimeter =

$$A_{\text{out}} := A_{\text{mat}} - A_{bo} = 631.1$$



Guess Value =

$$v_u := 1 \text{ ksf}$$

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

Given

$$d^2 + d_p d = \frac{W T_{\text{tot}}}{v_u}$$

$$v_u := \text{Find}(v_u) = 4.1 \text{ ksf}$$

$$V_u := v_u \cdot d \cdot W_f = 466.5 \text{ kips}$$

Required Shear Strength =

$$V_{\text{req}} := L F \cdot V_u = 621.8 \text{ kips}$$

Available Shear Strength =

$$V_{\text{avail}} := c \cdot 4 \cdot \sqrt{f_c \text{ psi}} \cdot b_o \cdot d = 3919.8 \text{ kip} \quad (\text{ACI } 11.11.2.1)$$

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

$$\text{Punching\_Shear\_Check} = \text{"Okay"}$$

### Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor =

$$m := .90 \quad (\text{ACI } 9.3.2.1)$$

$$q_b := q_{\text{adj}} - d_1 \cdot \text{Slope} = 1.086 \text{ ksf}$$

Maximum Bending at Face of Pier =

$$M_n := \frac{1}{m} \cdot \left[ (q_{\text{adj}} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 2381 \text{ kip-ft}$$

$$\lambda := \begin{cases} 0.85 & \text{if } 2500 \text{ psi} \leq f_c \leq 4000 \text{ psi} \\ 0.65 & \text{if } f_c > 8000 \text{ psi} \\ \left[ 0.85 - \left[ \frac{\left( \frac{f_c}{\text{psi}} - 4000 \right)}{1000} \right] \cdot 0.5 \right] & \text{otherwise} \end{cases} = 0.85 \quad (\text{ACI-2008 } 10.2.7.3)$$

$$R_u := \frac{M_n}{m \cdot W_f \cdot d^2} = 39.2 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \left( 1 - \sqrt{1 - \frac{2 R_u}{0.85 \cdot f_c}} \right) = 0.0007$$

$$\min := 1.333 \cdot \rho = 0.00088$$

Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

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

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

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

$$Pad\_Reinforcement\_Bot = \text{"Okay"}$$

Check top Bars:

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

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

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

$$Pad\_Reinforcement\_Top = \text{"Okay"}$$

**Development Length Pad Reinforcement:**

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot C_{vr\_pad} - NB_{bot} d_{bbot}}{NB_{bot} - 1} = 7.13 \cdot \text{in}$$

Spacing or Cover Dimension =

$$c := \text{if} \left( C_{vr\_pad} < \frac{B_{sPad}}{2}, C_{vr\_pad}, \frac{B_{sPad}}{2} \right) = 3 \cdot \text{in}$$

Transverse Reinforcement Index =

$$k_{tr} := 0 \quad (\text{ACI 12.2.3})$$

$$L_{dbt} := \frac{3 \cdot f_y \cdot pad' \cdot pad' \cdot pad' \cdot pad'}{40 \cdot \sqrt{f_c \cdot \text{psi}} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 27.4 \cdot \text{in}$$

Minimum Development Length =

$$L_{dbmin} := 12 \cdot \text{in} \quad (\text{ACI 12.2.1})$$

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - C_{vr\_pad} = 117 \cdot \text{in}$$

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

$$L_{pad\_Check} = \text{"Okay"}$$

### Steel Reinforcement in Pier:

Area of Pier =

$$A_p := \frac{d_p^2}{4} = 11 \cdot \text{in}^2$$

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

$$A_{sprov} := N_{B_{pier}} \cdot A_{B_{pier}} = 34.56 \cdot \text{in}^2$$

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

Steel\_Area\_Check = "Okay"

Bar Spacing In Pier =

$$B_{SPier} := \frac{d_p}{N_{B_{pier}}} - d_{B_{pier}} = 4.998 \cdot \text{in}$$

Diameter of Reinforcement Cage =

$$\text{Diam}_{cage} := d_p - 2 \cdot C_{v_{pier}} = 78 \cdot \text{in}$$

Maximum Moment in Pier =

$$M_p := \left[ OM + \text{Shear} \cdot \left( L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 50099.5 \cdot \text{in-kips}$$

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

$$(D \ N \ n \ P_u \ M_{xu}) := \left( d_p \cdot 12 \ N_{B_{pier}} \ B_{SPier} \ \frac{\text{Axial} \cdot 1.333}{\text{kips}} \ \frac{M_p}{\text{in-kips}} \right)$$

$$(D \ N \ n \ P_u \ M_{xu}) = (84 \ 44 \ 8 \ 46.655 \ 5.01 \times 10^4)$$

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

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

$$(P_n \ M_{xn} \ f_{sp}) = (62.327 \ 6.693 \times 10^4 \ -60 \ 6.272 \times 10^{-3})$$

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

Axial\_Load\_Check = "Okay"

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

Bending\_Check = "Okay"



## Development Length Pier Reinforcement:

Available Length in Foundation:

$$L_{\text{pier}} := L_p - C_{\text{vr}}_{\text{pier}} = 15\text{-in}$$

$$L_{\text{pad}} := T_f - C_{\text{vr}}_{\text{pad}} = 51\text{-in}$$

Tension:

(ACI 12.2.3)

Spacing or Cover Dimension =

$$c := \text{if} \left( C_{\text{vr}}_{\text{pier}} < \frac{B_{\text{SPier}}}{2}, C_{\text{vr}}_{\text{pier}}, \frac{B_{\text{SPier}}}{2} \right) = 2.499\text{-in}$$

Transverse Reinforcement =

$$k_{\text{tr}} := 0$$

(ACI 12.2.3)

$$L_{\text{dbt}} := \frac{3 f_y \text{ pier pier pier pier}}{40 \cdot \sqrt{f_c \cdot \text{psi}} \cdot \left( \frac{c + k_{\text{tr}}}{d_{\text{bpier}}} \right)} \cdot d_{\text{bpier}} = 32.88\text{-in}$$

Minimum Development Length =

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

$$L_{\text{dh}} := \frac{1200 \cdot d_{\text{bpier}}}{\sqrt{\frac{f_c}{\text{psi}}}} \cdot .7 = 15.336\text{-in} \quad (\text{ACI 12.2.1})$$

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

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

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

Compression:

(ACI 12.3.2)

$$L_{\text{dbc1}} := \frac{.02 \cdot d_{\text{bpier}} \cdot f_y}{\sqrt{f_c \cdot \text{psi}}} = 21.909\text{-in}$$

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

$$L_{\text{dbc}} := \text{if}(L_{\text{dbc1}} \geq L_{\text{dbmin}}, L_{\text{dbc1}}, L_{\text{dbmin}}) = 21.909\text{-in}$$

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

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

### Tie Size and Spacing in Column:

Minimum Tie Size =

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

Used #4 Ties

Seismic Factor =

$$z := \text{if}(Z \leq 2, 1, 0.5) = 1 \quad (\text{ACI 21.10.5})$$

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

$$s_{lim2} := \frac{48 \cdot d_{Tie}}{8} \cdot z = 24 \cdot \text{in}$$

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

$$s_{lim4} := 18 \cdot \text{in}$$

Maximum Spacing =

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

Number of Ties Required =

$$n_{tie} := \frac{L_{pier} - 3 \cdot \text{in}}{s_{tie}} + 1 = 1.75$$

### Check Anchor Steel Embedment:

Depth Available =

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

Length of Anchor Bolt =

$$L_{anchor} := \frac{(0.11 \cdot f_{ya}) \cdot \text{in}}{\sqrt{f_c} \cdot \text{psi}} = 12.552 \cdot \text{ft}$$

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

Depth\_Check = "No Good"

Note: Anchor plate is provided

**AM-X-CD-17-65-00T-RET(8' 65° Dual Broadband Antenna)**

Dual Band Electrical DownTilt Antenna

698 ~ 894MHz, X-pol., H65° / V8.0°

1710 ~ 2170MHz, X-pol., H65° / V7.0°

**Electrical Specification**

| Frequency Range                                         |            | 698~894MHz                                                                                                    | 1710~2170MHz                                                                                                |
|---------------------------------------------------------|------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Impedance                                               |            | 50Ω                                                                                                           |                                                                                                             |
| Polarization                                            |            | Dual, Slant ±45°                                                                                              |                                                                                                             |
| Gain                                                    |            | 16.8dBi / 14.65dBd @ 698-806MHz<br>17.5dBi / 15.35dBd @ 824-894MHz                                            | 17.0dBi / 14.85dBd @ 1710-1755MHz<br>17.3dBi / 15.15dBd @ 1850-1900MHz<br>17.5dBi / 15.35dBd @ 2110-2155MHz |
| Beamwidth                                               | Horizontal | 68° @ 698-806MHz<br>63° @ 824-894MHz                                                                          | 67° @ 1710-1755MHz<br>65° @ 1850-1900MHz<br>62° @ 2110-2155MHz                                              |
|                                                         | Vertical   | 9.2° @ 698-806MHz<br>8.0° @ 824-894MHz                                                                        | 7.3° @ 1710-1755MHz<br>7.0° @ 1850-1900MHz<br>6.7° @ 2110-2155MHz                                           |
| VSWR                                                    |            | ≤1.5:1                                                                                                        |                                                                                                             |
| Front-to-Back Ratio                                     |            | ≥27 dB                                                                                                        |                                                                                                             |
| Electrical Downtilt Range                               |            | 2° ~ 16°                                                                                                      | 0° ~ 10°                                                                                                    |
| Isolation Between Ports                                 |            | ≥30 dB                                                                                                        |                                                                                                             |
| Isolation Between Ports of Different Frequency Elements |            | ≥35 dB                                                                                                        |                                                                                                             |
| Cross Pole Discrimination                               |            | 10.0 dB @ ±60°<br>15.0 dBi @ 0°                                                                               |                                                                                                             |
| First Upper Side Lobe Suppression                       |            | 16dB                                                                                                          |                                                                                                             |
| Side Lobe Suppression                                   |            | > 16 dB @ 0-6° Tilt<br>> 18 dB @ 7-12° Tilt<br>(Up to 10° from Boresight)                                     | > 16 dB @ 0-6° Tilt<br>> 18 dB @ 7-10° Tilt<br>(Up to 10° from Boresight)                                   |
| Passive Intermodulation                                 |            | ≤ -150 dBc @ 2x20w                                                                                            |                                                                                                             |
| Input Maximum CW Power                                  |            | 500 W                                                                                                         | 300 W                                                                                                       |
| Environmental Compliance                                |            | IP65 for Radome<br>IP67 for Connectors                                                                        |                                                                                                             |
| RET Motor Configuration                                 |            | Field Replaceable RET Electronic Control Module /<br>RET Motor is internal to antenna & not field replaceable |                                                                                                             |
| Compliant with AISG 1.1 and 2.0                         |            | AISG 1.1 and 2.0                                                                                              |                                                                                                             |

**Mechanical Specification**

|                        |                            |
|------------------------|----------------------------|
| Dimension (W×D×H)      | 11.8×6.0×96 inches         |
| Weight (Without clamp) | 59.5 lbs (27.0 kg)         |
| Connector              | 4 x 7/16 DIN(F), Long Neck |
| Max Wind Speed         | 150 mph                    |
| Wind Load (@150 mph)   | 2521 N                     |



# 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

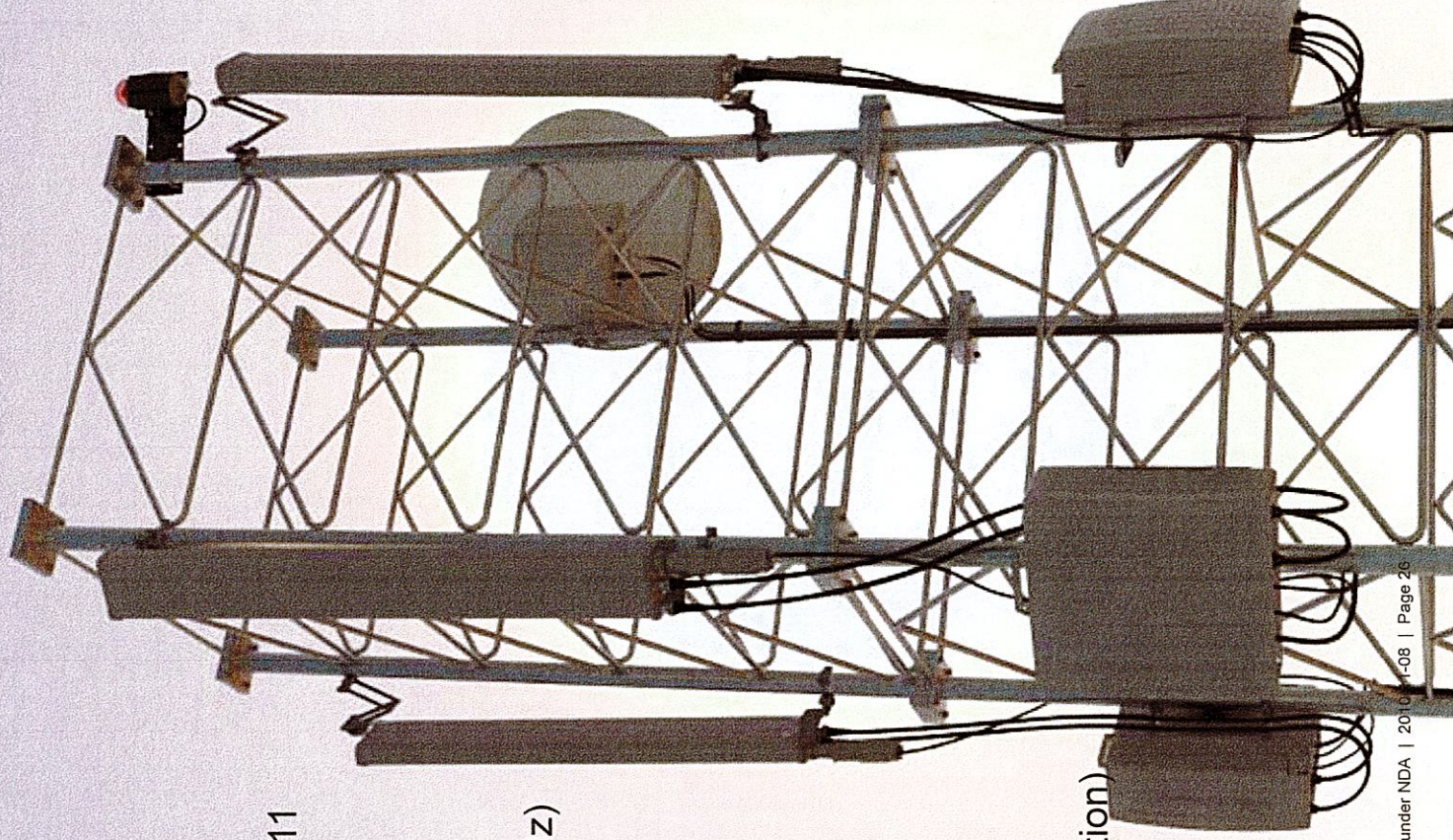
- ✓ AISG 2.0 Compatible
- ✓ Via RET Port and Centre Conductor
- ✓ Cascading
- ✓ 30 VDC Bias

## 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  $\geq 16$  in.
- Below  $\geq 12$  in.
- Side  $\geq 0$  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





# POWER

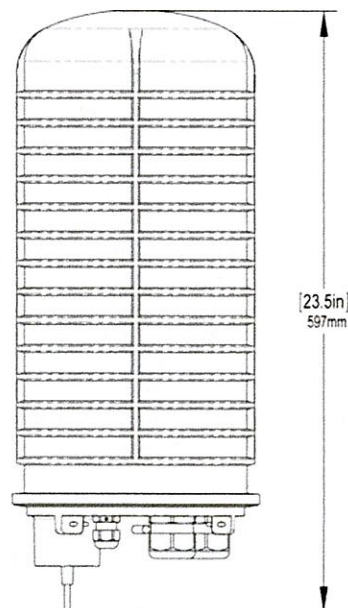
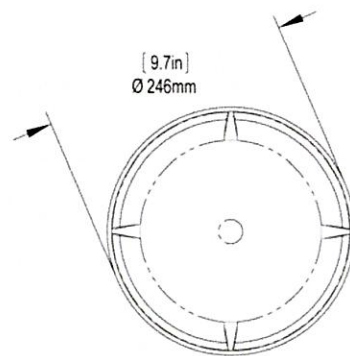
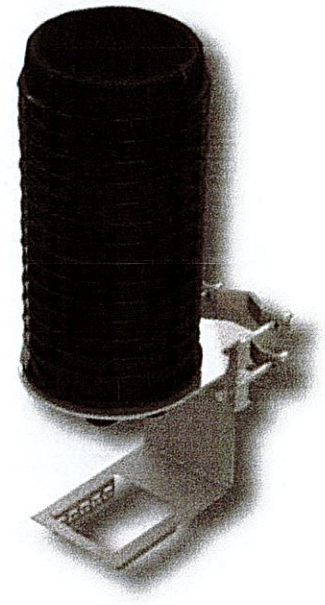
## DC6-48-60-18-8F

### DC Surge Suppression Solution

The DC6-48-60-18 is a dual chambered, DC surge suppression system for use in multi-circuit, Distributed Antenna Systems. The system will protect up to 6 Remote Radio Heads from voltage surges and lightning, and connect up to 18 fiber pairs. The system is enclosed in a NEMA 4 rated, waterproof enclosure.

#### FEATURES

- Protects up to 6 Remote Radio Heads, each with its own protection circuit.
- Flexible design allows for installation at the top of a tower for Remote Radio Head protection.
- Includes fiber connections for up to 18 pairs of fiber.
- LED indicators on individual circuits provide visual indication of suppressor status.
- Form 'C' relays allow for remote monitoring of the suppressor status.
- Patented Strikesorb technology provides over 60 kA of surge current capacity per circuit.
- Strikesorb suppression modules are fully recognized to UL 1449-3rd Edition Safety Standard, meeting all intermediate and high current fault requirements to facilitate use in OEM applications.
- Raycap recommends that DC protection system be installed within 2 meters or 6 feet of the radio.
- Dome design is lightweight and aerodynamic providing maximum flexibility for installation on top of towers.



**Raycap**



# DC6-48-60-18-8F

## DC Power Surge Protection

| Electrical Specifications                             |                    |
|-------------------------------------------------------|--------------------|
| Model Number                                          | DC6-48-60-18-8F    |
| Nominal Operating Voltage                             | 48 VDC             |
| Nominal Discharge Current ( $I_n$ )                   | 20 kA 8/20 $\mu$ s |
| Maximum Discharge Current ( $I_{max}$ ) per NEMA LS-1 | 60 kA 8/20 $\mu$ s |
| Maximum Continuous Operating Voltage ( $U_o$ )        | 75 VDC             |
| Voltage Protection Rating                             | 400 V              |

| Mechanical Specifications          |                                                     |
|------------------------------------|-----------------------------------------------------|
| Suppression Connection Method      | Compression lug, #2-#14 AWG Copper, #2-#12 Aluminum |
| Fiber Connection Method            | LC-LC Single mode duplex                            |
| Environmental Rating               | IP 68, 7m 72hrs                                     |
| Operating Temperature              | -40° C to + 80° C                                   |
| Storage Temperature                | -70° C to + 80° C                                   |
| Cold Temperature Cycling           | IEC 61300-2-22e -30° C to + 60° C 200 hrs @ 5 psi   |
| Resistance to Aggressive Materials | CEI IEC 61073-2 including acids and bases           |
| UV Protection                      | ISO 4892-2 Method A Xenon-Arc 2160 hrs              |
| Weight                             | 20 lbs without Mounting Bracket                     |

### STANDARDS

Strikesorb modules are compliant to the following Surge Protection Device (SPD) Standards:

- ANSI/UL 1449 - 3rd Edition
- IEEE C62.41
- NEMA LS-1, IEC 61643-1:2005 2nd Edition:2005
- IEC 61643-12
- EN 61643-11:2002 (including A11:2007)



**Raycap**

G02-00-068 REV 050610



GS-07F-0435V



Certified to  
ISO 9001:2000



TUV Rheinland  
of North America

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## Calculated Radio Frequency Emissions



CT1153

(Chaplin)

123 Palmer Road, Chaplin, CT 06235

(a.k.a. 147 Palmer Road)

(a.k.a. Palmer Road, Lot 54)

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December 12, 2012

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## 1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed modifications to the existing AT&T antenna arrays mounted on the monopole tower located on 123 Palmer Road in Chaplin, CT. The coordinates of the tower are 41° 47' 4.3" N, 72° 8' 8.7" W.

AT&T is proposing the following modifications:

- 1) Install three multi-band (700/850/1900/2100 MHz) antennas for their LTE network (one per sector).

## 2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

In 1985, the FCC established rules to regulate radio frequency (RF) exposure from FCC licensed antenna facilities. In 1996, the FCC updated these rules, which were further amended in August 1997 by OET Bulletin 65 Edition 97-01. These new rules include Maximum Permissible Exposure (MPE) limits for transmitters operating between 300 kHz and 100 GHz. The FCC MPE limits are based upon those recommended by the National Council on Radiation Protection and Measurements (NCRP), developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI).

The FCC general population/uncontrolled limits set the maximum exposure to which most people may be subjected. General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter ( $\text{mW}/\text{cm}^2$ ). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report.

Higher exposure limits are permitted under the occupational/controlled exposure category, but only for persons who are exposed as a consequence of their employment and who have been made fully aware of the potential for exposure, and they must be able to exercise control over their exposure. General population/uncontrolled limits are five times more stringent than the levels that are acceptable for occupational, or radio frequency trained individuals. Attachment B contains excerpts from OET Bulletin 65 and defines the Maximum Exposure Limit.

Finally, it should be noted that the MPE limits adopted by the FCC for both general population/uncontrolled exposure and for occupational/controlled exposure incorporate a substantial margin of safety and have been established to be well below levels generally accepted as having the potential to cause adverse health effects.

### 3. RF Exposure Prediction Methods

The emission field calculation results displayed in the following figures were generated using the following formula as outlined in FCC bulletin OET 65:

$$\text{Power Density} = \frac{1.6^2 \cdot \text{EIRP}}{4\pi \cdot R^2} \times \text{Off Beam Loss}$$

Where:

EIRP = Effective Isotropic Radiated Power

$$R = \text{Radial Distance} = \sqrt{H^2 + V^2}$$

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

These calculations assume that the antennas are operating at 100 percent capacity and power, and that all channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not take into account actual terrain elevations which could attenuate the signal. As a result, the predicted signal levels reported below are much higher than the actual signal levels will be from the finished modifications.

#### 4. Calculation Results

Table 1 below outlines the power density information for the site. Because the proposed AT&T antennas are directional in nature, the majority of the RF power is focused out towards the horizon. As a result, there will be less RF power directed below the antennas relative to the horizon, and consequently lower power density levels around the base of the tower. Please refer to Attachment C for the vertical patterns of the proposed AT&T antennas. The calculated results for AT&T in Table 1 include a nominal 10 dB off-beam pattern loss to account for the lower relative gain below the antennas.

| Carrier          | Antenna Height (Feet) | Operating Frequency (MHz) | Number of Trans. | ERP Per Transmitter (Watts) | Power Density (mw/cm <sup>2</sup> ) | Limit  | %MPE   |
|------------------|-----------------------|---------------------------|------------------|-----------------------------|-------------------------------------|--------|--------|
| Cingular GSM     | 127                   | 880                       | 4                | 296                         | 0.0264                              | 0.5867 | 4.50%  |
| Cingular GSM     | 127                   | 1900                      | 2                | 427                         | 0.0190                              | 1.0000 | 1.90%  |
| Cingular UMTS    | 127                   | 880                       | 1                | 500                         | 0.0111                              | 0.5867 | 1.90%  |
| Sprint           | 137                   | 1962.5                    | 11               | 342.5                       | 0.0722                              | 1.0000 | 7.22%  |
| T-Mobile         | 117                   | 1935                      | 8                | 137                         | 0.0288                              | 1.0000 | 2.88%  |
| Verizon cellular | 149                   | 869                       | 9                | 264                         | 0.0385                              | 0.5793 | 6.64%  |
| Verizon PCS      | 149                   | 1970                      | 11               | 268                         | 0.0477                              | 1.0000 | 4.77%  |
| Verizon AWS      | 149                   | 2145                      | 1                | 654                         | 0.0106                              | 1.0000 | 1.06%  |
| Verizon LTE      | 149                   | 698                       | 2                | 695                         | 0.0225                              | 0.4653 | 4.84%  |
| AT&T UMTS        | 128                   | 880                       | 2                | 565                         | 0.0025                              | 0.5867 | 0.42%  |
| AT&T UMTS        | 128                   | 1900                      | 2                | 875                         | 0.0038                              | 1.0000 | 0.38%  |
| AT&T LTE         | 128                   | 734                       | 1                | 1771                        | 0.0039                              | 0.4893 | 0.79%  |
| AT&T GSM         | 128                   | 880                       | 1                | 283                         | 0.0006                              | 0.5867 | 0.11%  |
| AT&T GSM         | 128                   | 1900                      | 4                | 525                         | 0.0046                              | 1.0000 | 0.46%  |
|                  |                       |                           |                  |                             |                                     | Total  | 29.58% |

**Table 1: Carrier Information<sup>1 2 3</sup>**

<sup>1</sup> The existing CSC filing for Cingular should be removed and replaced with the updated AT&T technologies and values provided in Table 1. The power density information for carriers other than AT&T was taken directly from the CSC database dated 7/26/2012. Please note that %MPE values listed are rounded to two decimal points. The total %MPE listed is a summation of each unrounded contribution. Therefore, summing each rounded value may not reflect the total value listed in the table.

<sup>2</sup> In the case where antenna models are not uniform across all 3 sectors for the same frequency band, the antenna model with the highest gain was used for the calculations to present a worse-case scenario.

<sup>3</sup> Antenna height listed for AT&T is in reference to the Centek Engineering Structural Analysis dated December 10, 2012.



## 5. Conclusion

The above analysis verifies that emissions from the existing site will be below the maximum power density levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. Even when using conservative methods, the cumulative power density from the proposed transmit antennas at the existing facility is well below the limits for the general public. The highest expected percent of Maximum Permissible Exposure at ground level is **29.58% of the FCC limit**.

As noted previously, obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. As a result, the predicted signal levels are more conservative (higher) than the actual signal levels will be from the finished modifications.

## 6. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate. The calculations follow guidelines set forth in ANSI/IEEE Std. C95.3, ANSI/IEEE Std. C95.1 and FCC OET Bulletin 65 Edition 97-01.



Daniel L. Goulet  
C Squared Systems, LLC

December 12, 2012

Date

### **Attachment A: References**

OET Bulletin 65 - Edition 97-01 - August 1997 Federal Communications Commission Office of Engineering & Technology

ANSI C95.1-1982, American National Standard Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz. IEEE-SA Standards Board

IEEE Std C95.3-1991 (Reaff 1997), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave. IEEE-SA Standards Board

## Attachment B: FCC Limits for Maximum Permissible Exposure (MPE)

### (A) Limits for Occupational/Controlled Exposure<sup>4</sup>

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (E) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------------|-------------------------------------------------------------------|
| 0.3-3.0               | 614                               | 1.63                              | (100)*                                  | 6                                                                 |
| 3.0-30                | 1842/f                            | 4.89/f                            | (900/f <sup>2</sup> )*                  | 6                                                                 |
| 30-300                | 61.4                              | 0.163                             | 1.0                                     | 6                                                                 |
| 300-1500              | -                                 | -                                 | f/300                                   | 6                                                                 |
| 1500-100,000          | -                                 | -                                 | 5                                       | 6                                                                 |

### (B) Limits for General Population/Uncontrolled Exposure<sup>5</sup>

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (E) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------------|-------------------------------------------------------------------|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                  | 30                                                                |
| 1.34-30               | 824/f                             | 2.19/f                            | (180/f <sup>2</sup> )*                  | 30                                                                |
| 30-300                | 27.5                              | 0.073                             | 0.2                                     | 30                                                                |
| 300-1500              | -                                 | -                                 | f/1500                                  | 30                                                                |
| 1500-100,000          | -                                 | -                                 | 1.0                                     | 30                                                                |

f = frequency in MHz \* Plane-wave equivalent power density

**Table 2: FCC Limits for Maximum Permissible Exposure (MPE)**

<sup>4</sup> Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

<sup>5</sup> General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.



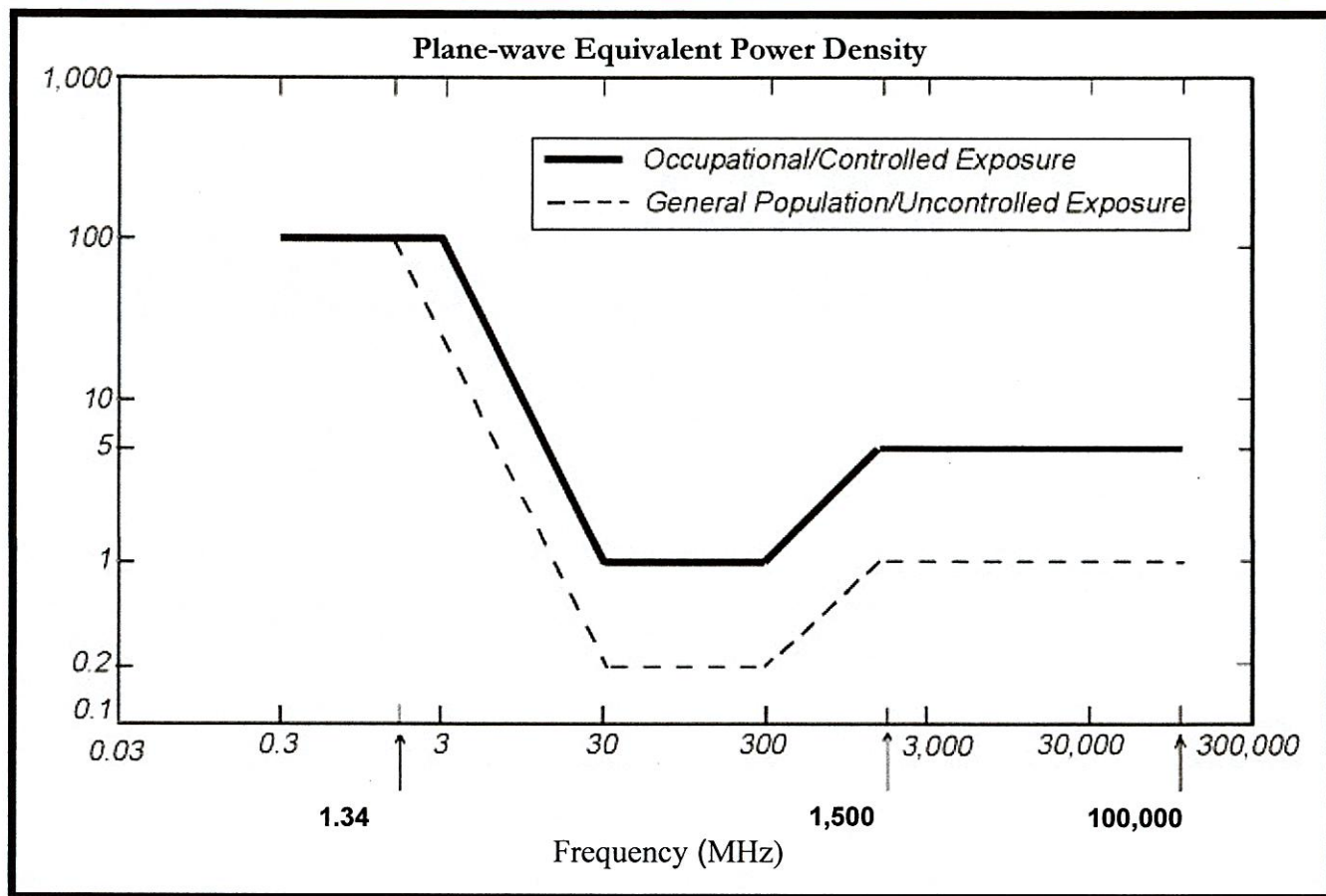
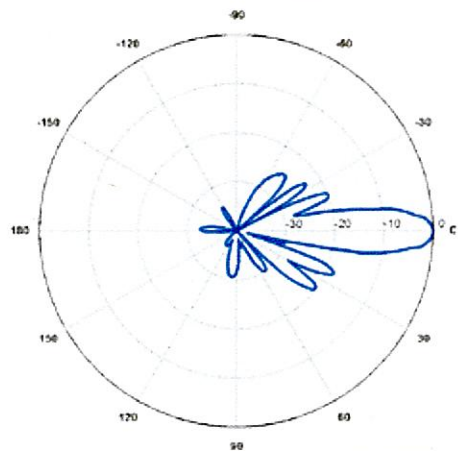


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

**Attachment C: AT&T Antenna Data Sheets and Electrical Patterns**

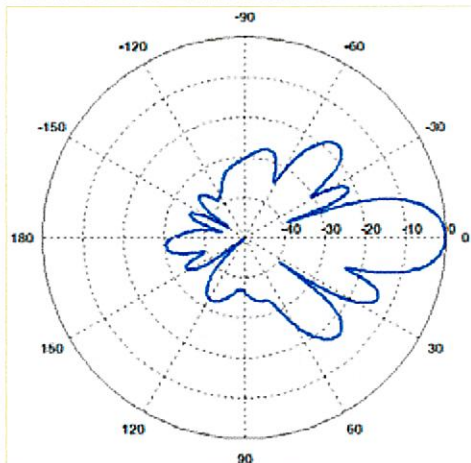
**700 MHz**

Manufacturer: KMW  
 Model #: AM-X-CD-17-65-00T-RET  
 Frequency Band: 698-806 MHz  
 Gain: 14.7 dBd  
 Vertical Beamwidth: 10°  
 Horizontal Beamwidth: 66°  
 Polarization: Dual Slant  $\pm 45^\circ$   
 Size L x W x D: 96.0" x 11.8" x 6.0"



**850 MHz**

Manufacturer: Powerwave  
 Model #: 7770.00  
 Frequency Band: 824-896 MHz  
 Gain: 11.5 dBd  
 Vertical Beamwidth: 15°  
 Horizontal Beamwidth: 82°  
 Polarization: Dual Linear  $\pm 45^\circ$   
 Size L x W x D: 55.0" x 11.0" x 5.0"



**1900 MHz**

Manufacturer: Powerwave  
 Model #: 7770.00  
 Frequency Band: 1850-1990 MHz  
 Gain: 13.4 dBd  
 Vertical Beamwidth: 7°  
 Horizontal Beamwidth: 86°  
 Polarization: Dual Linear  $\pm 45^\circ$   
 Size L x W x D: 55.0" x 11.0" x 5.0"

