



July 8, 2014

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

Regarding: Notice of Exempt Modification – Addition of 3 radio heads previously approved  
Property Address: Christian Hill Road (100 Berlin Road) Cromwell, CT (the “Property”)  
Applicant: New Cingular Wireless PCS LLC (“AT&T”)

Dear Ms. Bachman:

AT&T currently maintains a wireless telecommunications facility on an existing 111 foot self support structure (“tower”) location on the Property. AT&T’s facility consists of nine (9) wireless telecommunications antenna at 98 feet. The tower is owned by Cellco Partnership DBA Verizon Wireless. The Council approved the previous application on September 7th 2012 reference number EM-CING-033-120824. This application (attached) granted AT&T the use of 6 radio heads at this location. The approval expired one year from the issue date. During that time AT&T made the changes to the site per the approval but only installed three (3) of the six (6) radio heads that they received approval. AT&T would now like to install the additional three (3) radio heads that were originally approved under EM-CING-033-120824.

Please accept this application as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72 (b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to the Selectman and the Zoning Enforcement Officer for the Town of Cromwell. A copy of this letter is also being sent to Cellco Partnership DBA Verizon Wireless., the owner of the structure that AT&T is located.

The planned modifications to AT&T’s facility fall squarely within those activities explicitly provided for in R.C.S.A. § 16-50j-72(b)(2).

1. The planned modifications will not result in an increase in the height of the existing structure. AT&T’s additional; previously approved 3 radio heads will be installed at 98 foot level of the 111 foot self support structure.
2. The proposed modifications will not involve any changes to ground-mounted equipment and, therefore will not require an extension of the site boundary.
3. The proposed modification will not increase the noise level at the facility by six decibel or more, or to levels that exceed state and local criteria.



4. The operation of the modified facility will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. An RF emissions calculation (attached) for AT&T's modified facility was provided in the application which led to the September 7th 2012 Decision.
5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.
6. The tower and its foundation can support AT&T's proposed modifications. (Please see attached Structural analysis completed by CENTEK Engineering June 14th 2012).

For the foregoing reasons AT&T respectfully requests that the proposed addition of 3 radio heads previously approved be allowed within the exempt modifications under R.C.S.A. § 16-50j-72(b)(2).

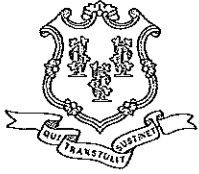
Sincerely,

A handwritten signature in cursive script that reads "David P. Cooper".

David P. Cooper  
Director of Site Acquisition  
Empire Telecom

CC Selectman and the Zoning Enforcement Officer for the Town of Cromwell  
Cellco Partnership DBA Verizon Wireless

CT5144



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)

September 7, 2012

Jennifer Young Gaudet  
HPC Wireless Services  
46 Mill Plain Road, Floor 2  
Danbury, CT 06811

RE: **EM-CING-033-120824** – New Cingular Wireless PCS, LLC notice of intent to modify an existing telecommunications facility located at Christian Hill Road (100 Berlin Road), Cromwell, Connecticut.

Dear Ms. Gaudet:

The Connecticut Siting Council (Council) hereby acknowledges your notice to modify this existing telecommunications facility, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies with the following conditions:

- Any deviation from the proposed modification as specified in this notice and supporting materials with Council shall render this acknowledgement invalid;
- Any material changes to this modification as proposed shall require the filing of a new notice with the Council;
- Not less than 45 days after completion of construction, the Council shall be notified in writing that construction has been completed;
- The validity of this action shall expire one year from the date of this letter; and
- The applicant may file a request for an extension of time beyond the one year deadline provided that such request is submitted to the Council not less than 60 days prior to the expiration;

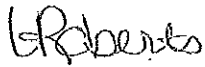
The proposed modifications including the placement of all necessary equipment and shelters within the tower compound are to be implemented as specified here and in your notice dated August 22, 2012. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

This decision is under the exclusive jurisdiction of the Council. Please be advised that the validity of this action shall expire one year from the date of this letter. Any additional change to this facility will require explicit notice to this agency pursuant to Regulations of Connecticut State Agencies Section 16-50j-73. Such notice shall include all relevant information regarding



the proposed change with cumulative worst-case modeling of radio frequency exposure at the closest point of uncontrolled access to the tower base, consistent with Federal Communications Commission, Office of Engineering and Technology, Bulletin 65. Thank you for your attention and cooperation.

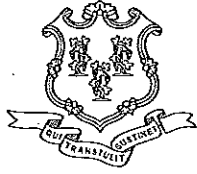
Very truly yours,



Linda Roberts  
Executive Director

LR/CDM/cm

c: The Honorable Mertie Terry, First Selectman, Town of Cromwell  
Frederic Curtin, Zoning Enforcement Officer, Town of Cromwell  
Kenneth Baldwin, Robinson & Cole



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/esc](http://www.ct.gov/esc)

August 24, 2012

The Honorable Mertie Terry  
First Selectman  
Town of Cromwell  
41 West Street  
Cromwell, CT 06416

RE: **EM-CING-033-120824** – New Cingular Wireless PCS, LLC notice of intent to modify an existing telecommunications facility located at Christian Hill Road (100 Berlin Road), Cromwell, Connecticut.

Dear First Selectman Terry:

The Connecticut Siting Council (Council) received this request to modify an existing telecommunications facility, pursuant to Regulations of Connecticut State Agencies Section 16-50j-72.

If you have any questions or comments regarding this proposal, please call me or inform the Council by September 7, 2012.

Thank you for your cooperation and consideration.

Very truly yours,

Linda Roberts  
Executive Director

LR/cm

Enclosure: Notice of Intent

c: Frederic Curtin, Zoning Enforcement Officer, Town of Cromwell



EM-CING-033-120824

C Wireless Services  
Hill Plain Rd.  
2  
ry, CT, 06811  
1.797.1112

ORIGINAL

August 22, 2012

**VIA OVERNIGHT COURIER**

**RECEIVED**  
AUG 24 2012

Connecticut Siting Council  
10 Franklin Square  
New Britain, Connecticut 06051  
Attn: Ms. Linda Roberts, Executive Director

CONNECTICUT  
SITING COUNCIL

Re: New Cingular Wireless PCS, LLC – Exempt Modification  
Christian Hill Road (100 Berlin Road), Cromwell, Connecticut

Dear Ms. Roberts:

This letter and attachments are submitted on behalf of New Cingular Wireless PCS, LLC (“AT&T”). AT&T is making modifications to certain existing sites in its Connecticut system in order to implement LTE technology. Please accept this letter and attachments as notification, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies (“R.C.S.A.”), of construction that 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 the Town of Cromwell.

AT&T plans to modify the existing wireless communications facility controlled by Cellco Partnership d/b/a Verizon Wireless and located off of Christian Hill Road (a/k/a 100 Berlin Road), Cromwell (coordinates 41°-36’-20.5” N, 72°-42’-04.93” W). Attached are a compound plan and elevation depicting the planned changes, and documentation of the structural sufficiency of the structure to accommodate the revised antenna configuration. Also included is a power density report 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 will add three (3) LTE panel antennas to the existing platform at a center line of approximately 98’. Six (6) RRUS (remote radio units) and a surge arrestor will be stack mounted to existing pipes behind the LTE antennas. AT&T will also place a DC power and fiber run from the equipment to the antennas along the existing coaxial cable

Ms. Linda Roberts  
August 22, 2012  
Page 2

run. These changes will not extend the height of the approximately 111' structure including antennas.

2. AT&T will stack two cabinets on a proposed 4' x 4' concrete pad adjacent to the existing AT&T equipment pad, and will mount a new GPS antenna to the existing steel canopy. These changes will be within the existing compound and will have no effect on the site boundaries.

3. The proposed changes will not increase the noise level at the existing facility by six (6) 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 on the attached report prepared by C Squared Systems, LLC, AT&T's operations at the site will result in a power density of approximately 3.35%; the combined site operations will result in a total power density of approximately 66.89%.

Please feel free to contact me by phone at (860) 798-7454 or by e-mail at [jgaudet@hpcwireless.com](mailto:jgaudet@hpcwireless.com) with questions concerning this matter. Thank you for your consideration.

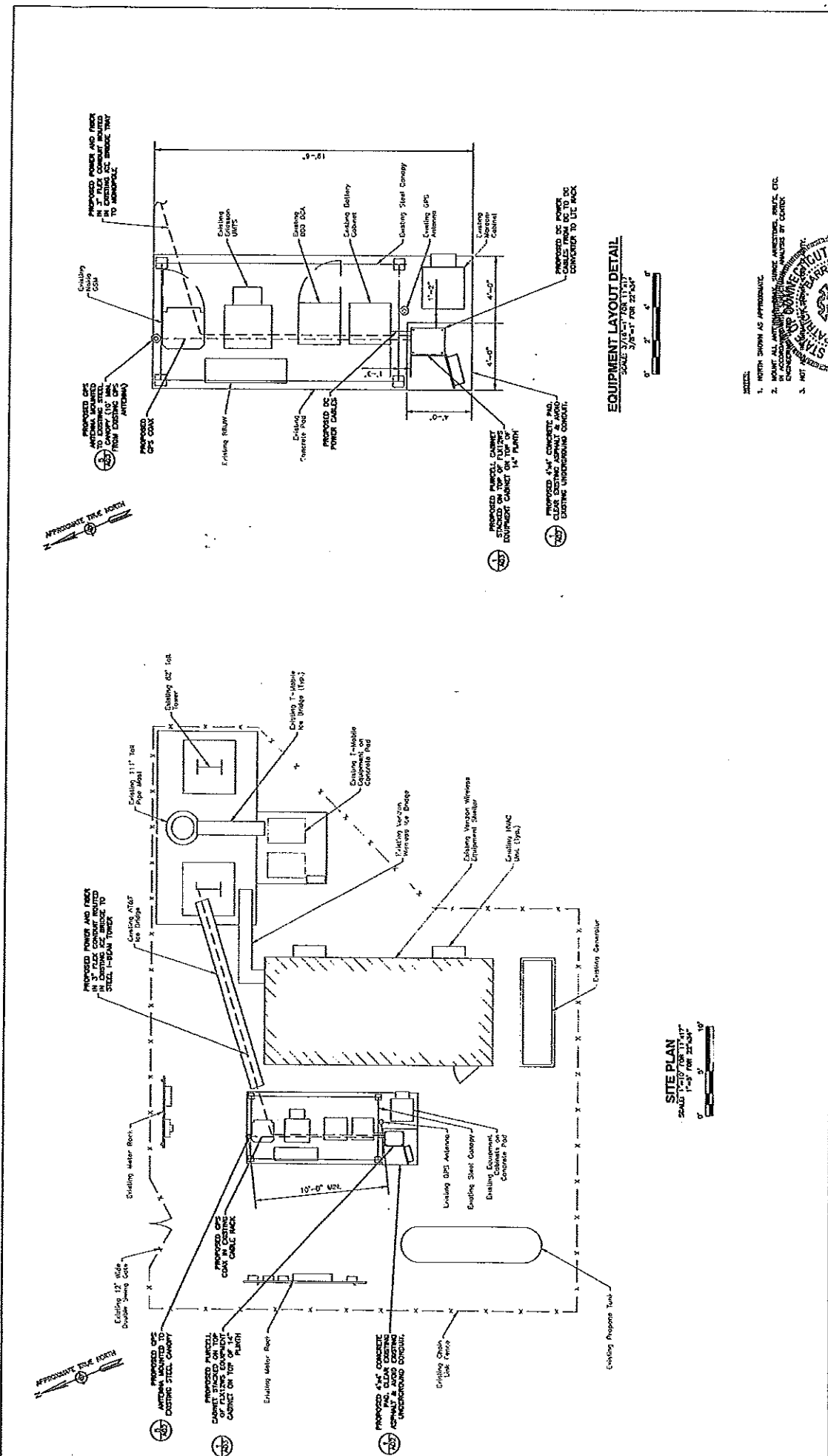
Respectfully yours,



Jennifer Young Gaudet

#### Attachments

cc: Honorable Mertie Terry, First Selectman, Town of Cromwell  
Shaner SPE Associates, LLP (underlying property owner)



**EQUIPMENT LAYOUT DETAIL**  
 SCALE: 3/8" = 1' FOR 24" x 36"

**SITE PLAN**  
 SCALE: 1/8" = 1' FOR 11' x 11'

- NOTES:
1. NORTH SHOWN AS APPROXIMATE.
  2. MONITOR ALL ANTENNAS, SWIRL ANTENNAS, RACKS, ETC. FOR CORROSION AND MAKE NECESSARY ANALYSIS BY CORROSION ENGINEER.
  3. NOT TO SCALE.



NO.	DATE	REVISIONS	BY	CHK'D	APP'D
1	08/17/12	FIELD ONE CONSTRUCTION	JDF	JDF	JDF
0	03/05/12	PRELIMINARY SUBMISSION	JDF	JDF	JDF

SCALE: AS SHOWN    PREPARED BY: GMM    DRAWN BY: JDF

**at&t**

200 ENTERPRISE DRIVE  
 SUITE 3A  
 ROCKY HILL, CT 06007

**CROMWELL SOUTH**  
 SITE NO. CT15144  
 100 CHRISTIAN HILL ROAD  
 CROMWELL, CT 06416

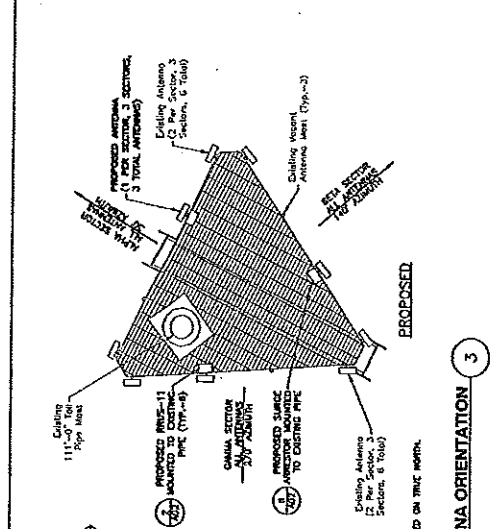
**NEXLINK**  
 600 MARSHALL ROAD, SUITE 100A  
 WINDSOR, CT 06095

**Dewberry**  
 Dewberry Engineers Inc.  
 100 WASHINGTON STREET  
 SUITE 201  
 FARMINGTON, CONNECTICUT  
 06030  
 TEL: 860.673.8778

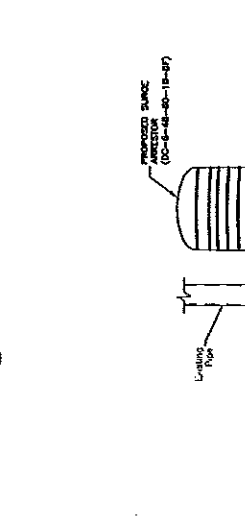
SITE PLAN & EQUIPMENT LAYOUT

DRAWING NO.	500-463-47/500-463-50
COWARD NUMBER	AD1
REV.	0

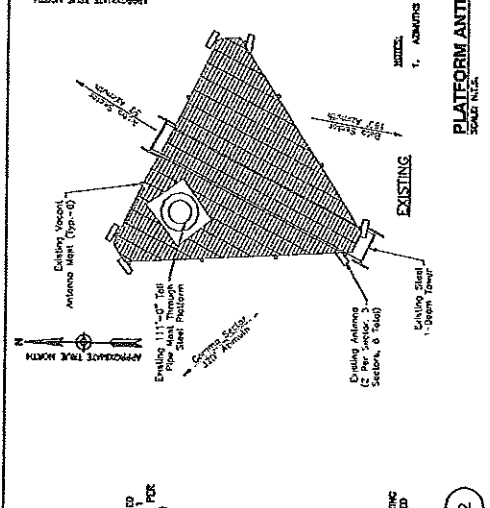




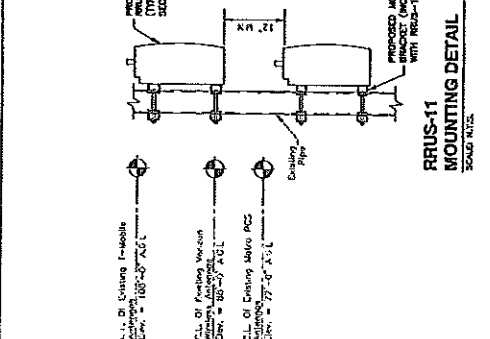
**1**  
CONCRETE PAD DETAIL  
SCALE: 1/4" = 1'-0"



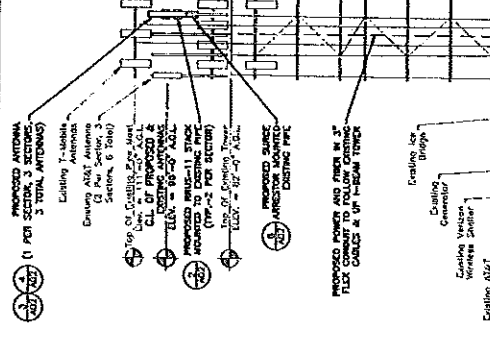
**2**  
ELEVATION LOOKING WEST  
SCALE: 1/4" = 1'-0"



**3**  
ISOMETRIC ANTENNA DETAIL  
SCALE: 1/4" = 1'-0"



**4**  
RRUS-11 MOUNTING DETAIL  
SCALE: 1/4" = 1'-0"



**5**  
SURGE ARRESTOR MOUNTING DETAIL  
SCALE: 1/4" = 1'-0"



**6**  
PLATFORM ANTENNA ORIENTATION  
SCALE: 1/4" = 1'-0"

**NOTES:**

1. PRIOR TO START OF ANY WORK, A FORMAL STRUCTURAL ANALYSIS SHALL BE PROVIDED TO THE CITY ENGINEER AND SHALL BE APPROVED IN ACCORDANCE WITH STRUCTURAL ANALYSIS BY THE CITY ENGINEER DATED 06/17/12 AND 06/14/13.
2. ALL ANTENNAS AND MOUNTS SHALL BE INSTALLED HORIZONTALLY FROM EXISTING GPS ANTENNA WITH ATAT APPROVAL.

**NOTES:**

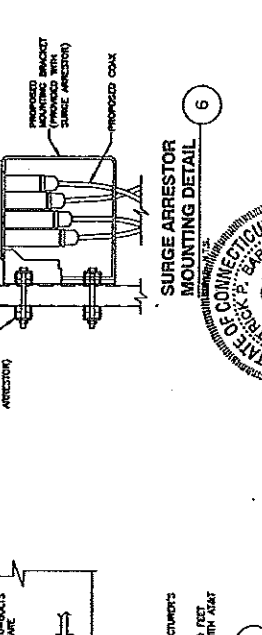
1. PLEASE SEE ADS FOR EXISTING ANTENNA MODEL.
2. FIELD LOCATE GPS ANTENNA A MINIMUM OF 10 FEET HORIZONTALLY FROM EXISTING GPS ANTENNA WITH ATAT APPROVAL.

**NOTES:**

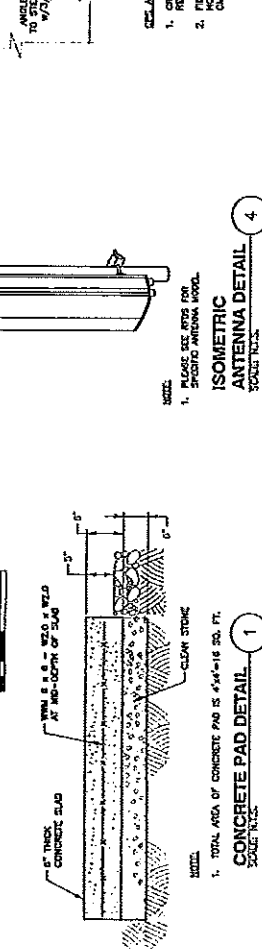
1. TOTAL AREA OF CONCRETE PAD IS 4.64'-18 SQ. FT.

**NOTES:**

1. FIELD LOCATE GPS ANTENNA A MINIMUM OF 10 FEET HORIZONTALLY FROM EXISTING GPS ANTENNA WITH ATAT APPROVAL.



**7**  
GPS ANTENNA  
SCALE: 1/4" = 1'-0"



**8**  
ELEVATION & CONSTRUCTION DETAILS  
SCALE: 1/4" = 1'-0"

**NOTES:**

1. GROUND ANTENNAS AND MOUNTS PER MANUFACTURER'S RECOMMENDATIONS AND AT&T STANDARDS.
2. FIELD LOCATE GPS ANTENNA A MINIMUM OF 10 FEET HORIZONTALLY FROM EXISTING GPS ANTENNA WITH ATAT APPROVAL.

**at&t**  
100 CHRISTIAN HILL ROAD  
CROMWELL, CT 06418

**Dewberry**  
Dewberry Engineers Inc.  
100 WINDSOR ROAD  
WINDSOR, CT 06097

**NEXLINK**  
80 MARSHALL PIKE ROAD, #1A  
WINDSOR, CT 06097

**STATE OF CONNECTICUT**  
PUBLIC ENGINEER  
PAUL J. BROWN

**PROFESSIONAL ENGINEER**

NO.	DATE	ISSUED BY:	DESIGNED BY:	DRAWN BY:	DATE
1	08/17/13	DESIGNED FOR CONSTRUCTION	DESIGNED FOR CONSTRUCTION	DESIGNED FOR CONSTRUCTION	DESIGNED FOR CONSTRUCTION
2	03/20/13	PRELIMINARY SUBMISSION	PRELIMINARY SUBMISSION	PRELIMINARY SUBMISSION	PRELIMINARY SUBMISSION

PROJECT NO.: 500-60447/30044389  
CONTRACT NUMBER: AIZ  
0

**CEN TEK** engineering

Centered on Solutions™

**Structural Analysis Report**

*82' Sign Structure w/ 111' Pipe Mast*

*Proposed AT&T Mobility  
Antenna Upgrade*

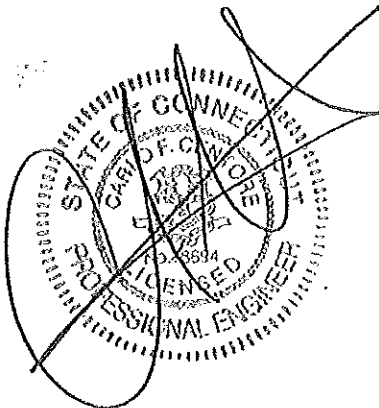
*AT&T Mobility Site Ref: CT5144*

*Verizon Site Ref: Cromwell SW*

*100 Berlin Road  
Cromwell, CT*

*Centek Project No. 12044.C02*

*Date: June 14, 2012*



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

CENTEK engineering, Inc.  
Structural Analysis – 82' Sign Structure  
AT&T Mobility Antenna Upgrade – CT5144  
Cromwell, CT  
June 14, 2012

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CENTEK engineering, Inc.  
Structural Analysis – 82' Sign Structure  
AT&T Mobility Antenna Upgrade – CT5144  
Cromwell, CT  
June 14, 2012

## Introduction

The purpose of this report is to summarize the results of the non-linear, P- $\Delta$  structural analysis of the antenna installation proposed by AT&T Mobility on the existing 82-ft sign structure located in Cromwell, Connecticut.

The host structure is a 82-ft sign structure with a 111-ft pipe mast. The existing structure geometry, member sizes and foundation system were obtained from a previous structural design report prepared by Centek (Formally Natcomm) job no. 10001.CO7 dated December 3, 2009. Antenna and appurtenance information were obtained from the aforementioned Centek structural analysis report, visual verification from grade by Centek personnel on April 26, 2012 and a RF data sheet.

The structure is made up of two (2) W24x68 vertical steel legs, one (1) HSS18x0.5 steel pipe mast, L5x5x5/16 horizontal and diagonal steel bracing and WT6x15 steel bracing.

AT&T proposes the installation of three (3) panel antennas, six (6) RRU's and one (1) Surge Arrestor mounted to the existing pipe masts on the Verizon Wireless 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 structure was designed to support several communication antennas. The existing, proposed and future loads considered in this analysis consist of the following:

- T-MOBILE: (Existing)  
Antennas: Six (6) RFS APX16DWV-16DWVS-E-A20 panel antennas and nine (9) Andrew OneBase Twin Dual Duplex TMA's on a low profile platform mounted on a 111-ft pipe mast with a RAD center elevation of 108-ft AGL.  
Coax Cables: Eighteen (18) 1-5/8"  $\varnothing$  coax cables, nine (9) within existing 111-ft pipe mast and nine (9) on the exterior of the pipe mast.
- VERIZON: (Existing To Remain)  
Antennas: Four (4) Decibel DB846F65ZAXY, two (2) Antel LPA-80080/6CF, three (3) Antel BXA-70063-6CF, and six (6) Decibel 948F85T2E-M\_2 panel antennas with a RAD center elevation of 88-ft AGL.  
Coax Cables: Eighteen (18) 1-5/8"  $\varnothing$  coax cables run on the exterior of the existing sign structure.
- MetroPCS (Existing)  
Antennas: Three (3) RFS APXV18-206517S-C panel antennas mounted to the steel flanges (legs) of the existing sign structure with a RAD center elevation of 77-ft AGL.  
Coax Cable: Six (6) 1-5/8"  $\varnothing$  coaxial cables vertically supported on the existing legs of the sign structure.

CENTEK engineering, Inc.  
Structural Analysis – 82' Sign Structure  
AT&T Mobility Antenna Upgrade – CT5144  
Cromwell, CT  
June 14, 2012

- T-MOBILE (Existing/Reserved)  
Antennas: One (1) VIC-100 GPS antenna on a side arm mounted to the leg of the sign structure with a RAD center elevation of 50-ft AGL.  
Coax Cables: One (1) 1/2" Ø coax cable run on the exterior of the existing sign structure.
- AT&T: (Existing)  
Antennas: Six (6) Powerwave 7770.00 panel antennas and twelve (12) Powerwave LPG21401 TMA's mounted on pipe mounts to the existing Verizon Wireless low profile platform with a RAD center elevation of 98-ft AGL.  
Coax Cables: Twelve (12) 1-5/8" Ø coax cables run on the exterior of existing sign structure.
- AT&T (PROPOSED):  
Antennas: Three (3) KMW AM-X-CD-16-65-00T panel antennas, six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted on pipe mounts to the existing Verizon Wireless low profile platform with a RAD center elevation of 98-ft AGL.  
Coax Cables: One (1) fiber cable and two (2) dc control cables running on the exterior of existing sign structure.

### Primary Assumptions Used in the Analysis

- The structure's theoretical capacity not including any assessment of the condition of the tower.
- The structure carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Structure is properly installed and maintained.
- Structure is in plumb condition.
- Structure 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 structure 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 structure 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.

CENTEK engineering, Inc.  
Structural Analysis – 82' Sign Structure  
AT&T Mobility Antenna Upgrade – CT5144  
Cromwell, CT  
June 14, 2012

## 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:	Middlesex; v = 85 mph (fastest mile)	[Section 16 of TIA/EIA-222-F-96]
	Cromwell; v = 100 mph (3 second gust) equivalent to v = 80 mph (fastest mile)	[Appendix K of the 2005 CT Building Code Supplement]
	<i>TIA/EIA-222-F and Appendix K wind speeds 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

<sup>1</sup> The 2005 Connecticut State Building Code as amended by the 2009 CT State Supplement. (CSBC)

CENTEK engineering, Inc.  
 Structural Analysis – 82' Sign Structure  
 AT&T Mobility Antenna Upgrade – CT5144  
 Cromwell, CT  
 June 14, 2012

### Structure Capacity

Member stresses were calculated utilizing the structural analysis software RISA-3D. 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 6, per RISA-3D "Steel Code Checks", this structure was found to be at **98.3%** of its total capacity.

Tower Section	Location	Stress Ratio (percentage of capacity)	Result
Leg 2	1.25'	98.3%	PASS

### Foundation and Anchors

The existing foundation consists of an 55-ft long (approx) x 8.5-ft wide x 3-ft deep reinforced concrete strip footing with concrete column pedestals. The sub-grade conditions used in the analysis of the existing foundation were based on normal soil values as permitted by EIA/TIA-222-F Section 7.1.3. The base of the sign structure is connected to the foundation by means of (20) 1"Ø, (assumed ASTM A-615-75) anchor bolts embedded into the existing concrete foundation. The base of the communications pipe structure is connected to the foundation by means of (10) 1.75"Ø, ASTM A615-75 anchor bolts embedded into the existing concrete foundation.

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 foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2	Proposed Loading	Result
Reinf. Conc. Pad w/ Pedestals	OTM	2.0	3.7	PASS

Note: OTM denotes Overturning Moment

- The structure anchor bolts, base plate and flange plates were found to be within allowable limits.

Structure Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts (Mast)	Tension	56.7%	PASS
Base Plate (Mast)	Bending	42.8%	PASS
Flange Bolts	Tension	70.0%	PASS
Flange Plate	Bending	60.6%	PASS
Anchor Bolts (Leg)	Tension	52.3%	PASS
Base Plate (Leg)	Bending	95.0%	PASS

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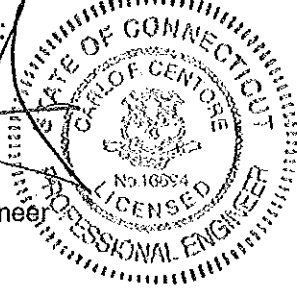
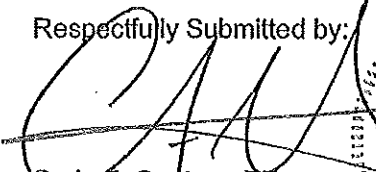
### Conclusion

This analysis shows that the subject structure 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 Mobility. If the existing conditions are different than the information in this report, Centek Engineering must be contacted for resolution of any potential issues.

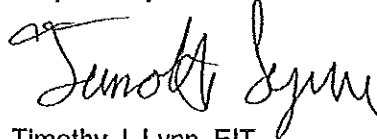
Please feel free to call with any questions or comments.

Respectfully Submitted by:



Carlo F. Centore, PE  
Principal ~ Structural Engineer

Prepared by:



Timothy J. Lynn, EIT  
Structural Engineer



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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.

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## GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM ~ RISA-3D

RISA-3D Structural Analysis Program is an integrated structural analysis and design software package for buildings, bridges, tower structures, etc.

### Modeling Features:

- Comprehensive CAD-like graphic drawing/editing capabilities that let you draw, modify and load elements as well as snap, move, rotate, copy, mirror, scale, split, merge, mesh, delete, apply, etc.
- Versatile drawing grids (orthogonal, radial, skewed)
- Universal snaps and object snaps allow drawing without grids
- Versatile general truss generator
- Powerful graphic select/unselect tools including box, line, polygon, invert, criteria, spreadsheet selection, with locking
- Saved selections to quickly recall desired selections
- Modification tools that modify single items or entire selections
- Real spreadsheets with cut, paste, fill, math, sort, find, etc.
- Dynamic synchronization between spreadsheets and views so you can edit or view any data in the plotted views or in the spreadsheets
- Simultaneous view of multiple spreadsheets
- Constant in-stream error checking and data validation
- Unlimited undo/redo capability
- Generation templates for grids, disks, cylinders, cones, arcs, trusses, tanks, hydrostatic loads, etc.
- Support for all units systems & conversions at any time
- Automatic interaction with RISASection libraries
- Import DXF, RISA-2D, STAAD and ProSteel 3D files
- Export DXF, SDNF and ProSteel 3D files

### Analysis Features:

- Static analysis and P-Delta effects
- Multiple simultaneous dynamic and response spectra analysis using Gupta, CQC or SRSS mode combinations
- Automatic inclusion of mass offset (5% or user defined) for dynamic analysis
- Physical member modeling that does not require members to be broken up at intermediate joints
- State of the art 3 or 4 node plate/shell elements
- High-end automatic mesh generation — draw a polygon with any number of sides to create a mesh of well-formed quadrilateral (NOT triangular) elements.
- Accurate analysis of tapered wide flanges - web, top and bottom flanges may all taper independently
- Automatic rigid diaphragm modeling
- Area loads with one-way or two-way distributions
- Multiple simultaneous moving loads with standard AASHTO loads and custom moving loads for bridges, cranes, etc.
- Torsional warping calculations for stiffness, stress and design
- Automatic Top of Member offset modeling
- Member end releases & rigid end offsets
- Joint master-slave assignments
- Joints detachable from diaphragms

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- Enforced joint displacements
- 1-Way members, for tension only bracing, slipping, etc.
- 1-Way springs, for modeling soils and other effects
- Euler members that take compression up to their buckling load, then turn off.
- Stress calculations on any arbitrary shape
- Inactive members, plates, and diaphragms allows you to quickly remove parts of structures from consideration
- Story drift calculations provide relative drift and ratio to height
- Automatic self-weight calculations for members and plates
- Automatic subgrade soil spring generator

Graphics Features:

- Unlimited simultaneous model view windows
- Extraordinary "true to scale" rendering, even when drawing
- High-speed redraw algorithm for instant refreshing
- Dynamic scrolling stops right where you want
- Plot & print virtually everything with color coding & labeling
- Rotate, zoom, pan, scroll and snap views
- Saved views to quickly restore frequent or desired views
- Full render or wire-frame animations of deflected model and dynamic mode shapes with frame and speed control
- Animation of moving loads with speed control
- High quality customizable graphics printing

Design Features:

- Designs concrete, hot rolled steel, cold formed steel and wood
- ACI 1999/2002, BS 8110-97, CSA A23.3-94, IS456:2000, EC 2-1992 with consistent bar sizes through adjacent spans
- Exact integration of concrete stress distributions using parabolic or rectangular stress blocks
- Concrete beam detailing (Rectangular, T and L)
- Concrete column interaction diagrams
- Steel Design Codes: AISC ASD 9th, LRFD 2nd & 3rd, HSS Specification, CAN/CSA-S16.1-1994 & 2004, BS 5950-1-2000, IS 800-1984, Euro 3-1993 including local shape databases
- AISI 1999 cold formed steel design
- NDS 1991/1997/2001 wood design, including Structural Composite Lumber, multi-ply, full sawn
- Automatic spectra generation for UBC 1997, IBC 2000/2003
- Generation of load combinations: ASCE, UBC, IBC, BOCA, SBC, ACI
- Unbraced lengths for physical members that recognize connecting elements and full lengths of members
- Automatic approximation of K factors
- Tapered wide flange design with either ASD or LRFD codes
- Optimization of member sizes for all materials and all design codes, controlled by standard or user-defined lists of available sizes and criteria such as maximum depths
- Automatic calculation of custom shape properties
- Steel Shapes: AISC, HSS, CAN, ARBED, British, Euro, Indian, Chilean
- Light Gage Shapes: AISI, SSMA, Dale / Incor, Dietrich, MarinoWARE
- Wood Shapes: Complete NDS species/grade database
- Full seamless integration with RISAFoot (Ver 2 or better) for advanced footing design and detailing
- Plate force summation tool

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Results Features:

- Graphic presentation of color-coded results and plotted designs
- Color contours of plate stresses and forces with quadratic smoothing, the contours may also be animated
- Spreadsheet results with sorting and filtering of: reactions, member & joint deflections, beam & plate forces/stresses, optimized sizes, code designs, concrete reinforcing, material takeoffs, frequencies and mode shapes
- Standard and user-defined reports
- Graphic member detail reports with force/stress/deflection diagrams and detailed design calculations and expanded diagrams that display magnitudes at any dialed location
- Saved solutions quickly restore analysis and design results.

**Development of Design Heights, Exposure Coefficients,  
and Velocity Pressures Per TIA/EIA**

**Wind Speeds**

Basic Wind Speed, V	V := 85	mph	
Basic Wind Speed with Ice, V <sub>i</sub>	V <sub>i</sub> := 74	mph	(per TIA/EIA-222-F Section 2.3.16)

**Heights above ground level, z**

Leg Member Section 1 =	z <sub>1</sub> := 10	ft
Leg Member Section 2 =	z <sub>2</sub> := 30	ft
Leg Member Section 3 =	z <sub>3</sub> := 50	ft
Leg Member Section 4 =	z <sub>4</sub> := 70	ft
Bracing Members =	z <sub>Br</sub> := 40	ft

**Exposure Coefficients, k<sub>z</sub>**

(per TIA/EIA-222-F Section 2.3.3)

Leg Member Section 1 =	$Kz_1 := \left(\frac{z_1}{33}\right)^{\frac{2}{7}} = 0.711$
Leg Member Section 2 =	$Kz_2 := \left(\frac{z_2}{33}\right)^{\frac{2}{7}} = 0.973$
Leg Member Section 3 =	$Kz_3 := \left(\frac{z_3}{33}\right)^{\frac{2}{7}} = 1.126$
Leg Member Section 4 =	$Kz_4 := \left(\frac{z_4}{33}\right)^{\frac{2}{7}} = 1.24$
Bracing Members =	$Kz_{Br} := \left(\frac{z_{Br}}{33}\right)^{\frac{2}{7}} = 1.057$

**Velocity Pressure without ice, q<sub>z</sub>**

(per TIA/EIA-222-F Section 2.3.3)

Leg Member Section 1 =	q <sub>z1</sub> := 0.00256 · K <sub>z1</sub> · V <sup>2</sup> = 13.15
Leg Member Section 2 =	q <sub>z2</sub> := 0.00256 · K <sub>z2</sub> · V <sup>2</sup> = 17.999
Leg Member Section 3 =	q <sub>z3</sub> := 0.00256 · K <sub>z3</sub> · V <sup>2</sup> = 20.827
Leg Member Section 4 =	q <sub>z4</sub> := 0.00256 · K <sub>z4</sub> · V <sup>2</sup> = 22.929
Bracing Members =	q <sub>zBr</sub> := 0.00256 · K <sub>zBr</sub> · V <sup>2</sup> = 19.541

**Velocity Pressure with Ice,  $qzICE$** 

(per TIA/EIA-222-F Section 2.3.3)

Leg Member Section 1 =

$$qzICE_1 := 0.00256 \cdot Kz_1 \cdot V_i^2 = 9.967$$

Leg Member Section 2 =

$$qzICE_2 := 0.00256 \cdot Kz_2 \cdot V_i^2 = 13.642$$

Leg Member Section 3 =

$$qzICE_3 := 0.00256 \cdot Kz_3 \cdot V_i^2 = 15.786$$

Leg Member Section 4 =

$$qzICE_4 := 0.00256 \cdot Kz_4 \cdot V_i^2 = 17.379$$

Bracing Members =

$$qzICE_{Br} := 0.00256 \cdot Kz_{Br} \cdot V_i^2 = 14.811$$

**TIA/EIA Common Factors:**

Gust Response Factor =

$$G_H := 1.69$$

(per TIA/EIA-222-F Section 2.3.4)

Gust Response Factor Multiplier =

$$m := 1.25$$

(per TIA/EIA-222-F Section 2.3.4.4)

Radial Ice Thickness =

$$I_r := 0.50$$

in

(per TIA/EIA-222-F Section 2.3.1)

Radial Ice Density =

$$I_d := 56.00$$

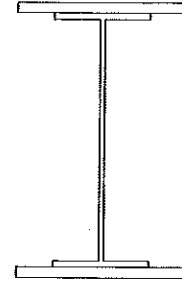
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Development of Wind & Ice Load on W24x68 w/ Plate

(per TIA/EIA-222-F-1996 Criteria)

W24x68 w/ Plate Data:

Shape =	Flat
Depth =	$d := 25.75$ in
Length =	$L := 20$ ft
Flange Width =	$b_f := 16$ in
Flange Thickness =	$t_f := 2.585$ in
Web Thickness =	$t_w := .415$ in
Member Cross Sectional Area =	$A_{member} := 52.1$ in <sup>2</sup>



Gravity Loads (without ice)

Weight of the Member =	Self Weight	(Computed internally by Risa-3D)	plf	BLC 1
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Gravity Loads (ice only)

Ice Area per Linear Foot =	$A_{i\_member} := 2(t_f + 2lr)(b_f + 2lr) + (d - 2t_f - 2lr)(t_w + 2lr) - A_{member} = 97.5$
Weight of Ice on Member =	$W_{ICE\_member} := Id \cdot \frac{A_{i\_member}}{144} = 38$ plf BLC 3

Wind Perpendicular to Flange:

Member Aspect Ratio =	$A_r\_member := \frac{12L}{b_f} = 15.0$
Member Force Coefficient =	$C_a\_member = 1.67$ (per TIA/EIA-222-F Table 3)

Wind Load (without ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Flange Projected Surface Area =	$A_{member} := \frac{b_f}{12} = 1.333$ ft
Section 1 Flange Wind Force =	$qz_1 G_H C_a\_member A_{member} = 49$ plf BLC 7

Wind Load (with ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Flange Projected Surface Area w/ Ice =	$A_{ICE\_member} := \frac{(b_f + 2lr)}{12} = 1.417$ ft
Section 1 Flange Wind Force w/ Ice =	$qz_{ICE} G_H C_a\_member A_{ICE\_member} = 40$ plf BLC 6

Wind Perpendicular to Web

Member Aspect Ratio =  $A_{r\text{member}} := \frac{12L}{d} = 9.3$

Member Force Coefficient =  $C_{a\text{member}} = 1.48$  (per TIA/EIA-222-F Table 3)

Wind Load (without ice) (per TIA/EIA-222-F-1996 Section 2.3.2)

Web Projected Surface Area =  $A_{\text{member}} := \frac{d}{12} = 2.146$  ft

Section 1 Web Wind Force =  $qz_1 G_H C_{a\text{member}} A_{\text{member}} = 70$  plf **BLC 5**

Wind Load (with ice) (per TIA/EIA-222-F-1996 Section 2.3.2)

Web Projected Surface Area w/ Ice =  $A_{ICE\text{member}} := \frac{(d + 2 \cdot I_r)}{12} = 2.229$  ft

Section 1 Web Wind Force w/ Ice =  $qz_{ICE} G_H C_{a\text{member}} A_{ICE\text{member}} = 55$  plf **BLC 4**

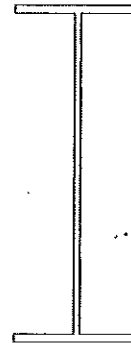


Development of Wind & Ice Load on W24x68

(per TIA/EIA-222-F-1996 Criteria)

W24x68 Data:

Shape =	Flat
Depth =	d := 23.75 in
Length =	L := 20 ft
Flange Width =	b <sub>f</sub> := 9 in
Flange Thickness =	t <sub>f</sub> := .585 in
Web Thickness =	t <sub>w</sub> := .415 in
Member Cross Sectional Area =	A <sub>member</sub> := 20.1 in <sup>2</sup>



Gravity Loads (without ice)

Weight of the Member =	Self Weight	(Computed internally by RIsa-3D)	plf	BLC 1
------------------------	-------------	----------------------------------	-----	-------

Gravity Loads (ice only)

Ice Area per Linear Foot =  $A_{i\ member} := 2(t_f + 2lr)(b_f + 2lr) + (d - 2t_f - 2lr)(t_w + 2lr) - A_{member} = 42.1$

Weight of Ice on Member =  $W_{ICE\_member} := 1d \frac{A_{i\ member}}{144} = 16$  plf BLC 3

Wind Perpendicular to Flange:

Member Aspect Ratio =  $Ar_{member} := \frac{12L}{b_f} = 26.7$

Member Force Coefficient =  $Ca_{member} = 2$  (per TIA/EIA-222-F Tab 3)

Wind Load (without ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Flange Projected Surface Area =  $A_{member} := \frac{b_f}{12} = 0.75$  ft

Section 2 Flange Wind Force =  $qz_2 G_H Ca_{member} A_{member} = 46$  plf BLC 7

Section 3 Flange Wind Force =  $qz_3 G_H Ca_{member} A_{member} = 53$  plf BLC 7

Section 4 Flange Wind Force =  $qz_4 G_H Ca_{member} A_{member} = 58$  plf BLC 7

Wind Load (with ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Flange Projected Surface Area w/ Ice =  $A_{ICE\_member} := \frac{(b_f + 2lr)}{12} = 0.833$  ft

Section 2 Flange Wind Force w/ Ice =  $qz_{ICE2} G_H Ca_{member} A_{ICE\_member} = 38$  plf BLC 6

Section 3 Flange Wind Force w/ Ice =  $qz_{ICE3} G_H Ca_{member} A_{ICE\_member} = 44$  plf BLC 6

Section 4 Flange Wind Force w/ Ice =  $qz_{ICE4} G_H Ca_{member} A_{ICE\_member} = 49$  plf BLC 6

Wind Perpendicular to Web

Member Aspect Ratio =  $Ar_{member} := \frac{12L}{d} = 10.1$

Member Force Coefficient =  $Ca_{member} = 1.5$  (per TIA/EIA-222-F Table 3)

Wind Load (without Ice) (per TIA/EIA-222-F-1996 Section 2.3.2)

Web Projected Surface Area =  $A_{member} := \frac{d}{12} = 1.979$  ft

Section 2 Web Wind Force =  $qz_2 \cdot G_H \cdot Ca_{member} \cdot A_{member} = 91$  plf **BLC 5**

Section 3 Web Wind Force =  $qz_3 \cdot G_H \cdot Ca_{member} \cdot A_{member} = 105$  plf **BLC 5**

Section 4 Web Wind Force =  $qz_4 \cdot G_H \cdot Ca_{member} \cdot A_{member} = 115$  plf **BLC 5**

Wind Load (with Ice) (per TIA/EIA-222-F-1996 Section 2.3.2)

Web Projected Surface Area w/ Ice =  $AICE_{member} := \frac{(d + 2 \cdot Ir)}{12} = 2.063$  ft

Section 2 Web Wind Force w/ Ice =  $qzICE_2 \cdot G_H \cdot Ca_{member} \cdot AICE_{member} = 71$  plf **BLC 4**

Section 3 Web Wind Force w/ Ice =  $qzICE_3 \cdot G_H \cdot Ca_{member} \cdot AICE_{member} = 83$  plf **BLC 4**

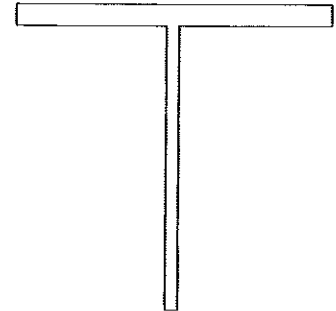
Section 4 Web Wind Force w/ Ice =  $qzICE_4 \cdot G_H \cdot Ca_{member} \cdot AICE_{member} = 91$  plf **BLC 4**

**Development of Wind & Ice Load on WT 6x15**

(per TIA/EIA-222-F-1996 Criteria)

**WT 6x15 Data:**

Shape = Flat  
 Depth =  $d := 6.17$  in  
 Length =  $L := 10$  ft  
 Flange Width =  $b_f := 6.52$  in  
 Flange Thickness =  $t_f := 0.44$  in  
 Web Thickness =  $t_w := 0.26$  in  
 Member Cross Sectional Area =  $A_{member} := 4.4$  in<sup>2</sup>



Member Aspect Ratio =  $Ar_{member} := \frac{12L}{b_f} = 18.4$

Member Force Coefficient =  $Ca_{member} = 1.78$  (per TIA/EIA-222-F Table 3)

**Gravity Loads (without ice)**

Weight of the Member = Self Weight (Computed Internally by Risa-3D) plf BLC 1

**Gravity Loads (ice only)**

Ice Area per Linear Foot =  $Ai_{member} := [(t_f + 2 \cdot lr) \cdot (b_f + 2 \cdot lr) + (d - t_f)(t_w + 2 \cdot lr) - A_{member}] = 13.6$

Weight of Ice on Member =  $W_{ICE\_member} := ld \cdot \frac{Ai_{member}}{144} = 5$  plf BLC 3

**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Member Projected Surface Area =  $A_{member} := \frac{b_f}{12} = 0.543$  ft

Total Member Wind Force =  $qz_{Br} \cdot G_H \cdot Ca_{member} \cdot A_{member} = 32$  plf BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Member Projected Surface Area w/ Ice =  $A_{ICE\_member} := \frac{(b_f + 2 \cdot lr)}{12} = 0.627$  ft

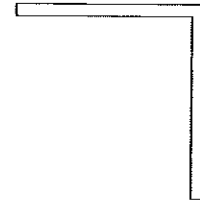
Total Member Wind Force w/ Ice =  $qz_{ICE} \cdot Br \cdot G_H \cdot Ca_{member} \cdot A_{ICE\_member} = 28$  plf BLC 4,6

**Development of Wind & Ice Load on L5x5x16**

(per TIA/EIA-222-F-1996 Criteria)

**L5x5x16 Data:**

Shape = Flat  
Length = L := 32 ft  
Width = b := 5 in  
Thickness = t := 0.3125 in  
Member Cross Sectional Area =  $A_{member} := 3.03 \text{ in}^2$



Member Aspect Ratio =  $Ar_{member} := \frac{12L}{b} = 76.8$

Member Force Coefficient =  $Ca_{member} = 2$  (per TIA/EIA-222-F Table 3)

**Gravity Loads (without ice)**

Weight of the Member = Self Weight (Computed Internally by Risa-3D) pif BLC 1

**Gravity Loads (ice only)**

Ice Area per Linear Foot =  $Ai_{member} := (b - t)(1 + 2 \cdot Ir) + (b + 2 \cdot Ir)(t + 2 \cdot Ir) - A_{member} = 11$

Weight of Ice on Member =  $W_{ICE\_member} := Id \cdot \frac{Ai_{member}}{144} = 4$  pif BLC 3

**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Member Projected Surface Area =  $A_{member} := \frac{b}{12} = 0.417$  ft

Total Member Wind Force =  $qzBr \cdot Gh \cdot Ca_{member} \cdot A_{member} = 28$  pif BLC 7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Member Projected Surface Area w/ Ice =  $A_{ICE\_member} := \frac{(b + 2 \cdot Ir)}{12} = 0.5$  ft

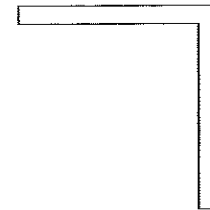
Total Member Wind Force w/ Ice =  $qzICE_{Br} \cdot Gh \cdot Ca_{member} \cdot A_{ICE\_member} = 25$  pif BLC 6

**Development of Wind & Ice Load on L3.5x3.5x5/16**

(per TIA/EIA-222-F-1996 Criteria)

**L3.5x3.5x5/16 Data:**

Shape = Flat  
 Length = L := 20 ft  
 Width = b := 3.5 in  
 Thickness = t := 0.3125 in  
 Member Cross Sectional Area =  $A_{member} := 2.09 \text{ in}^2$



Member Aspect Ratio =  $A_{r\ member} := \frac{12L}{b} = 68.6$

Member Force Coefficient =  $C_{a\ member} = 2$  (per TIA/EIA-222-F Table 3)

**Gravity Loads (without ice)**

Weight of the Member = Self Weight (Computed internally by Risa-3D) plf **BLC 1**

**Gravity Loads (ice only)**

Ice Area per Linear Foot =  $A_{i\ member} := [(b - t)(t + 2 \cdot lr) + (b + 2 \cdot lr)(t + 2 \cdot lr)] - A_{member} = 8$

Weight of Ice on Member =  $W_{ICE\ member} := l_d \cdot \frac{A_{i\ member}}{144} = 3$  plf **BLC 3**

**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Member Projected Surface Area =  $A_{member} := \frac{b}{12} = 0.292$  ft

Total Member Wind Force =  $qz_{Br} \cdot G_H \cdot C_{a\ member} \cdot A_{member} = 19$  plf **BLC 7**

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Member Projected Surface Area w/ Ice =  $A_{ICE\ member} := \frac{(b + 2 \cdot lr)}{12} = 0.375$  ft

Total Member Wind Force w/ Ice =  $qz_{ICE\ Br} \cdot G_H \cdot C_{a\ member} \cdot A_{ICE\ member} = 19$  plf **BLC 6**

**Development of Design Heights, Exposure Coefficients,  
 and Velocity Pressures Per TIA/EIA**

**Wind Speeds**

Basic Wind Speed, V	V := 85	mph	
Basic Wind Speed with Ice, V <sub>i</sub>	V <sub>i</sub> := 74	mph	(per TIA/EIA-222-F Section 2.3.16)

**Heights above ground level, z**

Mast 1 =	z <sub>mast1</sub> := 15	ft
Mast 2 =	z <sub>mast2</sub> := 45	ft
Mast 3 =	z <sub>mast3</sub> := 75	ft
Mast 4 =	z <sub>mast4</sub> := 100	ft
Verizon =	z <sub>vz</sub> := 88	ft
AT&T =	z <sub>att</sub> := 98	ft
T-Mobile =	z <sub>t_mb</sub> := 108	ft
MetroPCS =	z <sub>metro</sub> := 77	ft
GPS =	z <sub>gps</sub> := 50	ft

**Exposure Coefficients, k<sub>z</sub>**

(per TIA/EIA-222-F Section 2.3.3)

Mast 1 =	$K_{z_{mast1}} := \left( \frac{z_{mast1}}{33} \right)^{\frac{2}{7}} = 0.798$
Mast 2 =	$K_{z_{mast2}} := \left( \frac{z_{mast2}}{33} \right)^{\frac{2}{7}} = 1.093$
Mast 3 =	$K_{z_{mast3}} := \left( \frac{z_{mast3}}{33} \right)^{\frac{2}{7}} = 1.264$
Mast 4 =	$K_{z_{mast4}} := \left( \frac{z_{mast4}}{33} \right)^{\frac{2}{7}} = 1.373$
Verizon =	$K_{z_{vz}} := \left( \frac{z_{vz}}{33} \right)^{\frac{2}{7}} = 1.323$
AT&T =	$K_{z_{att}} := \left( \frac{z_{att}}{33} \right)^{\frac{2}{7}} = 1.365$
T-Mobile =	$K_{z_{t\_mb}} := \left( \frac{z_{t\_mb}}{33} \right)^{\frac{2}{7}} = 1.403$

$$\text{MetroPCS} = Kz_{\text{metro}} := \left( \frac{z_{\text{metro}}}{33} \right)^{\frac{2}{7}} = 1.274$$

$$\text{GPS} = Kz_{\text{gps}} := \left( \frac{z_{\text{gps}}}{33} \right)^{\frac{2}{7}} = 1.126$$

Velocity Pressure without ice,  $qz$  (per TIA/EIA-222-F Section 2.3.3)

$$\text{Mast 1} = qz_{\text{mast1}} := 0.00256 \cdot Kz_{\text{mast1}} \cdot V^2 = 14.765$$

$$\text{Mast 2} = qz_{\text{mast2}} := 0.00256 \cdot Kz_{\text{mast2}} \cdot V^2 = 20.21$$

$$\text{Mast 3} = qz_{\text{mast3}} := 0.00256 \cdot Kz_{\text{mast3}} \cdot V^2 = 23.386$$

$$\text{Mast 4} = qz_{\text{mast4}} := 0.00256 \cdot Kz_{\text{mast4}} \cdot V^2 = 25.389$$

$$\text{Verizon} = qz_{\text{vz}} := 0.00256 \cdot Kz_{\text{vz}} \cdot V^2 = 24.478$$

$$\text{AT\&T} = qz_{\text{att}} := 0.00256 \cdot Kz_{\text{att}} \cdot V^2 = 25.243$$

$$\text{T-Mobile} = qz_{\text{t_mb}} := 0.00256 \cdot Kz_{\text{t_mb}} \cdot V^2 = 25.953$$

$$\text{MetroPCS} = qz_{\text{metro}} := 0.00256 \cdot Kz_{\text{metro}} \cdot V^2 = 23.562$$

$$\text{GPS} = qz_{\text{gps}} := 0.00256 \cdot Kz_{\text{gps}} \cdot V^2 = 20.827$$

Velocity Pressure with ice,  $qz_{ICE}$  (per TIA/EIA-222-F Section 2.3.3)

$$\text{Mast 1} = qz_{ICE_{\text{mast1}}} := 0.00256 \cdot Kz_{\text{mast1}} \cdot V_i^2 = 11.191$$

$$\text{Mast 2} = qz_{ICE_{\text{mast2}}} := 0.00256 \cdot Kz_{\text{mast2}} \cdot V_i^2 = 15.318$$

$$\text{Mast 3} = qz_{ICE_{\text{mast3}}} := 0.00256 \cdot Kz_{\text{mast3}} \cdot V_i^2 = 17.725$$

$$\text{Mast 4} = qz_{ICE_{\text{mast4}}} := 0.00256 \cdot Kz_{\text{mast4}} \cdot V_i^2 = 19.243$$

$$\text{Verizon} = qz_{ICE_{\text{vz}}} := 0.00256 \cdot Kz_{\text{vz}} \cdot V_i^2 = 18.553$$

$$\text{AT\&T} = qz_{ICE_{\text{att}}} := 0.00256 \cdot Kz_{\text{att}} \cdot V_i^2 = 19.132$$

$$\text{T-Mobile} = qz_{ICE_{\text{t_mb}}} := 0.00256 \cdot Kz_{\text{t_mb}} \cdot V_i^2 = 19.671$$

$$\text{MetroPCS} = qz_{ICE_{\text{metro}}} := 0.00256 \cdot Kz_{\text{metro}} \cdot V_i^2 = 17.858$$

$$\text{GPS} = qz_{ICE_{\text{gps}}} := 0.00256 \cdot Kz_{\text{gps}} \cdot V_i^2 = 15.786$$

TIA/EIA Common Factors:

Gust Response Factor =	$G_H := 1.69$	(per TIA/EIA-222-F Section 2.3.4)
Gust Response Factor Multiplier =	$m := 1.25$	(per TIA/EIA-222-F Section 2.3.4.4)
Radial Ice Thickness =	$Ir := 0.50$ in	(per TIA/EIA-222-F Section 2.3.1)
Radial Ice Density =	$Id := 56.00$ pcf	

Development of Wind & Ice Load on PCS Mast

(per TIA/EIA-222-F-1996 Criteria)

PCS Mast Data:

Mast Shape =	Round	
Mast Diameter =	$D_{mast} := 18$	in (HSS18x0.5)
Mast Length =	$L_{mast} := 111$	ft
Mast Thickness =	$t_{mast} := .465$	in
Velocity Coefficient =	$C := \left( \sqrt{Kz_{mast1}} \right) \cdot V \cdot \frac{D_{mast}}{12} = 113.918$	
Structure Force Coefficient =	$C_{Fmast} = 0.59$	(per TIA/EIA-222-F Tab 1 for round pde)

Wind Load (without ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Mast Projected Surface Area =	$A_{mast} := \frac{D_{mast}}{12} = 1.5$	sf/ft
Total Mast Wind Force =	$qz_{mast1} \cdot G_H \cdot C_{Fmast} \cdot A_{mast} = 22$	plf BLC 5,7
Total Mast Wind Force =	$qz_{mast2} \cdot G_H \cdot C_{Fmast} \cdot A_{mast} = 30$	plf BLC 5,7
Total Mast Wind Force =	$qz_{mast3} \cdot G_H \cdot C_{Fmast} \cdot A_{mast} = 35$	plf BLC 5,7
Total Mast Wind Force =	$qz_{mast4} \cdot G_H \cdot C_{Fmast} \cdot A_{mast} = 38$	plf BLC 5,7

Wind Load (with ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Mast Projected Surface Area w/ Ice =	$A_{ICE_{mast}} := \frac{(D_{mast} + 2 \cdot I_r)}{12} = 1.583$	sf/ft
Total Mast Wind Force w/ Ice =	$qz_{ICE_{mast1}} \cdot G_H \cdot C_{Fmast} \cdot A_{ICE_{mast}} = 18$	plf BLC 4,6
Total Mast Wind Force w/ Ice =	$qz_{ICE_{mast2}} \cdot G_H \cdot C_{Fmast} \cdot A_{ICE_{mast}} = 24$	plf BLC 4,6
Total Mast Wind Force w/ Ice =	$qz_{ICE_{mast3}} \cdot G_H \cdot C_{Fmast} \cdot A_{ICE_{mast}} = 28$	plf BLC 4,6
Total Mast Wind Force w/ Ice =	$qz_{ICE_{mast4}} \cdot G_H \cdot C_{Fmast} \cdot A_{ICE_{mast}} = 30$	plf BLC 4,6

Gravity Loads (without ice)

Weight of the mast =	Self Weight (Computed internally by Risa-3D)	plf BLC 1
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Gravity Loads (ice only)

Ice Area per Linear Foot =	$A_i_{mast} := \frac{\pi}{4} \left[ (D_{mast} + I_r \cdot 2)^2 - D_{mast}^2 \right] = 29.1$	sq in
Weight of Ice on Mast =	$W_{ICE_{mast}} := I_d \cdot \frac{A_i_{mast}}{144} = 11$	plf BLC 3

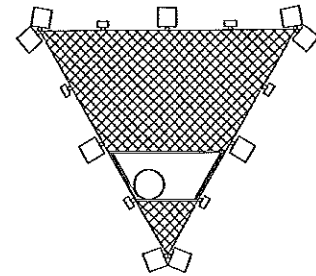


**Development of Wind & Ice Load on Antennas**

(per TIA/EIA-222-F-1996 Criteria)

**Antenna Data:**

Antenna Model =	Antel BXA-70063/6CF	(Verizon)
Antenna Shape =	Flat	
Antenna Height =	$L_{ant} := 71.0$	in
Antenna Width =	$W_{ant} := 11.2$	in
Antenna Thickness =	$T_{ant} := 4.5$	in
Antenna Weight =	$WT_{ant} := 17.0$	lbs
Number of Antennas =	$N_{ant} := 3$	
Antenna Aspect Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 6.3$	
Antenna Force Coefficient =	$Ca_{ant} := 1.4$	(per TIA/EIA-222-F-1996 Table 3)



**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 5.5$	sf
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 16.6$	sf
Total Antenna Wind Force =	$F_{ant} := qz_{vz} \cdot G_H \cdot Ca_{ant} \cdot A_{ant} = 959$	lbs BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 1) \cdot (W_{ant} + 1)}{144} = 6.1$	sf
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 18.3$	sf
Total Antenna Wind Force w/ Ice =	$F_{ant} := qz_{ICE} \cdot v_z \cdot G_H \cdot Ca_{ant} \cdot A_{ICEant} = 803$	lbs BLC 4,6

**Gravity Load (without ice)**

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 51$	lbs BLC 2
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**Gravity Load (ice only)**

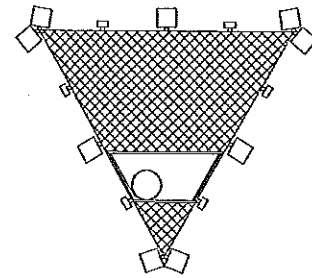
Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 3578$	cu in
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 1) \cdot (W_{ant} + 1) \cdot (T_{ant} + 1) - V_{ant} = 1253$	cu in
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot \rho_d = 41$	lbs
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 122$	lbs BLC 3

**Development of Wind & Ice Load on Antennas**

(per TIA/EIA-222-F-1996 Criteria)

**Antenna Data:**

Antenna Model =	Antel LPA-80080/6CF	(Verizon)
Antenna Shape =	Flat	
Antenna Height =	$L_{ant} := 70.9$	in
Antenna Width =	$W_{ant} := 13.2$	in
Antenna Thickness =	$T_{ant} := 5.5$	in
Antenna Weight =	$WT_{ant} := 21.0$	lbs
Number of Antennas =	$N_{ant} := 2$	
Antenna Aspect Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 5.4$	
Antenna Force Coefficient =	$Ca_{ant} = 1.4$	



(per TIA/EIA-222-F-1996 Table 3)

**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

*Assumes Maximum Possible Wind Pressure on Antennas*

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 6.5$	sf
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 13$	sf
Total Antenna Wind Force =	$F_{ant} := qz_{vz} \cdot G_H \cdot Ca_{ant} \cdot A_{ant} = 753$	lbs BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

*Assumes Maximum Possible Wind Pressure on Antennas*

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 1) \cdot (W_{ant} + 1)}{144} = 7.1$	sf
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 14.2$	sf
Total Antenna Wind Force w/ Ice =	$F_{ant} := qz_{ICEvz} \cdot G_H \cdot Ca_{ant} \cdot A_{ICEant} = 622$	lbs BLC 4,6

**Gravity Load (without ice)**

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 42$	lbs BLC 2
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**Gravity Load (ice only)**

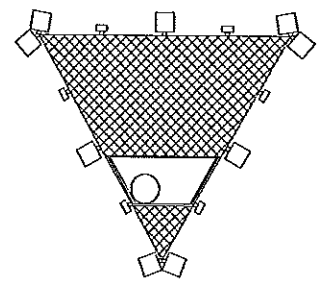
Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 5147$	cu in
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 1) \cdot (W_{ant} + 1) \cdot (T_{ant} + 1) - V_{ant} = 1489$	cu in
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 48$	lbs
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 97$	lbs BLC 3

**Development of Wind & Ice Load on Antennas**

(per TIA/EIA-222-F-1996 Criteria)

**Antenna Data:**

Antenna Model = Decibel DB846F65ZAXY (Verizon)  
 Antenna Shape = Flat  
 Antenna Height =  $L_{ant} := 72$  in  
 Antenna Width =  $W_{ant} := 10$  in  
 Antenna Thickness =  $T_{ant} := 8.5$  in  
 Antenna Weight =  $WT_{ant} := 21$  lbs  
 Number of Antennas =  $N_{ant} := 4$   
 Antenna Aspect Ratio =  $Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 7.2$   
 Antenna Force Coefficient =  $Ca_{ant} = 1.41$



(per TIA/EIA-222-F-1996 Table 3)

**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

*Assumes Maximum Possible Wind Pressure on Antennas*

Surface Area for One Antenna =  $SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 5$  sf  
 Antenna Projected Surface Area =  $A_{ant} := SA_{ant} \cdot N_{ant} = 20$  sf  
 Total Antenna Wind Force =  $F_{ant} := qz_{vz} \cdot G_H \cdot Ca_{ant} \cdot A_{ant} = 1164$  lbs BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

*Assumes Maximum Possible Wind Pressure on Antennas*

Surface Area for One Antenna w/ Ice =  $SA_{ICEant} := \frac{(L_{ant} + 1) \cdot (W_{ant} + 1)}{144} = 5.6$  sf  
 Antenna Projected Surface Area w/ Ice =  $A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 22.3$  sf  
 Total Antenna Wind Force w/ Ice =  $F_{ant} := qz_{ICE} \cdot G_H \cdot Ca_{ant} \cdot A_{ICEant} = 984$  lbs BLC 4,6

**Gravity Load (without ice)**

Weight of All Antennas =  $WT_{ant} \cdot N_{ant} = 84$  lbs BLC 2

**Gravity Load (ice only)**

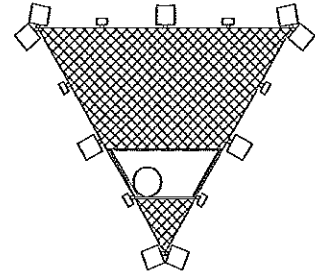
Volume of Each Antenna =  $V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 6120$  cu in  
 Volume of Ice on Each Antenna =  $V_{ice} := (L_{ant} + 1) \cdot (W_{ant} + 1) \cdot (T_{ant} + 1) - V_{ant} = 1509$  cu in  
 Weight of Ice on Each Antenna =  $W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 49$  lbs  
 Weight of Ice on All Antennas =  $W_{ICEant} \cdot N_{ant} = 196$  lbs BLC 3

**Development of Wind & Ice Load on Antennas**

(per TIA/EIA-222-F-1996 Criteria)

**Antenna Data:**

Antenna Model =	Decibel DB948F85T2E-M	(Verizon)
Antenna Shape =	Flat	
Antenna Height =	$L_{ant} := 48$	in
Antenna Width =	$W_{ant} := 7$	in
Antenna Thickness =	$T_{ant} := 3.5$	in
Antenna Weight =	$WT_{ant} := 8.5$	lbs
Number of Antennas =	$N_{ant} := 6$	
Antenna Aspect Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 6.9$	
Antenna Force Coefficient =	$Ca_{ant} = 1.4$	(per TIA/EIA-222-F-1996 Table 3)



**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 2.3$	sf
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 14$	sf
Total Antenna Wind Force =	$F_{ant} := qz_{vz} \cdot G_H \cdot Ca_{ant} \cdot A_{ant} = 811$	lbs BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 1) \cdot (W_{ant} + 1)}{144} = 2.7$	sf
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 16.3$	sf
Total Antenna Wind Force w/ Ice =	$F_{i_{ant}} := qz_{ICE} \cdot G_H \cdot Ca_{ant} \cdot A_{ICEant} = 717$	lbs BLC 4,6

**Gravity Load (without ice)**

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 51$	lbs BLC 2
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**Gravity Load (ice only)**

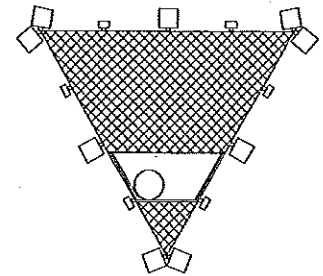
Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 1176$	cu in
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 1) \cdot (W_{ant} + 1) \cdot (T_{ant} + 1) - V_{ant} = 588$	cu in
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot \rho_d = 19$	lbs
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 114$	lbs BLC 3

**Development of Wind & Ice Load on Platform**

(per TIA/EIA-222-F-1996 Criteria)

**Platform Data:**

Platform Model =	13' Platform w/ Handrails	(Verizon)
Platform Shape =	Flat	
(Force Coefficient Value Included in Area) Platform Area =	$CaA_{plt} = 31.3$	sq ft
(Force Coefficient Value Included in Area) Platform Area w/ Ice =	$CaA_{ICEplt} = 40.2$	sq ft
Platform Weight =	$WT_{plt} = 1822$	lbs
Platform Weight w/ Ice =	$WT_{ICEplt} = 2452$	lbs



**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Total Platform Wind Force =  $F_{plt} = qz_{vz} \cdot G_H \cdot CaA_{plt} = 1295$  lbs **BLC 5,7**

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Total Platform Wind Force w/ Ice =  $F_{plt} = qz_{ICE} \cdot G_H \cdot CaA_{ICEplt} = 1260$  lbs **BLC 4,6**

**Gravity Load (without ice)**

Weight of Platform =  $WT_{plt} = 1822$  lbs **BLC 2**

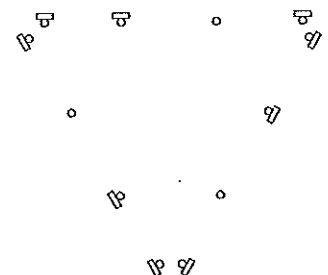
**Gravity Load (ice only)**

Weight of Ice on Platform =  $WT_{ICEplt} - WT_{plt} = 630$  lbs **BLC 3**

Development of Wind & Ice Load on Antennas

(per TIA/EIA-222-F-1996 Criteria)

**Antenna Data:**

Antenna Model =	Powerwave 7770	(AT&T)	
Antenna Shape =	Flat		
Antenna Height =	L <sub>ant</sub> := 55	in	
Antenna Width =	W <sub>ant</sub> := 11	in	
Antenna Thickness =	T <sub>ant</sub> := 5	in	
Antenna Weight =	WT <sub>ant</sub> := 35	lbs	
Number of Antennas =	N <sub>ant</sub> := 6		
Antenna Aspect Ratio =	A <sub>r ant</sub> := $\frac{L_{ant}}{W_{ant}} = 5.0$		
Antenna Force Coefficient =	Ca <sub>ant</sub> = 1.4		(per TIA/EIA-222-F-1996 Table 3)

Wind Load (without ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna =	SA <sub>ant</sub> := $\frac{L_{ant} \cdot W_{ant}}{144} = 4.2$	sf	
Antenna Projected Surface Area =	A <sub>ant</sub> := SA <sub>ant</sub> · N <sub>ant</sub> = 25.2	sf	
Total Antenna Wind Force =	F <sub>ant</sub> := qz <sub>ant</sub> · G <sub>H</sub> · Ca <sub>ant</sub> · A <sub>ant</sub> = 1506	lbs	BLC 5,7

Wind Load (with ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna w/ Ice =	SA <sub>ICEant</sub> := $\frac{(L_{ant} + 1) \cdot (W_{ant} + 1)}{144} = 4.7$	sf	
Antenna Projected Surface Area w/ Ice =	A <sub>ICEant</sub> := SA <sub>ICEant</sub> · N <sub>ant</sub> = 28	sf	
Total Antenna Wind Force w/ Ice =	F <sub>ant</sub> := qz <sub>ICEant</sub> · G <sub>H</sub> · Ca <sub>ant</sub> · A <sub>ICEant</sub> = 1267	lbs	BLC 4,6

Gravity Load (without ice)

Weight of All Antennas =	WT <sub>ant</sub> · N <sub>ant</sub> = 210	lbs	BLC 2
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
Gravity Load (ice only)

Volume of Each Antenna =	V <sub>ant</sub> := L <sub>ant</sub> · W <sub>ant</sub> · T <sub>ant</sub> = 3025	cu in	
Volume of Ice on Each Antenna =	V <sub>ice</sub> := (L <sub>ant</sub> + 1) · (W <sub>ant</sub> + 1) · (T <sub>ant</sub> + 1) - V <sub>ant</sub> = 1007	cu in	
Weight of Ice on Each Antenna =	W <sub>ICEant</sub> := $\frac{V_{ice}}{1728} \cdot \rho_{ice} = 33$	lbs	
Weight of Ice on All Antennas =	W <sub>ICEant</sub> · N <sub>ant</sub> = 196	lbs	BLC 3

**Development of Wind & Ice Load on Antennas**

(per TIA/EIA-222-F-1996 Criteria)

**Antenna Data:**

Antenna Model =	KMW AM-X-Cd-16.65-00T	(AT&T)
Antenna Shape =	Flat	
Antenna Height =	$L_{ant} := 72$	in
Antenna Width =	$W_{ant} := 11.8$	in
Antenna Thickness =	$T_{ant} := 5.9$	in
Antenna Weight =	$WT_{ant} := 49$	lbs
Number of Antennas =	$N_{ant} := 3$	
Antenna Aspect Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 6.1$	
Antenna Force Coefficient =	$C_{eant} := 1.4$	(per TIA/EIA-222-F-1996 Table 3)

**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

*Assumes Maximum Possible Wind Pressure on Antennas*

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 5.9$	sf
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 17.7$	sf
Total Antenna Wind Force =	$F_{ant} := qz_{ant} \cdot G_H \cdot C_{eant} \cdot A_{ant} = 1057$	lbs BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

*Assumes Maximum Possible Wind Pressure on Antennas*

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 1)(W_{ant} + 1)}{144} = 6.5$	sf
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 19.5$	sf
Total Antenna Wind Force w/ Ice =	$F_{ant} := qz_{ICEant} \cdot G_H \cdot C_{eant} \cdot A_{ICEant} = 881$	lbs BLC 4,6

**Gravity Load (without ice)**

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 147$	lbs BLC 2
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**Gravity Load (ice only)**

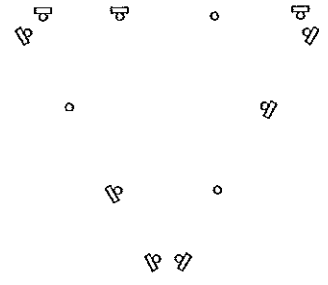
Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 5013$	cu in
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 1)(W_{ant} + 1)(T_{ant} + 1) - V_{ant} = 1435$	cu in
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot \rho_d = 46$	lbs
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 139$	lbs BLC 3

**Development of Wind & Ice Load on TMA's**

(per TIA/EIA-222-F-1998 Criteria)

**TMA Data:**

TMA Model =	Powerwave LGP214	(AT&T)
TMA Shape =	Flat	
TMA Height =	$L_{TMA} := 14.4$	in
TMA Width =	$W_{TMA} := 9.2$	in
TMA Thickness =	$T_{TMA} := 2.6$	in
TMA Weight =	$WT_{TMA} := 14.1$	lbs
Number of TMA's =	$N_{TMA} := 12$	
TMA Aspect Ratio =	$Ar_{TMA} := \frac{L_{TMA}}{W_{TMA}} = 1.6$	
TMA Force Coefficient =	$Ca_{TMA} = 1.4$	(per TIA/EIA-222-F Table 3)



**Wind Load (without ice)**

(per TIA/EIA-222-F-1998 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on TMA's

Surface Area for One TMA =	$SA_{TMA} := \frac{L_{TMA} \cdot W_{TMA}}{144} = 0.9$	sf
TMA Projected Surface Area =	$A_{TMA} := SA_{TMA} \cdot N_{TMA} = 11$	sf
Total TMA Wind Force =	$F_{TMA} := qz_{all} \cdot G_H \cdot Ca_{TMA} \cdot A_{TMA} = 659$	lbs BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1998 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on TMA's

Surface Area for One TMA w/ Ice =	$SA_{ICETMA} := \frac{(L_{TMA} + 1) \cdot (W_{TMA} + 1)}{144} = 1.1$	sf
TMA Projected Surface Area w/ Ice =	$A_{ICETMA} := SA_{ICETMA} \cdot N_{TMA} = 13.1$	sf
Total TMA Wind Force w/ Ice =	$F_{ITMA} := qz_{ICE} \cdot G_H \cdot Ca_{TMA} \cdot A_{ICETMA} = 593$	lbs BLC 4,6

**Gravity Load (without ice)**

Weight of All TMA's =	$WT_{TMA} \cdot N_{TMA} = 169$	lbs BLC 2
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**Gravity Load (ice only)**

Volume of Each TMA =	$V_{TMA} := L_{TMA} \cdot W_{TMA} \cdot T_{TMA} = 344$	cu in
Volume of Ice on Each TMA =	$V_{ice} := (L_{TMA} + 1) \cdot (W_{TMA} + 1) \cdot (T_{TMA} + 1) - V_{TMA} = 221$	cu in
Weight of Ice on Each TMA =	$W_{ICETMA} := \frac{V_{ice}}{1728} \cdot Id = 7$	lbs
Weight of Ice on All TMA's	$W_{ICETMA} \cdot N_{TMA} = 86$	lbs BLC 3



**Development of Wind & Ice Load on RRU's**

(per TIA/EIA-222-F-1996 Criteria)

**RRU Data:**

RRU Model =	Ericsson RRUS-11	(AT&T)	
RRU Shape =	Flat		⊠ ⊠ ○ ⊠
RRU Height =	$L_{RRU} := 17.8$	in	
RRU Width =	$W_{RRU} := 17.3$	in	○
RRU Thickness =	$T_{RRU} := 7.2$	in	
RRU Weight =	$WT_{RRU} := 50$	lbs	⊠ ○
Number of RRU's =	$N_{RRU} := 6$		⊠ ⊠
RRU Aspect Ratio =	$A_{rRRU} := \frac{L_{RRU}}{W_{RRU}} = 1$		
RRU Force Coefficient =	$C_{aRRU} = 1.4$		(per TIA/EIA-222-F Table 3)

**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on RRU's

Surface Area for One RRU =	$SA_{RRU} := \frac{L_{RRU} \cdot W_{RRU}}{144} = 2.1$	sf	
RRU Projected Surface Area =	$A_{RRU} := SA_{RRU} \cdot N_{RRU} = 12.8$	sf	
Total RRU Wind Force =	$F_{RRU} := qz_{all} \cdot G_H \cdot C_{aRRU} \cdot A_{RRU} = 766$	lbs	BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on RRU's

Surface Area for One RRU w/ Ice =	$SA_{ICERRU} := \frac{(L_{RRU} + 1) \cdot (W_{RRU} + 1)}{144} = 2.4$	sf	
RRU Projected Surface Area w/ Ice =	$A_{ICERRU} := SA_{ICERRU} \cdot N_{RRU} = 14.3$	sf	
Total RRU Wind Force w/ Ice =	$F_{ICERRU} := qz_{ICE} \cdot G_H \cdot C_{aRRU} \cdot A_{ICERRU} = 649$	lbs	BLC 4,6

**Gravity Load (without ice)**

Weight of All RRU's =	$WT_{RRU} \cdot N_{RRU} = 300$	lbs	BLC 2
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**Gravity Load (ice only)**

Volume of Each RRU =	$V_{RRU} := L_{RRU} \cdot W_{RRU} \cdot T_{RRU} = 2 \times 10^3$	cu in	
Volume of Ice on Each RRU =	$V_{ice} := (L_{RRU} + 1) \cdot (W_{RRU} + 1) \cdot (T_{RRU} + 1) - V_{RRU} = 604$	cu in	
Weight of Ice on Each RRU =	$W_{ICERRU} := \frac{V_{ice}}{1728} \cdot \rho_{ice} = 20$	lbs	
Weight of Ice on All RRU's =	$W_{ICERRU} \cdot N_{RRU} = 117$	lbs	BLC 3

**Development of Wind & Ice Load on Surge Arrestor**

(per TIA/EIA-222-F-1996 Criteria)

**Surge Arrestor Data:**

Surge Arrestor Model =	DC6-48-60-18-8F	(AT&T)
Surge Arrestor Shape =	Flat	
Surge Arrestor Height =	$L_{SA} := 23.5$	in
Surge Arrestor Width =	$W_{SA} := 9.7$	in
Surge Arrestor Thickness =	$T_{SA} := 9.7$	in
Surge Arrestor Weight =	$WT_{SA} := 20$	lbs
Number of Surge Arrestor =	$N_{SA} := 1$	
Surge Arrestor Aspect Ratio =	$Ar_{SA} := \frac{L_{SA}}{W_{SA}} = 2.4$	
Surge Arrestor Force Coefficient =	$Ca_{SA} := 1.4$	(per TIA/EIA-222-F Table 3)

**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Surge Arrestor

Surface Area for One Surge Arrestor =	$SA_{SA} := \frac{L_{SA} \cdot W_{SA}}{144} = 1.6$	sf
Surge Arrestor Projected Surface Area =	$A_{SA} := SA_{SA} \cdot N_{SA} = 1.6$	sf
Total Surge Arrestor Wind Force =	$F_{SA} := qz_{alt} \cdot G_H \cdot Ca_{SA} \cdot A_{SA} = 95$	lbs BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Surge Arrestor

Surface Area for One Surge Arrestor w/ Ice =	$SA_{ICESA} := \frac{(L_{SA} + 1) \cdot (W_{SA} + 1)}{144} = 1.8$	sf
Surge Arrestor Projected Surface Area w/ Ice =	$A_{ICESA} := SA_{ICESA} \cdot N_{SA} = 1.8$	sf
Total Surge Arrestor Wind Force w/ Ice =	$F_{ISA} := qz_{alt} \cdot G_H \cdot Ca_{SA} \cdot A_{ICESA} = 82$	lbs BLC 4,6

**Gravity Load (without ice)**

Weight of Surge Arrestor =	$WT_{SA} \cdot N_{SA} = 20$	lbs BLC 2
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**Gravity Load (ice only)**

Volume of Each Surge Arrestor =	$V_{SA} := L_{SA} \cdot W_{SA} \cdot T_{SA} = 2 \times 10^3$	cu in
Volume of Ice on Each Surge Arrestor =	$V_{ice} := (L_{SA} + 1) \cdot (W_{SA} + 1) \cdot (T_{SA} + 1) - V_{SA} = 594$	cu in
Weight of Ice on Each Surge Arrestor =	$W_{ICESA} := \frac{V_{ice}}{1728} \cdot \rho_{ice} = 19$	lbs
Weight of Ice on All Surge Arrestor =	$W_{ICESA} \cdot N_{SA} = 19$	lbs BLC 3

Development of Wind & Ice Load on Antenna Mounts

(per TIA/EIA-222-F-1996 Criteria)

Mount Data:

Mount Type:	4" $\Phi$ Pipes	(AT&T)	
Mount Shape =	Round		
Pipe Mount Length =	$L_{mnt} := 120$	in	
Exposed Pipe Mount Length =	$L_{exp.mnt} := 65$	(Antennas shield top 55' of pipe)	
4 inch Pipe Mount Linear Weight =	$W_{mnt} := 10.8$	plf	
Pipe Mount Outside Diameter =	$D_{mnt} := 4.5$	in	
Number of Mounting Pipes =	$N_{mnt} := 12$		
Mount Aspect Ratio =	$A_{r.mnt} := \frac{L_{mnt}}{D_{mnt}} = 27$		
Mount Force Factor =	$C_{a.mnt} = 1.2$		(per TIA/EIA-222-F Table 3)

Wind Load (without ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Surface Area for One Mount =	$SA_{mnt} := \frac{D_{mnt} \cdot L_{exp.mnt}}{144} = 2.031$	sf	
Mount Projected Surface Area =	$A_{mnt} := SA_{mnt} \cdot N_{mnt} = 24.375$	sf	
Total Mount Wind Force =	$F_{mnt} := qz_{alt} \cdot G_H \cdot C_{a.mnt} \cdot A_{mnt} = 1248$	lbs	BLC 5,7

Wind Load (with ice)

(per TIA/EIA-222-F-1996 Section 2.3.2)

Surface Area for One Mount w/ Ice =	$SA_{ICEmnt} := \frac{(D_{mnt} + 2 \cdot I_r) \cdot L_{exp.mnt}}{144} = 2.483$	sf	
Mount Projected Surface Area w/ Ice =	$A_{ICEmnt} := SA_{ICEmnt} \cdot N_{mnt} = 29.792$	sf	
Total Mount Wind Force =	$F_{mnt} := qz_{ICEalt} \cdot G_H \cdot C_{a.mnt} \cdot A_{ICEmnt} = 1156$	lbs	BLC 4,6

Gravity Loads (without ice)

(per TIA/EIA-222-F-1996)

Weight Each Pipe Mount =	$WT_{mnt} := W_{mnt} \cdot \frac{L_{mnt}}{12} = 108$	lbs	
Weight of All Mounts =	$WT_{mnt} \cdot N_{mnt} = 1296$	lbs	BLC 2

Gravity Loads (ice only)

(per TIA/EIA-222-F-1996)

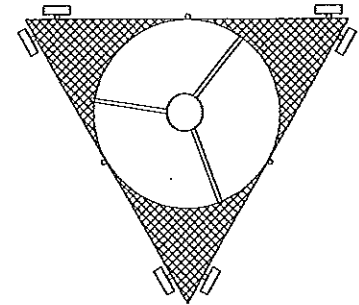
Volume of Each Pipe =	$V_{mnt} := \frac{\pi}{4} \cdot D_{mnt}^2 \cdot L_{mnt} = 1909$	cu in	
Volume of Ice on Each Pipe =	$V_{ice} := \left[ \frac{\pi}{4} \cdot (D_{mnt} + 1)^2 \cdot (L_{mnt} + 1) \right] - V_{mnt} = 966$	cu in	
Weight of Ice each mount (incl. hardware) =	$W_{ICEmnt} := \frac{V_{ice}}{1728} \cdot I_d = 31$	lbs	
Weight of Ice on All Mounts =	$W_{ICEmnt} \cdot N_{mnt} + 5 = 381$	lbs	BLC 3

**Development of Wind & Ice Load on Antennas**

(per TIA/EIA-222-F-1996 Criteria)

**Antenna Data:**

Antenna Model =	RFS APX 16DWV-16DWVS-E-A20	(T-Mobile)
Antenna Shape =	Flat	
Antenna Height =	$L_{ant} := 55.9$	in
Antenna Width =	$W_{ant} := 13$	in
Antenna Thickness =	$T_{ant} := 3.15$	in
Antenna Weight =	$WT_{ant} := 40.7$	lbs
Number of Antennas =	$N_{ant} := 6$	
Antenna Aspect Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 4.3$	
Antenna Force Coefficient =	$Ca_{ant} = 1.4$	(per TIA/EIA-222-F-1996 Table 3)



**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 5$	sf	
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 30.3$	sf	
Total Antenna Wind Force =	$F_{ant} := qz_{Lmb} \cdot G_H \cdot Ca_{ant} \cdot A_{ant} = 1859$	lbs	<b>BLC 5,7</b>

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 1)(W_{ant} + 1)}{144} = 5.5$	sf	
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 33.2$	sf	
Total Antenna Wind Force w/ Ice =	$F_{i_{ant}} := qz_{ICE} \cdot L_{mb} \cdot G_H \cdot Ca_{ant} \cdot A_{ICEant} = 1545$	lbs	<b>BLC 4,6</b>

**Gravity Load (without ice)**

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 244$	lbs	<b>BLC 2</b>
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**Gravity Load (ice only)**

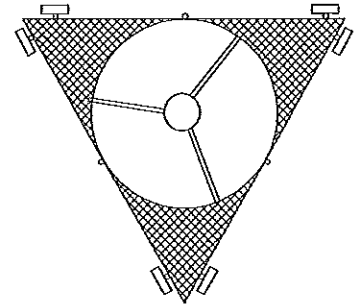
Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 2289$	cu in	
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 1)(W_{ant} + 1)(T_{ant} + 1) - V_{ant} = 1017$	cu in	
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot \rho_d = 33$	lbs	
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 198$	lbs	<b>BLC 3</b>

**Development of Wind & Ice Load on TMA's**

(per TIA/EIA-222-F-1996 Criteria)

**TMA Data:**

TMA Model =	Andrew OneBase PCS Twin Dual Duplex TMA	(T-Mobile)
TMA Shape =	Flat	
TMA Height =	$L_{TMA} := 10.2$	in
TMA Width =	$W_{TMA} := 6.7$	in
TMA Thickness =	$T_{TMA} := 3.7$	in
TMA Weight =	$W_{TMA} := 14.6$	lbs
Number of TMA's =	$N_{TMA} := 9$	
TMA Aspect Ratio =	$A_{rTMA} := \frac{L_{TMA}}{W_{TMA}} = 1.5$	
TMA Force Coefficient =	$Ca_{TMA} = 1.4$	(per TIA/EIA-222-F Table 3)



**Wind Load (without Ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on TMA's

Surface Area for One TMA =	$SA_{TMA} := \frac{L_{TMA} \cdot W_{TMA}}{144} = 0.5$	sf	
TMA Projected Surface Area =	$A_{TMA} := SA_{TMA} \cdot N_{TMA} = 4.3$	sf	
Total TMA Wind Force =	$F_{TMA} := qz_{L_{mb}} \cdot G_H \cdot Ca_{TMA} \cdot A_{TMA} = 262$	lbs	BLC 5,7

**Wind Load (with Ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on TMA's

Surface Area for One TMA w/ Ice =	$SA_{ICETMA} := \frac{(L_{TMA} + 1) \cdot (W_{TMA} + 1)}{144} = 0.6$	sf	
TMA Projected Surface Area w/ Ice =	$A_{ICETMA} := SA_{ICETMA} \cdot N_{TMA} = 5.4$	sf	
Total TMA Wind Force w/ Ice =	$F_{iTMA} := qz_{ICE} \cdot L_{mb} \cdot G_H \cdot Ca_{TMA} \cdot A_{ICETMA} = 251$	lbs	BLC 4,6

**Gravity Load (without Ice)**

Weight of All TMA's =	$W_{TMA} \cdot N_{TMA} = 131$	lbs	BLC 2
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**Gravity Load (ice only)**

Volume of Each TMA =	$V_{TMA} := L_{TMA} \cdot W_{TMA} \cdot T_{TMA} = 253$	cu in	
Volume of Ice on Each TMA =	$V_{ice} := (L_{TMA} + 1) \cdot (W_{TMA} + 1) \cdot (T_{TMA} + 1) - V_{TMA} = 152$	cu in	
Weight of Ice on Each TMA =	$W_{ICETMA} := \frac{V_{ice}}{1728} \cdot Id = 5$	lbs	
Weight of Ice on All TMA's =	$W_{ICETMA} \cdot N_{TMA} = 44$	lbs	BLC 3

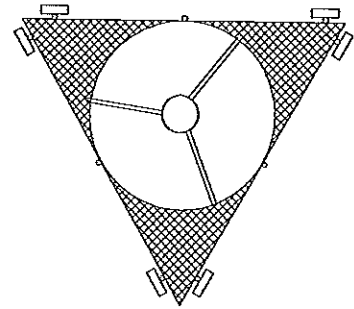
Development of Wind & Ice Load on Platform

(per TIA/EIA-222-F-1996 Criteria)

Platform Data:

Platform Model =	13' Low Profile Platform	
Platform Shape =	Flat	
(Force Coefficient Value Included in Area)	Platform Area =	$CaA_{plt} := 15.7$ sq ft
(Force Coefficient Value Included in Area)	Platform Area w/ Ice =	$CaA_{ICEplt} := 20.1$ sq ft
	Platform Weight =	$WT_{plt} := 1300$ lbs
	Platform Weight w/ Ice =	$WT_{ICEplt} := 1765$ lbs

(T-Mobile)



Wind Load (without ice):

(per TIA/EIA-222-F-1996 Section 2.3.2)

Total Platform Wind Force =  $F_{plt} := qz_{Lmb} \cdot G_H \cdot CaA_{plt} = 689$  lbs BLC 5,7

Wind Load (with ice):

(per TIA/EIA-222-F-1996 Section 2.3.2)

Total Platform Wind Force w/ Ice =  $F_{plt} := qz_{ICE} \cdot L_{mb} \cdot G_H \cdot CaA_{ICEplt} = 668$  lbs BLC 4,6

Gravity Load (without ice):

Weight of Platform =  $WT_{plt} = 1300$  lbs BLC 2

Gravity Load (Ice only):

Weight of Ice on Platform =  $WT_{ICEplt} - WT_{plt} = 465$  lbs BLC 3

**Development of Wind & Ice Load on Antennas**

(per TIA/EIA-222-F-1996 Criteria)

**Antenna Data:**

Antenna Model =	GPS VIC-100	(T-Mobile)
Antenna Shape =	Flat	
Antenna Height =	$L_{ant} := 3.9$	in
Antenna Width =	$W_{ant} := 3.5$	in
Antenna Thickness =	$T_{ant} := 3.5$	in
Antenna Weight =	$WT_{ant} := 8$	lbs
Number of Antennas =	$N_{ant} := 1$	
Antenna Aspect Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 1.1$	
Antenna Force Coefficient =	$Ca_{ant} = 1.4$	(per TIA/EIA-222-F-1996 Table 3)

**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 0.1$	sf
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 0.1$	sf
Total Antenna Wind Force =	$F_{ant} := qz_{gps} \cdot G_H \cdot Ca_{ant} \cdot A_{ant} = 5$	lbs BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 1)(W_{ant} + 1)}{144} = 0.2$	sf
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 0.2$	sf
Total Antenna Wind Force w/ Ice =	$F_{ant} := qz_{ICEgps} \cdot G_H \cdot Ca_{ant} \cdot A_{ICEant} = 6$	lbs BLC 4,6

**Gravity Load (without ice)**

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 8$	lbs BLC 2
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**Gravity Load (ice only)**

Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 48$	cu in
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 1)(W_{ant} + 1)(T_{ant} + 1) - V_{ant} = 51$	cu in
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 2$	lbs
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 2$	lbs BLC 3

**Development of Wind & Ice Load on Antennas**

(per TIA/EIA-222-F-1996 Criteria)

**Antenna Data:**

Antenna Model =	RFS APXV18-2065 17-S-C	(MetroPCS)
Antenna Shape =	Flat	
Antenna Height =	$L_{ant} := 72.0$	in
Antenna Width =	$W_{ant} := 6.8$	in
Antenna Thickness =	$T_{ant} := 3.15$	in
Antenna Weight =	$WT_{ant} := 32.5$	lbs
Number of Antennas =	$N_{ant} := 3$	
Antenna Asped Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 10.6$	
Antenna Force Coefficient =	$Ca_{ant} = 1.52$	(per TIA/EIA-222-F-1996 Table 3)



**Wind Load (without ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 3.4$	sf
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 10.2$	sf
Total Antenna Wind Force =	$F_{ant} := qz_{metro} \cdot G_H \cdot Ca_{ant} \cdot A_{ant} = 617$	lbs BLC 5,7

**Wind Load (with ice)**

(per TIA/EIA-222-F-1996 Section 2.3.2)

Assumes Maximum Possible Wind Pressure on Antennas

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 1) \cdot (W_{ant} + 1)}{144} = 4$	sf
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 11.9$	sf
Total Antenna Wind Force w/ Ice =	$F_{i_{ant}} := qz_{ICE} \cdot G_H \cdot Ca_{ant} \cdot A_{ICEant} = 544$	lbs BLC 4,6

**Gravity Load (without ice)**

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 98$	lbs BLC 2
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**Gravity Load (ice only)**

Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 1542$	cu in
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 1) \cdot (W_{ant} + 1) \cdot (T_{ant} + 1) - V_{ant} = 821$	cu in
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 27$	lbs
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 80$	lbs BLC 3

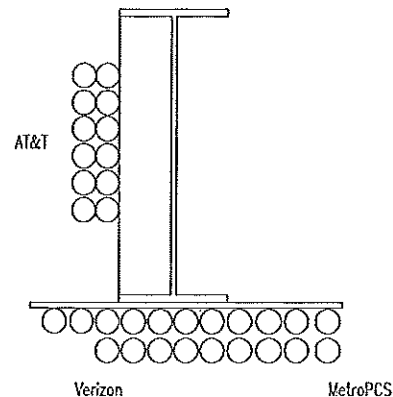


Development of Wind & Ice Load on Coax Cables

(per TIA/EIA-222-F-1996 Criteria)

Coax Cable Data:

Coax Type:	Use HELIAX 1-5/8"
Shape:	Round
Coax Outside Diameter =	$D_{coax} := 1.98$ in
Coax Cable Length =	$L_{coax} := 110$ ft
Weight of Coax per foot =	$WT_{coax} := 1.04$ plf
Total Number of Coax =	$N_{coax} := 32$
Number of Projected Coax =	$NP_{coax} := 5$
Coax aspect ratio =	$Ar_{coax} := L_{coax} \cdot \frac{12}{D_{coax}} = 667$
Coax Cable Force Factor =	$Ca_{coax} = 1.2$ TIA/EIA-222-F Table 3



Wind Load (without ice)

Surface Area for One Coax =	$SA_{coax} := \frac{D_{coax}}{12} = 0.17$	sf/ft
Coax Projected Surface Area =	$A_{coax} := SA_{coax} \cdot NP_{coax} = 0.825$	sf/ft
Coax Wind Force =	$F_{coax} := Ca_{coax} \cdot qz_{mast} \cdot G_H \cdot A_{coax} = 34$	plf BLC 5,7

per TIA/EIA-222-F Section 2.3.2

Wind Load (with ice)

Coax Projected Surface Area w/ Ice =	$A_{ICEcoax} := \frac{D_{coax}}{12} \cdot NP_{coax} + 2 \cdot \frac{1r}{12} = 0.908$	sf/ft
Coax Wind Force w/ Ice =	$F_{ICEcoax} := Ca_{coax} \cdot qz_{ICE} \cdot G_H \cdot A_{ICEcoax} = 28$	plf BLC 4,6

per TIA/EIA-222-F Section 2.3.2

Gravity Loads (without ice)

Weight of all cables w/o ice =	$WT_{coax} \cdot N_{coax} = 33$	plf BLC 2
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Gravity Loads (ice only)

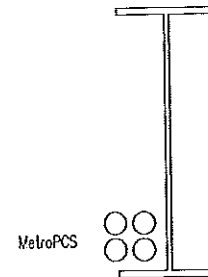
Ice Area per Linear Foot =	$Ai_{coax} := \frac{\pi}{4} \left[ (D_{coax} + 2 \cdot 1r)^2 - D_{coax}^2 \right] = 3.9$	si
Ice Weight per Linear Foot =	$WTi_{coax} := 1d \cdot \frac{Ai_{coax}}{144} = 2$	plf
Ice Weight All Coax per foot =	$WTi_{coax} \cdot N_{coax} = 48$	plf BLC 3

Development of Wind & Ice Load on Coax Cables

(per TIA/EIA-222-F-1996 Criteria)

Coax Cable Data:

Coax Type:	Use HELIAX 1-5/8"
Shape:	Round
Coax Outside Diameter =	$D_{coax} := 1.98$ in
Coax Cable Length =	$L_{coax} := 110$ ft
Weight of Coax per foot =	$WT_{coax} := 1.04$ plf
Total Number of Coax =	$N_{coax} := 4$
Number of Projected Coax =	$NP_{coax} := 0$
Coax aspect ratio =	$Ar_{coax} := L_{coax} \cdot \frac{12}{D_{coax}} = 667$
Coax Cable Force Factor =	$Ca_{coax} = 1.2$ TIA/EIA-222-F Table 3



Wind Load (without ice)

per TIA/EIA-222-F Section 2.3.2

Surface Area for One Coax =	$SA_{coax} := \frac{D_{coax}}{12} = 0.17$	s/ft
Coax Projected Surface Area =	$A_{coax} := SA_{coax} \cdot NP_{coax} = 0$	s/ft
Coax Wind Force =	$F_{coax} := Ca_{coax} \cdot qz_{mast} \cdot G_H \cdot A_{coax} = 0$	plf BLC 5,7

Wind Load (with ice)

per TIA/EIA-222-F Section 2.3.2

Coax Projected Surface Area w/ Ice =	$A_{ICEcoax} := \frac{D_{coax}}{12} \cdot NP_{coax} = 0$	s/ft
Coax Wind Force w/ Ice =	$F_{ICEcoax} := Ca_{coax} \cdot qz_{ICE} \cdot G_H \cdot A_{ICEcoax} = 0$	plf BLC 4,6

Gravity Loads (without ice)

Weight of all cables w/o ice =	$WT_{coax} \cdot N_{coax} = 4$	plf BLC 2
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Gravity Loads (ice only)

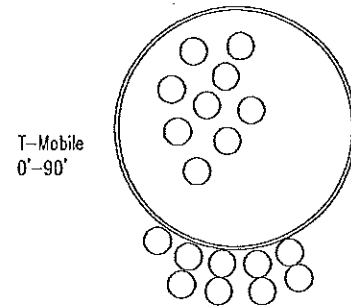
Ice Area per Linear Foot =	$A_{i_{coax}} := \frac{\pi}{4} \left[ (D_{coax} + 2 \cdot Ir)^2 - D_{coax}^2 \right] = 3.9$	si
Ice Weight per Linear Foot =	$WT_{i_{coax}} := Id \cdot \frac{A_{i_{coax}}}{144} = 2$	plf
Ice Weight All Coax per foot =	$WT_{i_{coax}} \cdot N_{coax} = 6$	plf BLC 3

Development of Wind & Ice Load on Coax Cables

(per TIA/EIA-222-F-1996 Criteria)

Coax Cable Data:

Coax Type:	Use HELIAX 1-5/8"
Shape:	Round
Coax Outside Diameter =	$D_{coax} := 1.98$ in
Coax Cable Length =	$L_{coax} := 110$ ft
Weight of Coax per foot =	$WT_{coax} := 1.04$ plf
Total Number of Coax =	$N_{coax} := 18$
Number of Projected Coax =	$NP_{coax} := 2$
Coax aspect ratio =	$Ar_{coax} := L_{coax} \frac{12}{D_{coax}} = 667$
Coax Cable Force Factor =	$Ca_{coax} = 1.2$ TIA/EIA-222-F Table 3



Wind Load per (without ice)

per TIA/EIA-222-F Section 2.3.2

Surface Area for One Coax =	$SA_{coax} := \frac{D_{coax}}{12} = 0.17$	sf/ft
Coax Projected Surface Area =	$A_{coax} := SA_{coax} \cdot NP_{coax} = 0.33$	sf/ft
Coax Wind Force =	$F_{coax} := Ca_{coax} \cdot qz_{mast3} \cdot G_H \cdot A_{coax} = 16$	plf BLC 5,7

Wind Load per (with ice)

per TIA/EIA-222-F Section 2.3.2

Coax Projected Surface Area w/ Ice =	$A_{ICEcoax} := \frac{D_{coax}}{12} \cdot NP_{coax} + 2 \cdot \frac{lr}{12} = 0.413$	sf/ft
Coax Wind Force w/ Ice =	$F_{i_{coax}} := Ca_{coax} \cdot qz_{ICE_{mast3}} \cdot G_H \cdot A_{ICEcoax} = 15$	plf BLC 4,6

Gravity Loads (without ice)

Weight of all cables w/o ice =	$WT_{coax} \cdot N_{coax} = 19$	plf BLC 2
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Gravity Loads (ice only)

Ice Area per Linear Foot =	$Ai_{coax} := \frac{\pi}{4} [(D_{coax} + 2 \cdot lr)^2 - D_{coax}^2] = 3.9$	si
Ice Weight per Linear Foot =	$WTi_{coax} := Id \cdot \frac{Ai_{coax}}{144} = 2$	plf
Ice Weight All Coax per foot =	$WTi_{coax} \cdot \frac{N_{coax}}{2} = 14$	plf BLC 3

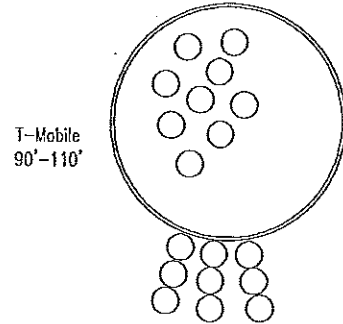
<b>CEN TEK</b> engineering Centered on Solutions 63-2 North Branford Road Branford, CT 06405 www.centeke.com P: (203) 488-0580 F: (203) 488-8587	Subject:	Wind Loading on Antennas and Mounts
	Location:	Cromwell, CT
	Rev. 0: 6/12/12	Prepared by: T.J.L. Checked by: C.F.C. Job No. 12044.CO2

**Development of Wind & Ice Load on Coax Cables**

(per TIA/EIA-222-F-1996 Criteria)

**Coax Cable Data:**

Coax Type:	Use HELIAX 1-5/8"
Shape:	Round
Coax Outside Diameter =	$D_{coax} := 1.98$ in
Coax Cable Length =	$L_{coax} := 110$ ft
Weight of Coax per foot =	$WT_{coax} := 1.04$ plf
Total Number of Coax =	$N_{coax} := 18$
Number of Projected Coax =	$NP_{coax} := 3$
Coax aspect ratio =	$Ar_{coax} := L_{coax} \frac{12}{D_{coax}} = 667$
Coax Cable Force Factor =	$Ca_{coax} = 1.2$ TIA/EIA-222-F Table 3



T-Mobile  
90'-110'

**Wind Load per (without ice)**

per TIA/EIA-222-F Section 2.3.2

Surface Area for One Coax =	$SA_{coax} := \frac{D_{coax}}{12} = 0.17$	sf/ft
Coax Projected Surface Area =	$A_{coax} := SA_{coax} \cdot NP_{coax} = 0.495$	sf/ft
Coax Wind Force =	$F_{coax} := Ca_{coax} \cdot q_{mast}^3 \cdot G_H \cdot A_{coax} = 23$	plf BLC 5,7

**Wind Load per (with ice)**

per TIA/EIA-222-F Section 2.3.2

Coax Projected Surface Area w/ Ice =	$A_{ICEcoax} := \frac{D_{coax}}{12} \cdot NP_{coax} + 2 \cdot \frac{I_r}{12} = 0.578$	sf/ft
Coax Wind Force w/ Ice =	$F_{i_{coax}} := Ca_{coax} \cdot q_{ICE} \cdot mast^3 \cdot G_H \cdot A_{ICEcoax} = 21$	plf BLC 4,6

**Gravity Loads (without ice)**

Weight of all cables w/o ice =	$WT_{coax} \cdot N_{coax} = 19$	plf BLC 2
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**Gravity Loads (ice only)**

Ice Area per Linear Foot =	$A_{i_{coax}} := \frac{\pi}{4} \left[ (D_{coax} + 2 \cdot I_r)^2 - D_{coax}^2 \right] = 3.9$	si
Ice Weight per Linear Foot =	$WT_{i_{coax}} := I_d \cdot \frac{A_{i_{coax}}}{144} = 2$	plf
Ice Weight All Coax per foot =	$WT_{i_{coax}} \cdot \frac{N_{coax}}{2} = 14$	plf BLC 3

Company : Centek Engineering  
 Designer : TJJ/CFC  
 Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

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**Global**

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation	Yes
Include Warping	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Vertical Axis	Y
Global Member Orientation Plane	XZ

Hot Rolled Steel Code	AISC 9th: ASD
Cold Formed Steel Code	AISI 1999: ASD
Wood Code	AF&PA NDS-97: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-02
Masonry Code	ACI 530-05/08: ASD
Aluminum Code	AA ADM1-05: ASD

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	PCA Load Contour
Parame Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections	Yes
Bad Framing Warnings	No
Unused Force Warnings	Yes

Seismic Code	UBC 1997
Seismic Base Elevation (ft)	Not Entered
Ct X	.035
Ct Z	.035
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	8.5
R Z	8.5
Ct Exp. X	.75
Ct Exp. Z	.75
Ca	.36
Cv	.54
Nv	1
SD1	1
SDS	1
S1	1
Occupancy Code	4
Seismic Zone	3
Use Group	I
Use Gravity Self Wt in Diaphragm Mass	Yes
Use Deck Self Wt in Diaphragm Mass	Yes
Use Lateral Self Wt in Diaphragm Mass	Yes
Seismic Detailing Code	None
Om X	1
Om Z	1
Rho X	1
Rho Z	1

Company : Centek Engineering  
 Designer : TJL/CFC  
 Job Number : 12044.CO2

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**Hot Rolled Steel Properties**

	Label	E [ksi]	G [ksi]	Nu	Therm (1E..	Density[k/ft...	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A36 Gr.36	29000	11154	.3	.65	.49	36	1.5	58	1.2
2	A572 Gr.50	29000	11154	.3	.65	.49	50	1.1	58	1.2
3	A992	29000	11154	.3	.65	.49	50	1.1	58	1.2
4	A500 Gr.42	29000	11154	.3	.65	.49	42	1.3	58	1.1
5	A500 Gr.46	29000	11154	.3	.65	.49	46	1.2	58	1.1

**Hot Rolled Steel Design Parameters**

	Label	Shape	Lengt...	Lbyy[ft]	Lbzz[ft]	Lcomp top[ft]	Lcomp bot[ft]	Kyy	Kzz	Cm...	Cm...	Cb	y sw..	z sw..	Function
1	CROSS..	L5x5x5/16	15.207	Segment	Segment										Lateral
2	CROSS..	L5x5x5/16	15.207	Segment	Segment										Lateral
3	CROSS..	L5x5x5/16	15.207	Segment	Segment										Lateral
4	CROSS..	L5x5x5/16	15.207	Segment	Segment										Lateral
5	CROSS..	L3.5x3.5	18.916	Segment	Segment										Lateral
6	CROSS..	L3.5x3.5	18.916	Segment	Segment										Lateral
7	CROSS..	L5x5x5/16	33.126												Lateral
8	CROSS..	L5x5x5/16	33.126												Lateral
9	HORZ1	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
10	HORZ2	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
11	HORZ3	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
12	HORZ4	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
13	HORZ5	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
14	HORZ6	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
15	HORZ7	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
16	HORZ8	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
17	HORZ9	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
18	HORZ10	L5x5x5/16	13.509	Segment	Segment	12	20								Lateral
19	HORZ11	Tube8x4	13.5	1	1	1	1								Lateral
20	LEG1	W24x68	60	Segment	Segment	20	14								Lateral
21	LEG2	W24x68	60	Segment	Segment	20	14								Lateral
22	LEG_W..	W24x68..	20.5	Segment	Segment	20.5									Lateral
23	LEG_W..	W24x68..	20.5	Segment	Segment	20.5									Lateral
24	WT1	WT6x15	10.091												Lateral
25	WT2	WT6x15	10.091												Lateral
26	WT3	WT6x15	10.091												Lateral
27	WT4	WT6x15	10.091												Lateral
28	WT5	WT6x15	10.091												Lateral
29	WT6	WT6x15	10.091												Lateral
30	WT7	WT6x15	10.091												Lateral
31	WT8	WT6x15	10.091												Lateral
32	WT9	WT6x15	10.091												Lateral
33	WT10	WT6x15	10.091												Lateral
34	WT11	WT6x15	10.091												Lateral
35	WT12	WT6x15	10.091												Lateral
36	WT13	WT6x15	10.091												Lateral
37	WT14	WT6x15	10.091												Lateral
38	WT15	WT6x15	10.091												Lateral
39	WT16	WT6x15	10.091												Lateral
40	WT17	WT6x15	10.091												Lateral
41	WT18	WT6x15	10.091												Lateral
42	WT19	WT6x15	10.091												Lateral

Company : Centek Engineering  
 Designer : TJL/CFC  
 Job Number : 12044.CO2

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**Hot Rolled Steel Design Parameters (Continued)**

Label	Shape	Leng...	Lbyl(ft)	Lbzz(ft)	Lcomp top(ft)	Lcomp bot(ft)	Kyy	Kzz	Cm...	Cm...	Cb	y sw...	z sw...	Function
43	WT20	WT6x15	10.091											Lateral
44	Mast1	HSS18x...	29	Segment	Segment									Lateral
45	Mast2	HSS18x...	27.5	Segment	Segment									Lateral
46	Mast3	HSS18x...	27.5	Segment	Segment									Lateral
47	Mast4	HSS18x...	27	Segment	Segment									Lateral
48	Horz 12	Tube8x4...	13.5	1	1	1	1							Lateral

**Hot Rolled Steel Section Sets**

Label	Shape	Type	Design List	Material	Design Rul...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	W24x68	Beam	Wide Flange	A992	Typical	20.1	70.4	1830	1.87
2	L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical	3.03	7.42	7.42	.108
3	L3.5x3.5x5/16	Beam	Wide Flange	A36 Gr.36	Typical	2.09	2.45	2.45	.073
4	Tube8x4x5/16	Beam	Wide Flange	A500 Gr.46	Typical	6.86	18.1	53.9	45.2
5	HSS18x0.5	Beam	Wide Flange	A500 Gr.42	Typical	25.6	985	985	1970
6	WT6x15	Beam	W Tee	A572 Gr.50	Typical	4.4	10.2	13.5	.228
7	W24x68 w/ pl	Beam	Wide Flange	A992	Typical	52.1	753.067	6733.167	10

**Member Primary Data**

Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	CROSSDIAG1	5	10		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
2	CROSSDIAG2	9	6		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
3	CROSSDIAG3	9	12		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
4	CROSSDIAG4	11	10		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
5	CROSSDIAG5	13	18		L3.5x3.5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
6	CROSSDIAG6	17	14		L3.5x3.5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
7	CROSSDIAG7	19	TOPLEG2		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
8	CROSSDIAG8	TOPLEG1	20		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
9	HORZ1	3	6		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
10	HORZ2	5	4		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
11	HORZ3	11	14		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
12	HORZ4	13	12		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
13	HORZ5	17	20		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
14	HORZ6	19	18		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
15	HORZ7	23	26		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
16	HORZ8	25	24		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
17	HORZ9	29	32		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
18	HORZ10	31	30		L5x5x5/16	Beam	Wide Flange	A36 Gr.36	Typical
19	HORZ11	TOPLEG1	TOPLEG2		Tube8x4x5/16	Beam	Wide Flange	A500 Gr.46	Typical
20	LEG1	TOPPLT1	TOPLEG1	90	W24x68	Beam	Wide Flange	A992	Typical
21	LEG2	TOPPLT2	TOPLEG2	90	W24x68	Beam	Wide Flange	A992	Typical
22	LEG W PLT1	BOTLEG1	TOPPLT1	90	W24x68 w/ pl	Beam	Wide Flange	A992	Typical
23	LEG W PLT2	BOTLEG2	TOPPLT2	90	W24x68 w/ pl	Beam	Wide Flange	A992	Typical
24	WT1	1	MC1	270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
25	WT2	MC1	2	270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
26	WT3	MC1	7	90	WT6x15	Beam	W Tee	A572 Gr.50	Typical
27	WT4	MC1	8	270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
28	WT5	MC2	7	90	WT6x15	Beam	W Tee	A572 Gr.50	Typical
29	WT6	MC2	8	270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
30	WT7	MC2	15	90	WT6x15	Beam	W Tee	A572 Gr.50	Typical
31	WT8	MC2	16	270	WT6x15	Beam	W Tee	A572 Gr.50	Typical

Company : Centek Engineering  
 Designer : TJL/CFC  
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**Member Primary Data (Continued)**

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
32	WT9	16	MC3		90	WT6x15	Beam	W Tee	A572 Gr.50	Typical
33	WT10	15	MC3		270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
34	WT11	21	MC3		270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
35	WT12	MC3	22		270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
36	WT13	21	MC4		270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
37	WT14	22	MC4		90	WT6x15	Beam	W Tee	A572 Gr.50	Typical
38	WT15	MC4	27		90	WT6x15	Beam	W Tee	A572 Gr.50	Typical
39	WT16	MC4	28		270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
40	WT17	MC5	27		90	WT6x15	Beam	W Tee	A572 Gr.50	Typical
41	WT18	MC5	28		270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
42	WT19	MC5	33		90	WT6x15	Beam	W Tee	A572 Gr.50	Typical
43	WT20	MC5	34		270	WT6x15	Beam	W Tee	A572 Gr.50	Typical
44	Mast1	BOTMAST	FC1			HSS18x0.5	Beam	Wide Flange	A500 Gr.42	Typical
45	Mast2	FC1	FC2			HSS18x0.5	Beam	Wide Flange	A500 Gr.42	Typical
46	Mast3	FC2	FC3			HSS18x0.5	Beam	Wide Flange	A500 Gr.42	Typical
47	Mast4	FC3	TOPMAST			HSS18x0.5	Beam	Wide Flange	A500 Gr.42	Typical
48	Horz 12	TOPLEG1	TOPLEG2			Tube8x4x5/16	Beam	Wide Flange	A500 Gr.46	Typical

**Joint Coordinates and Temperatures**

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	1	0	12	0	0	
2	2	13.5	12	0	0	
3	3	0	23	0	0	
4	4	13.5	23	0	0	
5	5	0	23.5	0	0	
6	6	13.5	23.5	0	0	
7	7	0	25.75	0	0	
8	8	13.5	25.75	0	0	
9	9	0	30.5	0	0	
10	10	13.5	30.5	0	0	
11	11	0	37.5	0	0	
12	12	13.5	37.5	0	0	
13	13	0	38	0	0	
14	14	13.5	38	0	0	
15	15	0	39.5	0	0	
16	16	13.5	39.5	0	0	
17	17	0	51.25	0	0	
18	18	13.5	51.25	0	0	
19	19	0	51.75	0	0	
20	20	13.5	51.75	0	0	
21	21	0	53.25	0	0	
22	22	13.5	53.25	0	0	
23	23	0	55.25	0	0	
24	24	13.5	55.25	0	0	
25	25	0	55.75	0	0	
26	26	13.5	55.75	0	0	
27	27	0	67	0	0	
28	28	13.5	67	0	0	
29	29	0	75.5	0	0	
30	30	13.5	75.5	0	0	
31	31	0	76	0	0	



Company : Gentek Engineering  
 Designer : TJJ/CFC  
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**Joint Coordinates and Temperatures (Continued)**

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
32	32	13.5	76	0	0	
33	33	0	80.75	0	0	
34	34	13.5	80.75	0	0	
35	35	6.75	23.25	0	0	
36	36	6.75	27	0	0	
37	37	6.75	34	0	0	
38	38	6.75	37.75	0	0	
39	39	6.75	44.625	0	0	
40	40	6.75	51.5	0	0	
41	41	6.75	55.5	0	0	
42	43	6.75	75.75	0	0	
43	BOTLEG1	0	1.5	0	0	
44	BOTLEG2	13.5	1.5	0	0	
45	BOTMAST	6.75	0	3	0	
46	MC1	6.75	18.875	3	0	
47	MC2	6.75	32.625	3	0	
48	MC3	6.75	46.375	3	0	
49	MC4	6.75	60.125	3	0	
50	MC5	6.75	73.875	3	0	
51	TOPLEG1	0	82	0	0	
52	TOPLEG2	13.5	82	0	0	
53	TOPMAST	6.75	111	3	0	
54	TOPPLT1	0	22	0	0	
55	TOPPLT2	13.5	22	0	0	
56	T MOBILE	6.75	108	3	0	
57	METRO	0	77	0	0	
58	METRO2	13.5	77	0	0	
59	FC1	6.75	29	3	0	
60	FC2	6.75	56.5	3	0	
61	FC3	6.75	84	3	0	
62	GPS	0	50	0	0	

**Joint Boundary Conditions**

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot. [k-ft/rad]	Y Rot. [k-ft/rad]	Z Rot. [k-ft/rad]	Footing
1	BOTLEG1	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction	
2	BOTMAST	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction	
3	BOTLEG2	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction	
4	TOPLEG1							
5	TOPLEG2							
6	FC3							
7	FC2							
8	FC1							

**Joint Loads and Enforced Displacements (BLC 2 : Weight of Equipment)**

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/f...]
1	TOPLEG1	L	Y	-.026
2	TOPLEG2	L	Y	-.026
3	TOPLEG1	L	Y	-.021
4	TOPLEG2	L	Y	-.021
5	TOPLEG1	L	Y	-.042

Company : Centek Engineering  
 Designer : TJL/CFC  
 Job Number : 12044.CO2

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**Joint Loads and Enforced Displacements (BLC 2 : Weight of Equipment) (Continued)**

	Joint Label	L,D,M	Direction	Magnitude(k,k-ft), (in,rad), (k*s^2/f..
6	TOPLEG2	L	Y	-.042
7	TOPLEG1	L	Y	-.026
8	TOPLEG2	L	Y	-.026
9	TOPLEG1	L	Y	-.911
10	TOPLEG2	L	Y	-.911
11	TOPLEG1	L	Y	-.105
12	TOPLEG2	L	Y	-.105
13	TOPLEG1	L	Y	-.074
14	TOPLEG2	L	Y	-.074
15	TOPLEG1	L	Y	-.085
16	TOPLEG2	L	Y	-.085
17	TOPLEG1	L	Y	-.15
18	TOPLEG2	L	Y	-.15
19	TOPLEG1	L	Y	-.01
20	TOPLEG2	L	Y	-.01
21	TOPLEG1	L	Y	-.648
22	TOPLEG2	L	Y	-.648
23	T MOBILE	L	Y	-.244
24	T MOBILE	L	Y	-.131
25	T MOBILE	L	Y	-1.3
26	GPS	L	Y	-.008
27	METRO2	L	Y	-.033
28	METRO	L	Y	-.066

**Joint Loads and Enforced Displacements (BLC 3 : Weight of Ice)**

	Joint Label	L,D,M	Direction	Magnitude(k,k-ft), (in,rad), (k*s^2/f..
1	TOPLEG1	L	Y	-.061
2	TOPLEG2	L	Y	-.061
3	TOPLEG1	L	Y	-.049
4	TOPLEG2	L	Y	-.049
5	TOPLEG1	L	Y	-.098
6	TOPLEG2	L	Y	-.098
7	TOPLEG1	L	Y	-.057
8	TOPLEG2	L	Y	-.057
9	TOPLEG1	L	Y	-.315
10	TOPLEG2	L	Y	-.315
11	TOPLEG1	L	Y	-.098
12	TOPLEG2	L	Y	-.098
13	TOPLEG1	L	Y	-.07
14	TOPLEG2	L	Y	-.07
15	TOPLEG1	L	Y	-.043
16	TOPLEG2	L	Y	-.043
17	TOPLEG1	L	Y	-.059
18	TOPLEG2	L	Y	-.059
19	TOPLEG1	L	Y	-.01
20	TOPLEG2	L	Y	-.01
21	TOPLEG1	L	Y	-.191
22	TOPLEG2	L	Y	-.191
23	T MOBILE	L	Y	-.198
24	T MOBILE	L	Y	-.044
25	T MOBILE	L	Y	-.465
26	GPS	L	Y	-.002

Company : Centek Engineering  
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**Joint Loads and Enforced Displacements (BLC 3 : Weight of Ice) (Continued)**

	Joint Label	L,D,M	Direction	Magnitude(k,k-ft), (in,rad), (k*s^2/f...
27	METRO2	L	Y	-.027
28	METRO	L	Y	-.053

**Joint Loads and Enforced Displacements (BLC 4 : TIA/EIA Wind with Ice (+X))**

	Joint Label	L,D,M	Direction	Magnitude(k,k-ft), (in,rad), (k*s^2/f...
1	TOPLEG1	L	X	.402
2	TOPLEG2	L	X	.402
3	TOPLEG1	L	X	.311
4	TOPLEG2	L	X	.311
5	TOPLEG1	L	X	.492
6	TOPLEG2	L	X	.492
7	TOPLEG1	L	X	.359
8	TOPLEG2	L	X	.359
9	TOPLEG1	L	X	.63
10	TOPLEG2	L	X	.63
11	TOPLEG1	L	X	.634
12	TOPLEG2	L	X	.634
13	TOPLEG1	L	X	.441
14	TOPLEG2	L	X	.441
15	TOPLEG1	L	X	.297
16	TOPLEG2	L	X	.297
17	TOPLEG1	L	X	.325
18	TOPLEG2	L	X	.325
19	TOPLEG1	L	X	.041
20	TOPLEG2	L	X	.041
21	TOPLEG1	L	X	.578
22	TOPLEG2	L	X	.578
23	T MOBILE	L	X	1.545
24	T MOBILE	L	X	.251
25	T MOBILE	L	X	.668
26	GPS	L	X	.006
27	METRO2	L	X	.181
28	METRO	L	X	.363
29	TOPLEG1	L	Y	5.14
30	TOPLEG2	L	Y	-5.14

**Joint Loads and Enforced Displacements (BLC 5 : TIA/EIA Wind (+X))**

	Joint Label	L,D,M	Direction	Magnitude(k,k-ft), (in,rad), (k*s^2/f...
1	TOPLEG1	L	X	.48
2	TOPLEG2	L	X	.48
3	TOPLEG1	L	X	.377
4	TOPLEG2	L	X	.377
5	TOPLEG1	L	X	.582
6	TOPLEG2	L	X	.582
7	TOPLEG1	L	X	.406
8	TOPLEG2	L	X	.406
9	TOPLEG1	L	X	.648
10	TOPLEG2	L	X	.648
11	TOPLEG1	L	X	.753
12	TOPLEG2	L	X	.753
13	TOPLEG1	L	X	.529
14	TOPLEG2	L	X	.529

Company : Centek Engineering  
 Designer : T.JL/CFC  
 Job Number : 12044.CO2

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**Joint Loads and Enforced Displacements (BLC 5 : TIA/EIA Wind (+X)) (Continued)**

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/f...
15	TOPLEG1	L	X	.33
16	TOPLEG2	L	X	.33
17	TOPLEG1	L	X	.383
18	TOPLEG2	L	X	.383
19	TOPLEG1	L	X	.048
20	TOPLEG2	L	X	.048
21	TOPLEG1	L	X	.624
22	TOPLEG2	L	X	.624
23	T MOBILE	L	X	1.859
24	T MOBILE	L	X	.262
25	T MOBILE	L	X	.689
26	GPS	L	X	.005
27	METRO2	L	X	.206
28	METRO	L	X	.411
29	TOPLEG1	L	Y	5.92
30	TOPLEG2	L	Y	-5.92

**Joint Loads and Enforced Displacements (BLC 6 : TIA/EIA Wind with Ice(+Z))**

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/f...
1	TOPLEG1	L	Z	.402
2	TOPLEG2	L	Z	.402
3	TOPLEG1	L	Z	.311
4	TOPLEG2	L	Z	.311
5	TOPLEG1	L	Z	.492
6	TOPLEG2	L	Z	.492
7	TOPLEG1	L	Z	.359
8	TOPLEG2	L	Z	.359
9	TOPLEG1	L	Z	.63
10	TOPLEG2	L	Z	.63
11	TOPLEG1	L	Z	.634
12	TOPLEG2	L	Z	.634
13	TOPLEG1	L	Z	.441
14	TOPLEG2	L	Z	.441
15	TOPLEG1	L	Z	.297
16	TOPLEG2	L	Z	.297
17	TOPLEG1	L	Z	.325
18	TOPLEG2	L	Z	.325
19	TOPLEG1	L	Z	.041
20	TOPLEG2	L	Z	.041
21	TOPLEG1	L	Z	.578
22	TOPLEG2	L	Z	.578
23	T MOBILE	L	Z	1.545
24	T MOBILE	L	Z	.251
25	T MOBILE	L	Z	.668
26	GPS	L	Z	.006
27	METRO2	L	Z	.181
28	METRO	L	Z	.363
29	TOPLEG1	L	Mx	34.71
30	TOPLEG2	L	Mx	34.71

**Joint Loads and Enforced Displacements (BLC 7 : TIA/EIA Wind (+Z))**

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/f...
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**Joint Loads and Enforced Displacements (BLC 7 : TIA/EIA Wind (+Z)) (Continued)**

	Joint Label	L,D,M	Direction	Magnitude(k,k-ft), (in,rad), (k*s^2/f...
1	TOPLEG1	L	Z	.48
2	TOPLEG2	L	Z	.48
3	TOPLEG1	L	Z	.377
4	TOPLEG2	L	Z	.377
5	TOPLEG1	L	Z	.582
6	TOPLEG2	L	Z	.582
7	TOPLEG1	L	Z	.406
8	TOPLEG2	L	Z	.406
9	TOPLEG1	L	Z	.648
10	TOPLEG2	L	Z	.648
11	TOPLEG1	L	Z	.753
12	TOPLEG2	L	Z	.753
13	TOPLEG1	L	Z	.529
14	TOPLEG2	L	Z	.529
15	TOPLEG1	L	Z	.33
16	TOPLEG2	L	Z	.33
17	TOPLEG1	L	Z	.383
18	TOPLEG2	L	Z	.383
19	TOPLEG1	L	Z	.048
20	TOPLEG2	L	Z	.048
21	TOPLEG1	L	Z	.624
22	TOPLEG2	L	Z	.624
23	T MOBILE	L	Z	1.859
24	T MOBILE	L	Z	.262
25	T MOBILE	L	Z	.689
26	GPS	L	Z	.005
27	METRO2	L	Z	.206
28	METRO	L	Z	.411
29	TOPLEG1	L	Mx	39.97
30	TOPLEG2	L	Mx	39.97

**Member Point Loads**

Member Label	Direction	Magnitude(k,k-ft)	Location(ft,%)
No Data to Print ...			

**Member Distributed Loads (BLC 2 : Weight of Equipment)**

	Member Label	Direction	Start Magnitude(k/ft,deg)	End Magnitude(k/f...	Start Location(ft,%)	End Location(ft,%)
1	LEG W PLT1	Y	-.004	-.004	0	0
2	LEG1	Y	-.004	-.004	0	0
3	LEG W PLT2	Y	-.033	-.033	0	0
4	LEG2	Y	-.033	-.033	0	0
5	Mast1	Y	-.019	-.019	0	0
6	Mast2	Y	-.019	-.019	0	0
7	Mast3	Y	-.019	-.019	0	0
8	Mast4	Y	-.019	-.019	0	0

**Member Distributed Loads (BLC 3 : Weight of Ice)**

	Member Label	Direction	Start Magnitude(k/ft,deg)	End Magnitude(k/f...	Start Location(ft,%)	End Location(ft,%)
1	CROSSDIAG1	Y	-.004	-.004	0	0

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**Member Distributed Loads (BLC 3 : Weight of Ice) (Continued)**

Member Label	Direction	Start Magnitude[k/ft.deg]	End Magnitude[k/f...	Start Location[ft,%]	End Location[ft,%]
2	CROSSDIAG2	Y	-0.004	-0.004	0 0
3	CROSSDIAG3	Y	-0.004	-0.004	0 0
4	CROSSDIAG4	Y	-0.004	-0.004	0 0
5	CROSSDIAG5	Y	-0.003	-0.003	0 0
6	CROSSDIAG6	Y	-0.003	-0.003	0 0
7	CROSSDIAG7	Y	-0.004	-0.004	0 0
8	CROSSDIAG8	Y	-0.004	-0.004	0 0
9	HORZ1	Y	-0.004	-0.004	0 0
10	HORZ2	Y	-0.004	-0.004	0 0
11	HORZ3	Y	-0.004	-0.004	0 0
12	HORZ4	Y	-0.004	-0.004	0 0
13	HORZ5	Y	-0.004	-0.004	0 0
14	HORZ6	Y	-0.004	-0.004	0 0
15	HORZ7	Y	-0.004	-0.004	0 0
16	HORZ8	Y	-0.004	-0.004	0 0
17	HORZ9	Y	-0.004	-0.004	0 0
18	HORZ10	Y	-0.004	-0.004	0 0
19	HORZ11	Y	-0.004	-0.004	0 0
20	LEG1	Y	-0.016	-0.016	0 0
21	LEG2	Y	-0.016	-0.016	0 0
22	LEG W PLT1	Y	-0.006	-0.006	0 0
23	LEG1	Y	-0.006	-0.006	0 0
24	LEG W PLT2	Y	-0.048	-0.048	0 0
25	LEG2	Y	-0.048	-0.048	0 0
26	LEG W PLT1	Y	-0.038	-0.038	0 0
27	LEG W PLT2	Y	-0.038	-0.038	0 0
28	Mast4	Y	-0.011	-0.011	0 0
29	Mast1	Y	-0.011	-0.011	0 0
30	Mast2	Y	-0.011	-0.011	0 0
31	Mast3	Y	-0.011	-0.011	0 0
32	WT1	Y	-0.005	-0.005	0 0
33	WT2	Y	-0.005	-0.005	0 0
34	WT3	Y	-0.005	-0.005	0 0
35	WT4	Y	-0.005	-0.005	0 0
36	WT5	Y	-0.005	-0.005	0 0
37	WT6	Y	-0.005	-0.005	0 0
38	WT7	Y	-0.005	-0.005	0 0
39	WT8	Y	-0.005	-0.005	0 0
40	WT9	Y	-0.005	-0.005	0 0
41	WT10	Y	-0.005	-0.005	0 0
42	WT11	Y	-0.005	-0.005	0 0
43	WT12	Y	-0.005	-0.005	0 0
44	WT13	Y	-0.005	-0.005	0 0
45	WT14	Y	-0.005	-0.005	0 0
46	WT15	Y	-0.005	-0.005	0 0
47	WT16	Y	-0.005	-0.005	0 0
48	WT17	Y	-0.005	-0.005	0 0
49	WT18	Y	-0.005	-0.005	0 0
50	WT19	Y	-0.005	-0.005	0 0
51	WT20	Y	-0.005	-0.005	0 0
52	Mast1	Y	-0.014	-0.014	0 0
53	Mast2	Y	-0.014	-0.014	0 0
54	Mast3	Y	-0.014	-0.014	0 0

Company : Centek Engineering  
 Designer : TJL/CFC  
 Job Number : 12044.CO2

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**Member Distributed Loads (BLC 3 : Weight of Ice) (Continued)**

	Member Label	Direction	Start Magnitude[k/ft,deg]	End Magnitude[k/f...	Start Location[ft,%]	End Location[ft,%]
55	Mast4	Y	-.014	-.014	0	0

**Member Distributed Loads (BLC 4 : TIA/EIA Wind with Ice (+X))**

	Member Label	Direction	Start Magnitude[k/ft,deg]	End Magnitude[k/f...	Start Location[ft,%]	End Location[ft,%]
1	LEG1	X	.071	.071	0	20
2	LEG1	X	.083	.083	20	40
3	LEG1	X	.091	.091	40	60
4	LEG2	X	.013	.013	0	0
5	LEG W PLT1	X	.055	.055	0	0
6	Mast1	X	.018	.018	0	0
7	Mast1	X	.015	.015	0	0
8	Mast2	X	.024	.024	0	0
9	Mast2	X	.015	.015	0	0
10	Mast3	X	.028	.028	0	0
11	Mast3	X	.015	.015	0	0
12	Mast4	X	.03	.03	0	0
13	Mast4	X	.021	.021	0	0
14	WT1	X	.028	.028	0	0
15	WT2	X	.028	.028	0	0
16	WT3	X	.028	.028	0	0
17	WT4	X	.028	.028	0	0
18	WT5	X	.028	.028	0	0
19	WT6	X	.028	.028	0	0
20	WT7	X	.028	.028	0	0
21	WT8	X	.028	.028	0	0
22	WT9	X	.028	.028	0	0
23	WT10	X	.028	.028	0	0
24	WT11	X	.028	.028	0	0
25	WT12	X	.028	.028	0	0
26	WT13	X	.028	.028	0	0
27	WT14	X	.028	.028	0	0
28	WT15	X	.028	.028	0	0
29	WT16	X	.028	.028	0	0
30	WT17	X	.028	.028	0	0
31	WT18	X	.028	.028	0	0
32	WT19	X	.028	.028	0	0
33	WT20	X	.028	.028	0	0

**Member Distributed Loads (BLC 5 : TIA/EIA Wind (+X))**

	Member Label	Direction	Start Magnitude[k/ft,deg]	End Magnitude[k/f...	Start Location[ft,%]	End Location[ft,%]
1	LEG1	X	.115	.115	40	60
2	LEG1	X	.105	.105	20	40
3	LEG1	X	.091	.091	0	20
4	LEG2	X	.014	.014	0	0
5	LEG W PLT1	X	.07	.07	0	0
6	Mast1	X	.022	.022	0	0
7	Mast1	X	.016	.016	0	0
8	Mast2	X	.03	.03	0	0
9	Mast2	X	.016	.016	0	0
10	Mast3	X	.035	.035	0	0
11	Mast3	X	.016	.016	0	0
12	Mast4	X	.038	.038	0	0

Company : Centek Engineering  
 Designer : T.JL/CFC  
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**Member Distributed Loads (BLC 5 : TIA/EIA Wind (+X)) (Continued)**

	Member Label	Direction	Start Magnitude[k/ft,deg]	End Magnitude[k/f...	Start Location[ft,%]	End Location[ft,%]
13	Mast4	X	.023	.023	0	0
14	WT1	X	.032	.032	0	0
15	WT2	X	.032	.032	0	0
16	WT3	X	.032	.032	0	0
17	WT4	X	.032	.032	0	0
18	WT5	X	.032	.032	0	0
19	WT6	X	.032	.032	0	0
20	WT7	X	.032	.032	0	0
21	WT8	X	.032	.032	0	0
22	WT9	X	.032	.032	0	0
23	WT10	X	.032	.032	0	0
24	WT11	X	.032	.032	0	0
25	WT12	X	.032	.032	0	0
26	WT13	X	.032	.032	0	0
27	WT14	X	.032	.032	0	0
28	WT15	X	.032	.032	0	0
29	WT16	X	.032	.032	0	0
30	WT17	X	.032	.032	0	0
31	WT18	X	.032	.032	0	0
32	WT19	X	.032	.032	0	0
33	WT20	X	.032	.032	0	0

**Member Distributed Loads (BLC 6 : TIA/EIA Wind with Ice(+Z))**

	Member Label	Direction	Start Magnitude[k/ft,deg]	End Magnitude[k/f...	Start Location[ft,%]	End Location[ft,%]
1	CROSSDIAG1	Z	.025	.025	0	0
2	CROSSDIAG2	Z	.025	.025	0	0
3	CROSSDIAG3	Z	.025	.025	0	0
4	CROSSDIAG4	Z	.025	.025	0	0
5	CROSSDIAG5	Z	.019	.019	0	0
6	CROSSDIAG6	Z	.019	.019	0	0
7	CROSSDIAG7	Z	.025	.025	0	0
8	CROSSDIAG8	Z	.025	.025	0	0
9	HORZ1	Z	.025	.025	0	0
10	HORZ2	Z	.025	.025	0	0
11	HORZ3	Z	.025	.025	0	0
12	HORZ4	Z	.025	.025	0	0
13	HORZ5	Z	.025	.025	0	0
14	HORZ6	Z	.025	.025	0	0
15	HORZ7	Z	.025	.025	0	0
16	HORZ8	Z	.025	.025	0	0
17	HORZ9	Z	.025	.025	0	0
18	HORZ10	Z	.025	.025	0	0
19	HORZ11	Z	.025	.025	0	0
20	LEG1	Z	.038	.038	0	20
21	LEG1	Z	.044	.044	20	40
22	LEG1	Z	.049	.049	40	60
23	LEG2	Z	.038	.038	0	20
24	LEG2	Z	.044	.044	20	40
25	LEG2	Z	.049	.049	40	60
26	LEG2	Z	.028	.028	0	0
27	LEG W PLT1	Z	.04	.04	0	0
28	LEG W PLT2	Z	.04	.04	0	0



Company : Centek Engineering  
 Designer : TJL/CFC  
 Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

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**Member Distributed Loads (BLC 6 : TIA/EIA Wind with Ice(+Z)) (Continued)**

	Member Label	Direction	Start Magnitude[k/f,deg]	End Magnitude[k/f...	Start Location[ft,%]	End Location[ft,%]
29	Mast1	Z	.018	.018	0	0
30	Mast1	Z	.015	.015	0	0
31	Mast2	Z	.024	.024	0	0
32	Mast2	Z	.015	.015	0	0
33	Mast3	Z	.028	.028	0	0
34	Mast3	Z	.015	.015	0	0
35	Mast4	Z	.03	.03	0	0
36	Mast4	Z	.021	.021	0	0
37	WT1	Z	.028	.028	0	0
38	WT2	Z	.028	.028	0	0
39	WT3	Z	.028	.028	0	0
40	WT4	Z	.028	.028	0	0
41	WT5	Z	.028	.028	0	0
42	WT6	Z	.028	.028	0	0
43	WT7	Z	.028	.028	0	0
44	WT8	Z	.028	.028	0	0
45	WT9	Z	.028	.028	0	0
46	WT10	Z	.028	.028	0	0
47	WT11	Z	.028	.028	0	0
48	WT12	Z	.028	.028	0	0
49	WT13	Z	.028	.028	0	0
50	WT14	Z	.028	.028	0	0
51	WT15	Z	.028	.028	0	0
52	WT16	Z	.028	.028	0	0
53	WT17	Z	.028	.028	0	0
54	WT18	Z	.028	.028	0	0
55	WT19	Z	.028	.028	0	0
56	WT20	Z	.028	.028	0	0

**Member Distributed Loads (BLC 7 : TIA/EIA Wind (+Z))**

	Member Label	Direction	Start Magnitude[k/f,deg]	End Magnitude[k/f...	Start Location[ft,%]	End Location[ft,%]
1	CROSSDIAG1	Z	.028	.028	0	0
2	CROSSDIAG2	Z	.028	.028	0	0
3	CROSSDIAG3	Z	.028	.028	0	0
4	CROSSDIAG4	Z	.028	.028	0	0
5	CROSSDIAG5	Z	.019	.019	0	0
6	CROSSDIAG6	Z	.019	.019	0	0
7	CROSSDIAG7	Z	.028	.028	0	0
8	CROSSDIAG8	Z	.028	.028	0	0
9	HORZ1	Z	.028	.028	0	0
10	HORZ2	Z	.028	.028	0	0
11	HORZ3	Z	.028	.028	0	0
12	HORZ4	Z	.028	.028	0	0
13	HORZ5	Z	.028	.028	0	0
14	HORZ6	Z	.028	.028	0	0
15	HORZ7	Z	.028	.028	0	0
16	HORZ8	Z	.028	.028	0	0
17	HORZ9	Z	.028	.028	0	0
18	HORZ10	Z	.028	.028	0	0
19	HORZ11	Z	.028	.028	0	0
20	LEG1	Z	.046	.046	0	20
21	LEG1	Z	.053	.053	20	40

Company : Centek Engineering  
 Designer : T.JL/CFC  
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82' Sign Structure with 111' Pipe Mast

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**Member Distributed Loads (BLC 7 : TIA/EIA Wind (+Z)) (Continued)**

Member Label	Direction	Start Magnitude[k/ft,deg]	End Magnitude[k/ft,deg]	Start Location[ft,%]	End Location[ft,%]
22	LEG1	Z	.058	.058	40 60
23	LEG2	Z	.046	.046	0 20
24	LEG2	Z	.053	.053	20 40
25	LEG2	Z	.058	.058	40 60
26	LEG2	Z	.034	.034	0 0
27	LEG W PLT1	Z	.049	.049	0 0
28	LEG W PLT2	Z	.049	.049	0 0
29	Mast1	Z	.022	.022	0 0
30	Mast1	Z	.016	.016	0 0
31	Mast2	Z	.03	.03	0 0
32	Mast2	Z	.016	.016	0 0
33	Mast3	Z	.035	.035	0 0
34	Mast3	Z	.016	.016	0 0
35	Mast4	Z	.038	.038	0 0
36	Mast4	Z	.023	.023	0 0
37	WT1	Z	.032	.032	0 0
38	WT2	Z	.032	.032	0 0
39	WT3	Z	.032	.032	0 0
40	WT4	Z	.032	.032	0 0
41	WT5	Z	.032	.032	0 0
42	WT6	Z	.032	.032	0 0
43	WT7	Z	.032	.032	0 0
44	WT8	Z	.032	.032	0 0
45	WT9	Z	.032	.032	0 0
46	WT10	Z	.032	.032	0 0
47	WT11	Z	.032	.032	0 0
48	WT12	Z	.032	.032	0 0
49	WT13	Z	.032	.032	0 0
50	WT14	Z	.032	.032	0 0
51	WT15	Z	.032	.032	0 0
52	WT16	Z	.032	.032	0 0
53	WT17	Z	.032	.032	0 0
54	WT18	Z	.032	.032	0 0
55	WT19	Z	.032	.032	0 0
56	WT20	Z	.032	.032	0 0

**Basic Load Cases**

BLC Description	Category	X Grav...	Y Grav...	Z Gravity	Joint	Point	Distrib...	Area(M...Surfac...
1 Self Weight	None			-1				
2 Weight of Equipment	None				28		8	
3 Weight of Ice	None				28		55	
4 TIA/EIA Wind with Ice (+X)	None				30		33	
5 TIA/EIA Wind (+X)	None				30		33	
6 TIA/EIA Wind with Ice(+Z)	None				30		56	
7 TIA/EIA Wind (+Z)	None				30		56	

**Load Combinations**

Description	So...	PDelta	SRSS	BLCFac..	BLCFac..	BLCFac..	BLCFac..	BLCFac..	BLCFac..	BLCFac..	BLCFac..
1 TIA/EIA Wind + Ice in +X Dir... Yes				1	1	2	1	3	1	4	1
2 TIA/EIA Wind in +X Direction Yes				1	1	2	1	5	1		

**Load Combinations (Continued)**

Description	So...	PDelta	SRSS	BLCFac.	BLCFac.	BLCFac.	BLCFac.	BLCFac.	BLCFac.	BLCFac.	BLCFac.	BLCFac.	BLCFac.	BLCFac.
3 TIA/EIA Wind + Ice in +Z Dir...	Yes			1	1	2	1	3	1	6	1			
4 TIA/EIA Wind in +Z Direction	Yes			1	1	2	1	7	1					
5 TIA/EIA Wind + Ice in -Z' Dir...	Yes			1	1	2	1	3	1	6	-1			
6 TIA/EIA Wind in -Z' Direction	Yes			1	1	2	1	7	-1					
7 Self Weight				1	1									

**Envelope Member Section Forces**

Member	Sec	Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Momen...	LC	z-z Momen...	LC	
CROSSDIAG1	1	max	2.184	4	.098	3	.204	6	.001	6	0	1	0	1
	2	min	-8.053	2	-.041	6	-.205	4	-.001	4	0	1	0	1
	3	max	2.166	4	.059	4	.098	6	.001	6	.249	6	.564	6
	4	min	-8.071	2	-.076	6	-.099	4	-.001	4	-.202	4	-.614	4
	5	max	2.303	4	.14	5	.009	6	.002	6	.117	6	1.047	6
	6	min	-8.228	2	-.044	4	-.04	2	-.002	4	-.211	3	-.952	4
	7	max	2.285	4	.097	6	.099	4	.002	6	.193	6	.62	6
	8	min	-8.246	2	-.079	4	-.098	6	-.002	4	-.15	4	-.666	4
	9	max	2.267	4	.062	6	.205	4	.002	6	0	1	0	1
	10	min	-8.264	2	-.114	3	-.204	6	-.002	4	0	1	0	1
CROSSDIAG2	1	max	8.528	2	.123	4	.221	6	.001	4	0	1	0	1
	2	min	-5.13	6	-.072	6	-.221	4	-.001	2	0	1	0	1
	3	max	8.546	2	.088	4	.115	6	.001	4	.211	6	.693	6
	4	min	-5.112	6	-.107	6	-.114	4	-.001	2	-.167	4	-.734	4
	5	max	8.762	2	.053	4	.009	6	.001	4	.155	6	1.194	6
	6	min	-5.094	6	-.148	5	-.034	1	-.001	6	-.244	4	-1.089	4
	7	max	8.78	2	.086	6	.114	4	.001	4	.267	6	.637	6
	8	min	-4.593	6	-.069	4	-.115	6	-.001	6	-.218	4	-.683	4
	9	max	8.798	2	.051	6	.221	4	.001	4	0	1	0	1
	10	min	-4.575	6	-.105	3	-.221	6	-.001	6	0	1	0	1
CROSSDIAG3	1	max	1.583	6	.089	3	.203	6	0	6	0	1	0	1
	2	min	-13.36	2	-.03	6	-.205	4	0	4	0	1	0	1
	3	max	1.565	6	.05	4	.097	6	0	6	.277	6	.531	6
	4	min	-13.378	2	-.065	6	-.098	4	0	4	-.228	4	-.588	4
	5	max	1.547	6	.127	5	.01	6	.001	6	.173	6	.965	6
	6	min	-13.535	2	-.031	4	-.039	2	-.001	4	-.263	4	-.884	4
	7	max	1.084	6	.083	6	.098	4	.001	6	.228	6	.579	6
	8	min	-13.553	2	-.066	4	-.097	6	-.001	4	-.184	4	-.632	4
	9	max	1.066	6	.048	6	.205	4	.001	6	0	1	0	1
	10	min	-13.571	2	-.103	3	-.203	6	-.001	4	0	1	0	1
CROSSDIAG4	1	max	13.432	2	.111	3	.222	6	0	4	0	1	0	1
	2	min	-3.074	6	-.059	6	-.221	4	-.001	2	0	1	0	1
	3	max	13.45	2	.075	4	.116	6	0	4	.249	6	.66	6
	4	min	-3.056	6	-.094	6	-.114	4	-.001	2	-.201	4	-.7	4
	5	max	13.664	2	.041	4	.01	6	0	4	.215	6	1.128	6
	6	min	-3.038	6	-.136	5	-.033	1	-.001	2	-.297	4	-1.021	4
	7	max	13.682	2	.076	6	.114	4	0	4	.298	6	.612	6
	8	min	-2.586	6	-.059	4	-.116	6	0	6	-.245	4	-.656	4
	9	max	13.7	2	.041	6	.221	4	0	4	0	1	0	1
	10	min	-2.568	6	-.097	3	-.222	6	0	6	0	1	0	1
CROSSDIAG5	1	max	8.082	6	.09	3	.177	5	0	2	0	1	0	1
	2	min	-13.146	2	-.045	6	-.178	3	0	4	0	1	0	1
	3	max	8.058	6	.058	4	.087	5	0	2	.258	5	.627	6













Company : Centek Engineering  
 Designer : TJL/CFC  
 Job Number : 12044.CO2

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**Envelope Member Section Forces (Continued)**

Member	Sec	Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Momen...	LC	z-z Momen...	LC
309		5	max	35.765	4	.148	6	-.011	4	.002	2	0	1
310			min	-36.676	6	-.148	4	-.162	1	-.002	4	0	1
311	WT9	1	max	42.802	6	.148	4	.045	2	0	3	0	1
312			min	-42.053	4	-.148	6	-.113	3	-.005	2	0	1
313		2	max	42.752	6	.074	4	.023	2	0	3	.086	2
314			min	-42.055	4	-.074	6	-.056	3	-.005	2	-.214	3
315		3	max	42.702	6	0	1	0	1	0	3	.114	2
316			min	-42.057	4	0	1	0	1	-.005	2	-.285	3
317		4	max	42.652	6	.074	6	.056	3	0	3	.086	2
318			min	-42.058	4	-.074	4	-.023	2	-.005	2	-.214	3
319		5	max	42.603	6	.148	6	.113	3	0	3	0	1
320			min	-42.06	4	-.148	4	-.045	2	-.005	2	0	1
321	WT10	1	max	38.759	6	.148	4	.162	1	.003	6	0	1
322			min	-39.111	4	-.148	6	.011	6	-.005	2	0	1
323		2	max	38.709	6	.074	4	.081	1	.003	6	.306	1
324			min	-39.113	4	-.074	6	.005	6	-.005	2	.02	6
325		3	max	38.66	6	0	1	0	1	.003	6	.408	1
326			min	-39.115	4	0	1	0	1	-.005	2	.027	6
327		4	max	38.61	6	.074	6	-.005	6	.003	6	.306	1
328			min	-39.116	4	-.074	4	-.081	1	-.005	2	.02	6
329		5	max	38.56	6	.148	6	-.011	6	.003	6	0	1
330			min	-39.118	4	-.148	4	-.162	1	-.005	2	0	1
331	WT11	1	max	36.081	4	.148	4	.113	5	.005	2	0	1
332			min	-35.85	6	-.148	6	-.045	2	-.002	6	0	1
333		2	max	36.131	4	.074	4	.056	5	.005	2	.214	5
334			min	-35.849	6	-.074	6	-.023	2	-.002	6	-.086	2
335		3	max	36.181	4	0	1	0	1	.005	2	.285	5
336			min	-35.847	6	0	1	0	1	-.002	6	-.114	2
337		4	max	36.23	4	.074	6	.023	2	.005	2	.214	5
338			min	-35.845	6	-.074	4	-.056	5	-.002	6	-.086	2
339		5	max	36.28	4	.148	6	.045	2	.005	2	0	1
340			min	-35.844	6	-.148	4	-.113	5	-.002	6	0	1
341	WT12	1	max	39.294	4	.148	4	.162	1	.004	2	0	1
342			min	-39.996	6	-.148	6	.011	4	0	4	0	1
343		2	max	39.244	4	.074	4	.081	1	.004	2	.306	1
344			min	-39.998	6	-.074	6	.005	4	0	4	.02	4
345		3	max	39.194	4	0	1	0	1	.004	2	.408	1
346			min	-40	6	0	1	0	1	0	4	.027	4
347		4	max	39.144	4	.074	6	-.005	4	.004	2	.306	1
348			min	-40.002	6	-.074	4	-.081	1	0	4	.02	4
349		5	max	39.095	4	.148	6	-.011	4	.004	2	0	1
350			min	-40.003	6	-.148	4	-.162	1	0	4	0	1
351	WT13	1	max	34.935	6	.148	4	.162	1	.003	6	0	1
352			min	-33.98	4	-.148	6	.011	6	-.01	2	0	1
353		2	max	34.886	6	.074	4	.081	1	.003	6	.306	1
354			min	-33.982	4	-.074	6	.005	6	-.01	2	.02	6
355		3	max	34.836	6	0	1	0	1	.003	6	.408	1
356			min	-33.984	4	0	1	0	1	-.01	2	.027	6
357		4	max	34.786	6	.074	6	-.005	6	.003	6	.306	1
358			min	-33.985	4	-.074	4	-.081	1	-.01	2	.02	6
359		5	max	34.736	6	.148	6	-.011	6	.003	6	0	1
360			min	-33.987	4	-.148	4	-.162	1	-.01	2	0	1
361	WT14	1	max	34.775	6	.148	4	.045	2	.003	6	0	1





**Envelope Member Section Forces (Continued)**

Member	Sec		Axial[k]	LC y Shear[k]	LC z Shear[k]	LC Torque[k-ft]	LC y-y Momen...	LC z-z Momen...	LC	
468		min	2.391	6 0	3 -3.222	4 0	1 -11.927	6 0	3	
469	5	max	0	1 0	1 0	1 0	1 0	1 0	1	
470		min	0	1 0	1 0	1 0	1 0	1 0	1	
471	Horz 12	1	max	7.056	6 .192	6 .001	6 .235	6 .201	6 2.712	6
472		min	-5.758	4 .113	1 -.005	2 -.834	2 -.206	4 -1.779	4	
473		2	max	7.056	6 .114	6 .001	6 .235	6 .206	6 2.196	6
474		min	-5.758	4 .034	1 -.005	2 -.834	2 -.208	4 -2.27	4	
475		3	max	7.056	6 .035	6 .001	6 .235	6 .21	6 1.945	6
476		min	-5.758	4 -.044	1 -.005	2 -.834	2 -.21	4 -2.495	4	
477		4	max	7.056	6 -.044	6 .001	6 .235	6 .215	6 1.961	6
478		min	-5.758	4 -.123	1 -.005	2 -.834	2 -.212	4 -2.454	4	
479		5	max	7.056	6 -.123	6 .001	6 .235	6 .22	6 2.243	6
480		min	-5.758	4 -.202	1 -.005	2 -.834	2 -.215	4 -2.147	4	

**Envelope Member Section Stresses**

Member	Sec		Axial[ksi]	LC y Shear[...]	LC z Shear[...]	LC y-Top[ksi]	LC y-Bot[ksi]	LC z-Top[ksi]	LC z-Bot[ksi]	LC	
1	CROSSDIAG1	1	max	.721	4 .075	3 .157	6 0	1 0	1 0	1	
2		min	-2.658	2 -.032	6 -.157	4 0	1 0	1 0	1 0	1	
3		2	max	.715	4 .046	4 .075	6 2.131	4 1.957	6 1.708	6 1.561	4
4		min	-2.664	2 -.058	6 -.076	4 -1.957	6 -2.131	4 -1.385	4 -1.924	6	
5		3	max	.76	4 .107	5 .007	6 3.303	4 3.634	6 .806	6 1.636	3
6		min	-2.715	2 -.034	4 -.031	2 -3.634	6 -3.303	4 -1.452	3 -909	6	
7		4	max	.754	4 .074	6 .076	4 2.31	4 2.151	6 1.323	6 1.16	4
8		min	-2.721	2 -.06	4 -.075	6 -2.151	6 -2.31	4 -1.03	4 -1.491	6	
9		5	max	.748	4 .048	6 .157	4 0	1 0	1 0	1 0	1
10		min	-2.727	2 -.087	3 -.157	6 0	1 0	1 0	1 0	1 0	1
11	CROSSDIAG2	1	max	2.814	2 .094	4 .17	6 0	1 0	1 0	1 0	1
12		min	-1.693	6 -.055	6 -.17	4 0	1 0	1 0	1 0	1 0	1
13		2	max	2.82	2 .068	4 .088	6 2.548	4 2.405	6 1.452	6 1.292	4
14		min	-1.687	6 -.082	6 -.088	4 -2.405	6 -2.548	4 -1.147	4 -1.636	6	
15		3	max	2.892	2 .041	4 .007	6 3.778	4 4.142	6 1.062	6 1.892	4
16		min	-1.681	6 -.113	5 -.026	1 -4.142	6 -3.778	4 -1.679	4 -1.197	6	
17		4	max	2.898	2 .066	6 .088	4 2.368	4 2.211	6 1.835	6 1.692	4
18		min	-1.516	6 -.053	4 -.088	6 -2.211	6 -2.368	4 -1.501	4 -2.068	6	
19		5	max	2.904	2 .039	6 .17	4 0	1 0	1 0	1 0	1
20		min	-1.51	6 -.081	3 -.17	6 0	1 0	1 0	1 0	1 0	1
21	CROSSDIAG3	1	max	.523	6 .069	3 .156	6 0	1 0	1 0	1 0	1
22		min	-4.409	2 -.023	6 -.157	4 0	1 0	1 0	1 0	1 0	1
23		2	max	.517	6 .038	4 .074	6 2.039	4 1.841	6 1.9	6 1.764	4
24		min	-4.415	2 -.05	6 -.076	4 -1.841	6 -2.039	4 -1.566	4 -2.141	6	
25		3	max	.511	6 .097	5 .007	6 3.067	4 3.349	6 1.191	6 2.037	4
26		min	-4.467	2 -.024	4 -.03	2 -3.349	6 -3.067	4 -1.808	4 -1.343	6	
27		4	max	.358	6 .063	6 .076	4 2.192	4 2.009	6 1.569	6 1.423	4
28		min	-4.473	2 -.051	4 -.074	6 -2.008	6 -2.192	4 -1.263	4 -1.768	6	
29		5	max	.352	6 .037	6 .157	4 0	1 0	1 0	1 0	1
30		min	-4.479	2 -.079	3 -.156	6 0	1 0	1 0	1 0	1 0	1
31	CROSSDIAG4	1	max	4.433	2 .085	3 .171	6 0	1 0	1 0	1 0	1
32		min	-1.015	6 -.045	6 -.17	4 0	1 0	1 0	1 0	1 0	1
33		2	max	4.439	2 .058	4 .089	6 2.43	4 2.291	6 1.714	6 1.557	4
34		min	-1.009	6 -.072	6 -.088	4 -2.291	6 -2.43	4 -1.382	4 -1.931	6	
35		3	max	4.509	2 .031	4 .007	6 3.542	4 3.915	6 1.48	6 2.303	4











Company : Centek Engineering  
 Designer : TJJ/CFC  
 Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

June 14, 2012  
 5:27 PM

Checked By: \_\_\_\_\_

**Envelope Member Section Stresses (Continued)**

Member	Sec		Axial[ksi]	LC y	Shear[...]	LC z	Shear[...]	LC y-Top[ksi]	LC y-Bot[ksi]	LC z-Top[ksi]	LC z-Bot[ksi]	LC					
248		min	-3.004	4	-.055	4	-.024	3	-.315	6	-1.216	4	-.328	2	-.819	3	
249	5	max	5.652	2	.11	6	.019	2	0	1	0	1	0	1	0	1	
250		min	-3.003	4	-.11	4	-.047	3	0	1	0	1	0	1	0	1	
251	WT3	1	max	6.508	2	.11	4	.019	2	0	1	0	1	0	1	0	1
252		min	-4.074	6	-.11	6	-.047	5	0	1	0	1	0	1	0	1	
253	2	max	6.49	2	.055	4	.009	2	.315	4	1.216	6	.328	2	.819	5	
254		min	-4.075	6	-.055	6	-.024	5	-.315	6	-1.216	4	-.819	5	-.328	2	
255	3	max	6.472	2	0	1	0	1	.42	4	1.621	6	.438	2	1.092	5	
256		min	-4.075	6	0	1	0	1	-.42	6	-1.621	4	-1.092	5	-.438	2	
257	4	max	6.453	2	.055	6	.024	5	.315	4	1.216	6	.328	2	.819	5	
258		min	-4.076	6	-.055	4	-.009	2	-.315	6	-1.216	4	-.819	5	-.328	2	
259	5	max	6.435	2	.11	6	.047	5	0	1	0	1	0	1	0	1	
260		min	-4.076	6	-.11	4	-.019	2	0	1	0	1	0	1	0	1	
261	WT4	1	max	4.116	4	.11	4	.068	1	0	1	0	1	0	1	0	1
262		min	-6.67	2	-.11	6	.004	4	0	1	0	1	0	1	0	1	
263	2	max	4.105	4	.055	4	.034	1	.315	4	1.216	6	1.174	1	-.077	4	
264		min	-6.664	2	-.055	6	.002	4	-.315	6	-1.216	4	.077	4	-1.174	1	
265	3	max	4.093	4	0	1	0	1	.42	4	1.621	6	1.565	1	-.103	4	
266		min	-6.657	2	0	1	0	1	-.42	6	-1.621	4	.103	4	-1.565	1	
267	4	max	4.082	4	.055	6	-.002	4	.315	4	1.216	6	1.174	1	-.077	4	
268		min	-6.651	2	-.055	4	-.034	1	-.315	6	-1.216	4	.077	4	-1.174	1	
269	5	max	4.071	4	.11	6	-.004	4	0	1	0	1	0	1	0	1	
270		min	-6.644	2	-.11	4	-.068	1	0	1	0	1	0	1	0	1	
271	WT5	1	max	9.093	6	.11	4	-.004	6	0	1	0	1	0	1	0	1
272		min	-9.112	4	-.11	6	-.068	1	0	1	0	1	0	1	0	1	
273	2	max	9.104	6	.055	4	-.002	6	.315	4	1.216	6	-.077	6	1.174	1	
274		min	-9.111	4	-.055	6	-.034	1	-.315	6	-1.216	4	-1.174	1	.077	6	
275	3	max	9.115	6	0	1	0	1	.42	4	1.621	6	-.103	6	1.565	1	
276		min	-9.111	4	0	1	0	1	-.42	6	-1.621	4	-1.565	1	.103	6	
277	4	max	9.127	6	.055	6	.034	1	.315	4	1.216	6	-.077	6	1.174	1	
278		min	-9.11	4	-.055	4	.002	6	-.315	6	-1.216	4	-1.174	1	.077	6	
279	5	max	9.138	6	.11	6	.068	1	0	1	0	1	0	1	0	1	
280		min	-9.11	4	-.11	4	.004	6	0	1	0	1	0	1	0	1	
281	WT6	1	max	10.25	6	.11	4	.047	3	0	1	0	1	0	1	0	1
282		min	-10.037	4	-.11	6	-.019	2	0	1	0	1	0	1	0	1	
283	2	max	10.262	6	.055	4	.024	3	.315	4	1.216	6	.819	3	.328	2	
284		min	-10.037	4	-.055	6	-.009	2	-.315	6	-1.216	4	-.328	2	-.819	3	
285	3	max	10.273	6	0	1	0	1	.42	4	1.621	6	1.092	3	.438	2	
286		min	-10.036	4	0	1	0	1	-.42	6	-1.621	4	-.438	2	-1.092	3	
287	4	max	10.284	6	.055	6	.009	2	.315	4	1.216	6	.819	3	.328	2	
288		min	-10.036	4	-.055	4	-.024	3	-.315	6	-1.216	4	-.328	2	-.819	3	
289	5	max	10.295	6	.11	6	.019	2	0	1	0	1	0	1	0	1	
290		min	-10.036	4	-.11	4	-.047	3	0	1	0	1	0	1	0	1	
291	WT7	1	max	7.252	4	.11	4	.019	2	0	1	0	1	0	1	0	1
292		min	-7.19	6	-.11	6	-.047	5	0	1	0	1	0	1	0	1	
293	2	max	7.241	4	.055	4	.009	2	.315	4	1.216	6	.328	2	.819	5	
294		min	-7.191	6	-.055	6	-.024	5	-.315	6	-1.216	4	-.819	5	-.328	2	
295	3	max	7.229	4	0	1	0	1	.42	4	1.621	6	.438	2	1.092	5	
296		min	-7.191	6	0	1	0	1	-.42	6	-1.621	4	-1.092	5	-.438	2	
297	4	max	7.218	4	.055	6	.024	5	.315	4	1.216	6	.328	2	.819	5	
298		min	-7.191	6	-.055	4	-.009	2	-.315	6	-1.216	4	-.819	5	-.328	2	
299	5	max	7.207	4	.11	6	.047	5	0	1	0	1	0	1	0	1	
300		min	-7.192	6	-.11	4	-.019	2	0	1	0	1	0	1	0	1	

**Envelope Member Section Stresses (Continued)**

Member	Sec		Axial[ksi]	LC y Shear[...]	LC z Shear[...]	LC y-Top[ksi]	LC y-Bot[ksi]	LC z-Top[ksi]	LC z-Bot[ksi]	LC							
301	WT8	1	max	8.174	4	.11	4	.068	1	0	1	0	1	0	1	0	1
302			min	-8.334	6	-.11	6	.004	4	0	1	0	1	0	1	0	1
303		2	max	8.162	4	.055	4	.034	1	.315	4	1.216	6	1.174	1	-.077	4
304			min	-8.334	6	-.055	6	.002	4	-.315	6	-1.216	4	.077	4	-1.174	1
305		3	max	8.151	4	0	1	0	1	.42	4	1.621	6	1.565	1	-.103	4
306			min	-8.335	6	0	1	0	1	-.42	6	-1.621	4	.103	4	-1.565	1
307		4	max	8.14	4	.055	6	-.002	4	.315	4	1.216	6	1.174	1	-.077	4
308			min	-8.335	6	-.055	4	-.034	1	-.315	6	-1.216	4	.077	4	-1.174	1
309		5	max	8.129	4	.11	6	-.004	4	0	1	0	1	0	1	0	1
310			min	-8.336	6	-.11	4	-.068	1	0	1	0	1	0	1	0	1
311	WT9	1	max	9.728	6	.11	4	.019	2	0	1	0	1	0	1	0	1
312			min	-9.558	4	-.11	6	-.047	3	0	1	0	1	0	1	0	1
313		2	max	9.716	6	.055	4	.009	2	.315	4	1.216	6	.328	2	.819	3
314			min	-9.558	4	-.055	6	-.024	3	-.315	6	-1.216	4	-.819	3	-.328	2
315		3	max	9.705	6	0	1	0	1	.42	4	1.621	6	.438	2	1.092	3
316			min	-9.558	4	0	1	0	1	-.42	6	-1.621	4	-1.092	3	-.438	2
317		4	max	9.694	6	.055	6	.024	3	.315	4	1.216	6	.328	2	.819	3
318			min	-9.559	4	-.055	4	-.009	2	-.315	6	-1.216	4	-.819	3	-.328	2
319		5	max	9.682	6	.11	6	.047	3	0	1	0	1	0	1	0	1
320			min	-9.559	4	-.11	4	-.019	2	0	1	0	1	0	1	0	1
321	WT10	1	max	8.809	6	.11	4	.068	1	0	1	0	1	0	1	0	1
322			min	-8.889	4	-.11	6	.004	6	0	1	0	1	0	1	0	1
323		2	max	8.798	6	.055	4	.034	1	.315	4	1.216	6	1.174	1	-.077	6
324			min	-8.889	4	-.055	6	.002	6	-.315	6	-1.216	4	.077	6	-1.174	1
325		3	max	8.786	6	0	1	0	1	.42	4	1.621	6	1.565	1	-.103	6
326			min	-8.89	4	0	1	0	1	-.42	6	-1.621	4	.103	6	-1.565	1
327		4	max	8.775	6	.055	6	-.002	6	.315	4	1.216	6	1.174	1	-.077	6
328			min	-8.89	4	-.055	4	-.034	1	-.315	6	-1.216	4	.077	6	-1.174	1
329		5	max	8.764	6	.11	6	-.004	6	0	1	0	1	0	1	0	1
330			min	-8.891	4	-.11	4	-.068	1	0	1	0	1	0	1	0	1
331	WT11	1	max	8.2	4	.11	4	.047	5	0	1	0	1	0	1	0	1
332			min	-8.148	6	-.11	6	-.019	2	0	1	0	1	0	1	0	1
333		2	max	8.212	4	.055	4	.024	5	.315	4	1.216	6	.819	5	.328	2
334			min	-8.147	6	-.055	6	-.009	2	-.315	6	-1.216	4	-.328	2	-.819	5
335		3	max	8.223	4	0	1	0	1	.42	4	1.621	6	1.092	5	.438	2
336			min	-8.147	6	0	1	0	1	-.42	6	-1.621	4	-.438	2	-1.092	5
337		4	max	8.234	4	.055	6	.009	2	.315	4	1.216	6	.819	5	.328	2
338			min	-8.147	6	-.055	4	-.024	5	-.315	6	-1.216	4	-.328	2	-.819	5
339		5	max	8.245	4	.11	6	.019	2	0	1	0	1	0	1	0	1
340			min	-8.146	6	-.11	4	-.047	5	0	1	0	1	0	1	0	1
341	WT12	1	max	8.93	4	.11	4	.068	1	0	1	0	1	0	1	0	1
342			min	-9.09	6	-.11	6	.004	4	0	1	0	1	0	1	0	1
343		2	max	8.919	4	.055	4	.034	1	.315	4	1.216	6	1.174	1	-.077	4
344			min	-9.09	6	-.055	6	.002	4	-.315	6	-1.216	4	.077	4	-1.174	1
345		3	max	8.908	4	0	1	0	1	.42	4	1.621	6	1.565	1	-.103	4
346			min	-9.091	6	0	1	0	1	-.42	6	-1.621	4	.103	4	-1.565	1
347		4	max	8.896	4	.055	6	-.002	4	.315	4	1.216	6	1.174	1	-.077	4
348			min	-9.091	6	-.055	4	-.034	1	-.315	6	-1.216	4	.077	4	-1.174	1
349		5	max	8.885	4	.11	6	-.004	4	0	1	0	1	0	1	0	1
350			min	-9.092	6	-.11	4	-.068	1	0	1	0	1	0	1	0	1
351	WT13	1	max	7.94	6	.11	4	.068	1	0	1	0	1	0	1	0	1
352			min	-7.723	4	-.11	6	.004	6	0	1	0	1	0	1	0	1
353		2	max	7.929	6	.055	4	.034	1	.315	4	1.216	6	1.174	1	-.077	6

Company : Centek Engineering  
 Designer : TJL/CFC  
 Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

June 14, 2012  
 5:27 PM

Checked By: \_\_\_\_\_

**Envelope Member Section Stresses (Continued)**

Member	Sec		Axial[ksi]	LC y Shear...	LC z Shear...	LC y-Top[ksi]	LC y-Bot[ksi]	LC z-Top[ksi]	LC z-Bot[ksi]	LC							
354		min	-7.723	4	-.055	6	.002	6	-.315	6	-1.216	4	.077	6	-1.174	1	
355	3	max	7.917	6	0	1	0	1	.42	4	1.621	6	1.565	1	-.103	6	
356		min	-7.724	4	0	1	0	1	-.42	6	-1.621	4	.103	6	-1.565	1	
357	4	max	7.906	6	.055	6	-.002	6	.315	4	1.216	6	1.174	1	-.077	6	
358		min	-7.724	4	-.055	4	-.034	1	-.315	6	-1.216	4	.077	6	-1.174	1	
359	5	max	7.895	6	.11	6	-.004	6	0	1	0	1	0	1	0	1	
360		min	-7.724	4	-.11	4	-.068	1	0	1	0	1	0	1	0	1	
361	WT14	1	max	7.903	6	.11	4	.019	2	0	1	0	1	0	1	0	1
362		min	-8.032	4	-.11	6	-.047	3	0	1	0	1	0	1	0	1	1
363	2	max	7.892	6	.055	4	.009	2	.315	4	1.216	6	.328	2	.819	3	
364		min	-8.032	4	-.055	6	-.024	3	-.315	6	-1.216	4	-.819	3	-.328	2	
365	3	max	7.881	6	0	1	0	1	.42	4	1.621	6	.438	2	1.092	3	
366		min	-8.032	4	0	1	0	1	-.42	6	-1.621	4	-1.092	3	-.438	2	
367	4	max	7.869	6	.055	6	.024	3	.315	4	1.216	6	.328	2	.819	3	
368		min	-8.033	4	-.055	4	-.009	2	-.315	6	-1.216	4	-.819	3	-.328	2	
369	5	max	7.858	6	.11	6	.047	3	0	1	0	1	0	1	0	1	
370		min	-8.033	4	-.11	4	-.019	2	0	1	0	1	0	1	0	1	
371	WT15	1	max	11.769	4	.11	4	.019	2	0	1	0	1	0	1	0	1
372		min	-11.907	6	-.11	6	-.047	5	0	1	0	1	0	1	0	1	1
373	2	max	11.758	4	.055	4	.009	2	.315	4	1.216	6	.328	2	.819	5	
374		min	-11.907	6	-.055	6	-.024	5	-.315	6	-1.216	4	-.819	5	-.328	2	
375	3	max	11.746	4	0	1	0	1	.42	4	1.621	6	.438	2	1.092	5	
376		min	-11.907	6	0	1	0	1	-.42	6	-1.621	4	-1.092	5	-.438	2	
377	4	max	11.735	4	.055	6	.024	5	.315	4	1.216	6	.328	2	.819	5	
378		min	-11.908	6	-.055	4	-.009	2	-.315	6	-1.216	4	-.819	5	-.328	2	
379	5	max	11.724	4	.11	6	.047	5	0	1	0	1	0	1	0	1	
380		min	-11.908	6	-.11	4	-.019	2	0	1	0	1	0	1	0	1	
381	WT16	1	max	12.074	4	.11	4	.068	1	0	1	0	1	0	1	0	1
382		min	-11.87	6	-.11	6	.004	4	0	1	0	1	0	1	0	1	1
383	2	max	12.062	4	.055	4	.034	1	.315	4	1.216	6	1.174	1	-.077	4	
384		min	-11.871	6	-.055	6	.002	4	-.315	6	-1.216	4	.077	4	-1.174	1	
385	3	max	12.051	4	0	1	0	1	.42	4	1.621	6	1.565	1	-.103	4	
386		min	-11.871	6	0	1	0	1	-.42	6	-1.621	4	.103	4	-1.565	1	
387	4	max	12.04	4	.055	6	-.002	4	.315	4	1.216	6	1.174	1	-.077	4	
388		min	-11.871	6	-.055	4	-.034	1	-.315	6	-1.216	4	.077	4	-1.174	1	
389	5	max	12.028	4	.11	6	-.004	4	0	1	0	1	0	1	0	1	
390		min	-11.872	6	-.11	4	-.068	1	0	1	0	1	0	1	0	1	
391	WT17	1	max	11.67	6	.11	4	-.004	6	0	1	0	1	0	1	0	1
392		min	-11.573	4	-.11	6	-.068	1	0	1	0	1	0	1	0	1	1
393	2	max	11.682	6	.055	4	-.002	6	.315	4	1.216	6	-.077	6	1.174	1	
394		min	-11.573	4	-.055	6	-.034	1	-.315	6	-1.216	4	-1.174	1	.077	6	
395	3	max	11.693	6	0	1	0	1	.42	4	1.621	6	-.103	6	1.565	1	
396		min	-11.572	4	0	1	0	1	-.42	6	-1.621	4	-1.565	1	.103	6	
397	4	max	11.704	6	.055	6	.034	1	.315	4	1.216	6	-.077	6	1.174	1	
398		min	-11.572	4	-.055	4	.002	6	-.315	6	-1.216	4	-1.174	1	.077	6	
399	5	max	11.716	6	.11	6	.068	1	0	1	0	1	0	1	0	1	
400		min	-11.572	4	-.11	4	.004	6	0	1	0	1	0	1	0	1	1
401	WT18	1	max	11.729	6	.11	4	.047	3	0	1	0	1	0	1	0	1
402		min	-11.914	4	-.11	6	-.019	2	0	1	0	1	0	1	0	1	1
403	2	max	11.74	6	.055	4	.024	3	.315	4	1.216	6	.819	3	.328	2	
404		min	-11.913	4	-.055	6	-.009	2	-.315	6	-1.216	4	-.328	2	-.819	3	
405	3	max	11.752	6	0	1	0	1	.42	4	1.621	6	1.092	3	.438	2	
406		min	-11.913	4	0	1	0	1	-.42	6	-1.621	4	-.438	2	-1.092	3	

Company : Centek Engineering  
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82' Sign Structure with 111' Pipe Mast

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Checked By: \_\_\_\_\_

**Envelope Member Section Stresses (Continued)**

Member	Sec		Axial[ksi]	LC y Shear[...]	LC z Shear[...]	LC y-Top[ksi]	LC y-Bot[ksi]	LC z-Top[ksi]	LC z-Bot[ksi]	LC	
407	4	max	11.763	6 .055	6 .009	2 .315	4 1.216	6 .819	3 .328	2	
408		min	-11.913	4 -.055	4 -.024	3 -.315	6 -1.216	4 -.328	2 -.819	3	
409	5	max	11.774	6 .11	6 .019	2 0	1 0	1 0	1 0	1	
410		min	-11.912	4 -.11	4 -.047	3 0	1 0	1 0	1 0	1	
411	WT19	1	max	5.711	4 .11	4 .019	2 0	1 0	1 0	1	
412		min	-5.821	6 -.11	6 -.047	5 0	1 0	1 0	1 0	1	
413	2	max	5.7	4 .055	4 .009	2 .315	4 1.216	6 .328	2 .819	5	
414		min	-5.822	6 -.055	6 -.024	5 -.315	6 -1.216	4 -.819	5 -.328	2	
415	3	max	5.689	4 0	1 0	1 .42	4 1.621	6 .438	2 1.092	5	
416		min	-5.822	6 0	1 0	1 -.42	6 -1.621	4 -1.092	5 -.438	2	
417	4	max	5.677	4 .055	6 .024	5 .315	4 1.216	6 .328	2 .819	5	
418		min	-5.823	6 -.055	4 -.009	2 -.315	6 -1.216	4 -.819	5 -.328	2	
419	5	max	5.666	4 .11	6 .047	5 0	1 0	1 0	1 0	1	
420		min	-5.823	6 -.11	4 -.019	2 0	1 0	1 0	1 0	1	
421	WT20	1	max	6.05	4 .11	4 .068	1 0	1 0	1 0	1	
422		min	-5.874	6 -.11	6 .004	4 0	1 0	1 0	1 0	1	
423	2	max	6.039	4 .055	4 .034	1 .315	4 1.216	6 1.174	1 -.077	4	
424		min	-5.875	6 -.055	6 .002	4 -.315	6 -1.216	4 .077	4 -1.174	1	
425	3	max	6.028	4 0	1 0	1 .42	4 1.621	6 1.565	1 -.103	4	
426		min	-5.875	6 0	1 0	1 -.42	6 -1.621	4 .103	4 -1.565	1	
427	4	max	6.016	4 .055	6 -.002	4 .315	4 1.216	6 1.174	1 -.077	4	
428		min	-5.876	6 -.055	4 -.034	1 -.315	6 -1.216	4 .077	4 -1.174	1	
429	5	max	6.005	4 .11	6 -.004	4 0	1 0	1 0	1 0	1	
430		min	-5.876	6 -.11	4 -.068	1 0	1 0	1 0	1 0	1	
431	Mast1	1	max	19.176	4 .399	2 .221	6 .035	6 6.596	2 9.99	4 9.929	6
432		min	-18.114	6 -.004	6 -.219	4 -6.596	2 -.035	6 -9.929	6 -9.99	4	
433	2	max	19.146	4 .378	2 .2	6 0	4 2.641	2 7.871	4 7.786	6	
434		min	-18.144	6 -.004	6 -.197	4 -2.641	2 0	4 -7.786	6 -7.871	4	
435	3	max	19.116	4 .356	2 .178	6 1.095	2 .039	6 5.971	4 5.863	6	
436		min	-18.174	6 -.004	6 -.176	4 -.039	6 -1.095	2 -5.863	6 -5.971	4	
437	4	max	17.446	4 .001	6 .121	4 2.457	2 .056	6 5.4	4 5.306	6	
438		min	-16.539	6 -.199	2 -.128	6 -.056	6 -2.457	2 -5.306	6 -5.4	4	
439	5	max	17.416	4 .001	6 .142	4 .321	2 .043	6 6.737	4 6.716	6	
440		min	-16.569	6 -.221	2 -.149	6 -.043	6 -.321	2 -6.716	6 -6.737	4	
441	Mast2	1	max	17.416	4 .001	6 .142	4 .321	2 .043	6 6.737	4 6.716	6
442		min	-16.569	6 -.221	2 -.149	6 -.043	6 -.321	2 -6.716	6 -6.737	4	
443	2	max	13.332	4 .004	6 .17	6 .004	4 .816	2 6.701	4 6.706	6	
444		min	-12.521	6 -.002	4 -.168	4 -.816	2 -.004	4 -6.706	6 -6.701	4	
445	3	max	13.304	4 .004	6 .146	6 .027	6 .951	2 5.202	4 5.182	6	
446		min	-12.55	6 -.026	2 -.143	4 -.951	2 -.027	6 -5.182	6 -5.202	4	
447	4	max	9.097	4 .223	2 .198	6 .044	6 .076	2 3.558	4 3.543	6	
448		min	-8.406	6 -.001	6 -.202	4 -.076	2 -.044	6 -3.543	6 -3.558	4	
449	5	max	9.069	4 .198	2 .174	6 1.952	2 .014	3 1.724	4 1.747	6	
450		min	-8.434	6 -.001	6 -.178	4 -.014	3 -1.952	2 -1.747	6 -1.724	4	
451	Mast3	1	max	9.069	4 .198	2 .174	6 1.952	2 .014	3 1.724	4 1.747	6
452		min	-8.434	6 -.001	6 -.178	4 -.014	3 -1.952	2 -1.747	6 -1.724	4	
453	2	max	4.397	4 0	3 .722	4 .019	6 1.234	2 4.12	4 4.153	6	
454		min	-3.84	6 -.918	2 -.72	6 -1.234	2 -.019	6 -4.153	6 -4.12	4	
455	3	max	4.368	4 0	3 .749	4 .007	6 10.221	2 11.217	4 11.229	6	
456		min	-3.869	6 -.945	2 -.747	6 -10.221	2 -.007	6 -11.229	6 -11.217	4	
457	4	max	.267	3 .376	2 .376	6 0	3 13.324	2 13.324	4 13.324	6	
458		min	.206	2 0	3 -.376	4 -13.324	2 0	3 -13.324	6 -13.324	4	
459	5	max	.231	3 .348	2 .348	6 0	3 9.832	2 9.832	4 9.832	6	

**Envelope Member Section Stresses (Continued)**

Member	Sec		Axial[ksi]	LC	y Shear[...]	LC	z Shear[...]	LC	y-Top[ksi]	LC	y-Bot[ksi]	LC	z-Top[ksi]	LC	z-Bot[ksi]	LC	
460		min	.177	2	0	3	-.348	4	-9.832	2	0	3	-9.832	6	-9.832	4	
461	Mast4	1	max	.231	3	.348	2	.348	6	0	3	9.832	2	9.832	4	9.832	6
462		min	.177	6	0	3	-.348	4	-9.832	2	0	3	-9.832	6	-9.832	4	
463		2	max	.197	3	.316	2	.316	6	0	3	6.686	2	6.686	4	6.686	6
464		min	.149	6	0	3	-.316	4	-6.686	2	0	3	-6.686	6	-6.686	4	
465		3	max	.162	3	.284	2	.284	6	0	3	3.845	2	3.845	4	3.845	6
466		min	.121	6	0	3	-.284	4	-3.845	2	0	3	-3.845	6	-3.845	4	
467		4	max	.128	3	.252	2	.252	6	0	3	1.308	2	1.308	4	1.308	6
468		min	.093	6	0	3	-.252	4	-1.308	2	0	3	-1.308	6	-1.308	4	
469		5	max	0	1	0	1	0	1	0	1	0	1	0	1	0	1
470		min	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1
471	Horz 12	1	max	1.029	6	.038	6	0	6	1.585	4	2.415	6	.267	6	.273	4
472		min	-.839	4	.023	1	-.002	2	-2.415	6	-1.585	4	-.273	4	-.267	6	6
473		2	max	1.029	6	.023	6	0	6	2.022	4	1.955	6	.273	6	.276	4
474		min	-.839	4	.007	1	-.002	2	-1.955	6	-2.022	4	-.276	4	-.273	6	6
475		3	max	1.029	6	.007	6	0	6	2.222	4	1.733	6	.279	6	.279	4
476		min	-.839	4	-.009	1	-.002	2	-1.733	6	-2.222	4	-.279	4	-.279	6	6
477		4	max	1.029	6	-.009	6	0	6	2.185	4	1.746	6	.285	6	.282	4
478		min	-.839	4	-.025	1	-.002	2	-1.746	6	-2.185	4	-.282	4	-.285	6	6
479		5	max	1.029	6	-.025	6	0	6	1.912	4	1.997	6	.291	6	.285	4
480		min	-.839	4	-.04	1	-.002	2	-1.997	6	-1.912	4	-.285	4	-.291	6	6

**Envelope Joint Reactions**

Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC	
1	BOTLEG1	max	5.184	6	251.939	6	19.857	6	580.793	6	.028	2	113.593	2
2		min	-14.733	2	-224.997	4	-19.874	4	-585.176	4	-.004	4	-29.889	6
3	BOTMAST	max	.047	6	490.899	4	2.833	6	90.556	6	.082	2	60.159	2
4		min	-5.113	2	-463.717	6	-2.803	4	-91.112	4	-.022	6	-.323	6
5	BOTLEG2	max	5.038	4	254.614	6	21.703	6	625.675	6	.028	2	112.453	2
6		min	-14.276	2	-223.067	4	-21.717	4	-628.929	4	-.016	6	-26.475	4
7	Totals:	max	0	4	58.551	5	44.393	6						
8		min	-34.122	2	42.835	2	-44.393	4						

**Envelope Joint Displacements**

Joint		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [...]	LC	Y Rotation [...]	LC	Z Rotation [...]	LC	
1	1	max	.289	2	.019	4	.261	4	3.73e-3	4	3.45e-5	4	1.85e-4	6
2		min	-.057	6	-.021	6	-.259	6	-3.697e-3	6	-2.263e-4	2	-2.599e-3	2
3	2	max	.288	2	.019	4	.28	4	3.994e-3	4	1.26e-4	6	1.719e-6	3
4		min	-.044	4	-.021	6	-.278	6	-3.97e-3	6	-2.229e-4	2	-2.596e-3	2
5	3	max	.486	2	.041	4	.937	4	6.558e-3	4	6.272e-5	4	4.819e-4	6
6		min	-.024	6	-.045	6	-.929	6	-6.489e-3	6	-6.052e-4	2	-5.421e-4	4
7	4	max	.486	2	.04	4	1.002	4	6.961e-3	4	3.069e-4	6	4.651e-4	4
8		min	-.015	6	-.045	6	-.996	6	-6.913e-3	6	-5.958e-4	2	-4.27e-4	6
9	5	max	.486	2	.043	4	.978	4	6.841e-3	4	6.847e-5	4	9.332e-4	6
10		min	-.028	6	-.047	6	-.969	6	-6.768e-3	6	-6.83e-4	2	-9.993e-4	4
11	6	max	.485	2	.043	4	1.046	4	7.251e-3	4	3.44e-4	6	9.95e-4	4
12		min	-.011	6	-.048	6	-1.039	6	-7.202e-3	6	-6.723e-4	2	-9.664e-4	6
13	7	max	.472	2	.053	4	1.183	4	7.992e-3	4	8.675e-5	4	8.909e-4	6
14		min	-.065	6	-.059	6	-1.171	6	-7.901e-3	6	-1.033e-3	2	-9.009e-4	4
15	8	max	.47	2	.053	4	1.262	4	8.426e-3	4	5.033e-4	6	9.2e-4	4

Company : Centek Engineering  
 Designer : TJL/CFC  
 Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

June 14, 2012  
 5:27 PM

Checked By:

**Envelope Joint Displacements (Continued)**

	Joint		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [...]	LC	Y Rotation [...]	LC	Z Rotation [...]	LC
16		min	-.029	4	-.059	6	-1.254	6	-8.368e-3	6	-1.017e-3	2	-9.375e-4	6
17	9	max	.541	2	.071	4	1.701	4	9.998e-3	4	1.901e-4	6	9.253e-4	4
18		min	-.038	6	-.078	6	-1.684	6	-9.871e-3	6	-1.821e-3	2	-1.406e-3	2
19	10	max	.541	2	.07	4	1.806	4	1.045e-2	4	7.832e-4	6	1.071e-3	6
20		min	-.008	6	-.078	6	-1.794	6	-1.038e-2	6	-1.792e-3	2	-1.458e-3	2
21	11	max	.623	2	.097	4	2.645	4	1.221e-2	4	4.295e-4	6	7.498e-4	6
22		min	-.029	6	-.106	6	-2.615	6	-1.203e-2	6	-2.966e-3	2	-1.277e-3	2
23	12	max	.624	2	.096	4	2.787	4	1.265e-2	4	1.154e-3	6	6.287e-4	4
24		min	-.026	6	-.107	6	-2.77	6	-1.26e-2	6	-2.916e-3	2	-1.173e-3	2
25	13	max	.632	2	.099	4	2.719	4	1.234e-2	4	4.475e-4	6	8.596e-4	6
26		min	-.034	6	-.108	6	-2.688	6	-1.215e-2	6	-3.046e-3	2	-1.353e-3	2
27	14	max	.631	2	.098	4	2.864	4	1.278e-2	4	1.179e-3	6	7.286e-4	4
28		min	-.022	6	-.109	6	-2.847	6	-1.273e-2	6	-2.995e-3	2	-1.222e-3	2
29	15	max	.656	2	.105	4	2.945	4	1.27e-2	4	5.029e-4	6	7.739e-4	6
30		min	-.05	6	-.114	6	-2.91	6	-1.249e-2	6	-3.285e-3	2	-1.283e-3	2
31	16	max	.653	2	.104	4	3.098	4	1.313e-2	4	1.251e-3	6	6.791e-4	4
32		min	-.009	6	-.115	6	-3.08	6	-1.309e-2	6	-3.229e-3	2	-1.115e-3	2
33	17	max	.836	2	.136	4	4.903	4	1.487e-2	4	1.172e-3	6	2.019e-4	4
34		min	-.042	6	-.148	6	-4.831	6	-1.453e-2	6	-5.471e-3	2	-2.281e-3	2
35	18	max	.832	2	.134	4	5.113	4	1.523e-2	4	1.756e-3	6	7.375e-4	6
36		min	-.035	6	-.149	6	-5.096	6	-1.531e-2	6	-5.374e-3	2	-2.23e-3	2
37	19	max	.851	2	.137	4	4.993	4	1.494e-2	4	1.201e-3	6	1.38e-4	4
38		min	-.041	6	-.15	6	-4.918	6	-1.46e-2	6	-5.563e-3	2	-2.423e-3	2
39	20	max	.846	2	.136	4	5.204	4	1.53e-2	4	1.777e-3	6	7.212e-4	6
40		min	-.04	6	-.151	6	-5.188	6	-1.538e-2	6	-5.465e-3	2	-2.376e-3	2
41	21	max	.896	2	.141	4	5.264	4	1.515e-2	4	1.288e-3	6	3.269e-4	6
42		min	-.045	6	-.154	6	-5.183	6	-1.479e-2	6	-5.829e-3	2	-2.38e-3	2
43	22	max	.891	2	.14	4	5.482	4	1.55e-2	4	1.839e-3	6	4.367e-4	6
44		min	-.051	6	-.155	6	-5.467	6	-1.56e-2	6	-5.736e-3	2	-2.493e-3	2
45	23	max	.948	2	.144	4	5.631	4	1.542e-2	4	1.44e-3	6	3.535e-4	6
46		min	-.054	6	-.158	6	-5.541	6	-1.503e-2	6	-6.284e-3	2	-2.069e-3	2
47	24	max	.947	2	.143	4	5.857	4	1.575e-2	4	1.939e-3	6	1.605e-4	6
48		min	-.057	6	-.159	6	-5.846	6	-1.589e-2	6	-6.198e-3	2	-2.12e-3	2
49	25	max	.961	2	.145	4	5.724	4	1.549e-2	4	1.478e-3	6	3.14e-4	6
50		min	-.056	6	-.159	6	-5.632	6	-1.509e-2	6	-6.399e-3	2	-2.041e-3	2
51	26	max	.959	2	.144	4	5.952	4	1.581e-2	4	1.964e-3	6	1.571e-4	6
52		min	-.058	6	-.16	6	-5.941	6	-1.595e-2	6	-6.313e-3	2	-2.026e-3	2
53	27	max	1.217	2	.163	4	7.908	4	1.683e-2	4	2.332e-3	6	3.567e-4	6
54		min	-.09	6	-.18	6	-7.755	6	-1.634e-2	6	-8.961e-3	2	-2.088e-3	2
55	28	max	1.206	2	.162	4	8.172	4	1.702e-2	4	2.524e-3	6	1.113e-4	4
56		min	-.071	6	-.182	6	-8.189	6	-1.727e-2	6	-8.912e-3	2	-2.157e-3	2
57	29	max	1.44	2	.164	4	9.672	4	1.777e-2	4	3.324e-3	6	6.676e-4	4
58		min	-.104	6	-.184	6	-9.467	6	-1.725e-2	6	-1.149e-2	2	-1.844e-3	2
59	30	max	1.44	2	.163	4	9.951	4	1.789e-2	4	2.953e-3	6	8.92e-4	6
60		min	-.103	6	-.185	6	-9.996	6	-1.817e-2	6	-1.146e-2	2	-1.878e-3	2
61	31	max	1.451	2	.165	4	9.779	4	1.783e-2	4	3.383e-3	6	7.725e-4	4
62		min	-.1	6	-.184	6	-9.571	6	-1.731e-2	6	-1.163e-2	2	-1.786e-3	2
63	32	max	1.45	2	.163	4	10.059	4	1.794e-2	4	2.978e-3	6	9.782e-4	6
64		min	-.108	6	-.186	6	-10.105	6	-1.823e-2	6	-1.161e-2	2	-1.793e-3	2
65	33	max	1.538	2	.166	4	10.81	4	1.84e-2	4	3.937e-3	6	1.061e-3	6
66		min	-.088	6	-.186	6	-10.573	6	-1.788e-2	6	-1.304e-2	2	-1.316e-3	2
67	34	max	1.537	2	.164	4	11.096	4	1.85e-2	4	3.217e-3	6	1.06e-3	4
68		min	-.136	6	-.188	6	-11.159	6	-1.879e-2	6	-1.304e-2	2	-1.27e-3	2

**Envelope Joint Displacements (Continued)**

	Joint		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [...]	LC	Y Rotation [...]	LC	Z Rotation [...]	LC
69	35	max	.486	2	.013	4	1.072	4	6.852e-3	4	4.222e-4	6	-2.178e-6	4
70		min	-.02	6	-.064	5	-1.089	6	-6.783e-3	6	-1.733e-3	2	-3.199e-4	2
71	36	max	.509	2	.051	4	1.537	4	8.58e-3	4	5.552e-4	6	6.62e-6	6
72		min	-.021	6	-.057	6	-1.525	6	-8.478e-3	6	-2.285e-3	2	-4.763e-4	2
73	37	max	.579	2	.097	4	2.401	4	1.125e-2	4	8.204e-4	6	8.868e-6	6
74		min	-.025	6	-.107	6	-2.383	6	-1.112e-2	6	-3.317e-3	2	-6.853e-4	2
75	38	max	.627	2	.066	4	2.834	4	1.243e-2	4	9.714e-4	6	-4.32e-6	6
76		min	-.028	6	-.119	6	-2.835	6	-1.231e-2	6	-3.873e-3	2	-6.928e-4	2
77	39	max	.724	2	.118	4	4.673	4	1.382e-2	4	1.309e-3	6	2.97e-5	6
78		min	-.033	6	-.13	6	-4.639	6	-1.368e-2	6	-5.067e-3	2	-1.043e-3	2
79	40	max	.841	2	.166	4	5.169	4	1.502e-2	4	1.652e-3	6	-6.168e-6	6
80		min	-.04	6	-.222	6	-5.15	6	-1.489e-2	6	-6.285e-3	2	-9.361e-4	2
81	41	max	.954	2	.151	4	5.893	4	1.559e-2	4	1.896e-3	6	-6.304e-6	4
82		min	-.056	6	-.205	6	-5.866	6	-1.546e-2	6	-7.136e-3	2	-9.797e-4	2
83	43	max	1.445	2	.216	4	9.995	4	1.786e-2	4	3.282e-3	6	-7.108e-6	4
84		min	-.104	6	-.277	6	-9.938	6	-1.773e-2	6	-1.2e-2	2	-1.137e-3	2
85	BOTLEG1	max	0	2	0	4	0	4	0	4	0	4	0	6
86		min	0	6	0	6	0	6	0	6	0	2	0	2
87	BOTLEG2	max	0	2	0	4	0	4	0	4	0	6	0	4
88		min	0	4	0	6	0	6	0	6	0	2	0	2
89	BOTMAST	max	0	2	0	6	0	4	0	4	0	6	0	6
90		min	0	6	0	4	0	6	0	6	0	2	0	2
91	MC1	max	.321	2	.142	6	.808	4	6.367e-3	4	2.725e-6	6	6.639e-6	4
92		min	0	6	-.149	4	-.8	6	-6.287e-3	6	-1.016e-5	2	-1.348e-3	2
93	MC2	max	.439	2	.236	6	2.154	4	1.025e-2	4	4.668e-6	6	2.544e-5	4
94		min	-.002	4	-.249	4	-2.129	6	-1.014e-2	6	-1.728e-5	2	-5.432e-4	2
95	MC3	max	.572	2	.307	6	4.183	4	1.399e-2	4	6.458e-6	6	2.011e-5	4
96		min	-.007	4	-.324	4	-4.139	6	-1.387e-2	6	-2.387e-5	2	-1.11e-3	2
97	MC4	max	.742	2	.355	6	6.662	4	1.564e-2	4	7.929e-6	6	7.949e-6	4
98		min	-.009	4	-.376	4	-6.598	6	-1.552e-2	6	-2.927e-5	2	-4.889e-4	2
99	MC5	max	.966	2	.377	6	9.519	4	2.062e-2	4	8.816e-6	6	5.887e-6	4
100		min	-.01	4	-.401	4	-9.437	6	-2.051e-2	6	-3.253e-5	2	-4.272e-3	2
101	TOPLEG1	max	1.557	2	.165	4	11.088	4	1.855e-2	4	4.088e-3	6	1.361e-3	6
102		min	-.11	6	-.186	6	-10.843	6	-1.803e-2	6	-1.348e-2	2	-1.411e-3	4
103	TOPLEG2	max	1.555	2	.164	4	11.376	4	1.865e-2	4	3.309e-3	6	1.472e-3	4
104		min	-.116	6	-.188	6	-11.443	6	-1.893e-2	6	-1.348e-2	2	-1.279e-3	6
105	TOPMAST	max	6.301	2	.375	6	22.136	4	3.148e-2	4	8.816e-6	6	5.887e-6	4
106		min	-.012	4	-.403	4	-22.008	6	-3.138e-2	6	-3.253e-5	2	-1.513e-2	2
107	TOPPLT1	max	.481	2	.036	4	.86	4	5.962e-3	4	5.116e-5	4	2.846e-4	4
108		min	-.023	6	-.04	6	-.853	6	-5.902e-3	6	-4.499e-4	2	-9.08e-4	2
109	TOPPLT2	max	.481	2	.036	4	.92	4	6.346e-3	4	2.327e-4	6	5.173e-4	6
110		min	-.014	6	-.04	6	-.915	6	-6.303e-3	6	-4.43e-4	2	-9.23e-4	2
111	T MOBILE	max	5.756	2	.375	6	21.002	4	3.148e-2	4	8.816e-6	6	5.887e-6	4
112		min	-.012	4	-.403	4	-20.879	6	-3.137e-2	6	-3.253e-5	2	-1.513e-2	2
113	METRO	max	1.472	2	.165	4	9.994	4	1.794e-2	4	3.499e-3	6	8.444e-4	4
114		min	-.092	6	-.185	6	-9.779	6	-1.742e-2	6	-1.193e-2	2	-1.676e-3	2
115	METRO2	max	1.471	2	.164	4	10.275	4	1.805e-2	4	3.028e-3	6	1.004e-3	6
116		min	-.121	6	-.186	6	-10.325	6	-1.834e-2	6	-1.191e-2	2	-1.668e-3	2
117	FC1	max	.417	2	.211	6	1.735	4	9.066e-3	4	4.156e-6	6	2.228e-5	4
118		min	-.001	4	-.223	4	-1.715	6	-8.953e-3	6	-1.54e-5	2	-5.013e-4	2
119	FC2	max	.711	2	.343	6	5.985	4	1.542e-2	4	7.541e-6	6	9.598e-6	4
120		min	-.008	4	-.362	4	-5.926	6	-1.53e-2	6	-2.784e-5	2	-8.961e-4	2
121	FC3	max	1.864	2	.376	6	12.403	4	2.639e-2	4	8.816e-6	6	5.887e-6	4

Company : Centek Engineering  
 Designer : TJL/CFC  
 Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

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**Envelope Joint Displacements (Continued)**

Joint	X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [...]	LC	Y Rotation [...]	LC	Z Rotation [...]	LC
122	min	4	-.402	4	-12.309	6	-2.629e-2	6	-3.253e-5	2	-1.005e-2	2
123	GPS	2	.132	4	4.681	4	1.468e-2	4	1.101e-3	6	3.189e-4	4
124	min	6	-.145	6	-4.614	6	-1.436e-2	6	-5.238e-3	2	-1.818e-3	2

**Envelope AISC ASD Steel Code Checks**

Member	Shape	Code Check	Loc(ft)	LC	Sh...	Loc(ft)	.....Fa...	Ft [ksf]	Fb y-y [ksf]	Fb.....	AS...	
1	CROSS...	L5X5X5	.095	15.2...	2	.011	15.207	z417..	28.793	- Code check based o...	H2..	
2	CROSS...	L5X5X5	.165	15.2...	2	.011	15.207	z417..	28.793	- Code check based o...	H1..	
3	CROSS...	L5X5X5	.156	15.2...	2	.011	15.207	z417..	28.793	- Code check based o...	H2..	
4	CROSS...	L5X5X5	.257	15.2...	2	.010	15.207	z417..	28.793	- Code check based o...	H1..	
5	CROSS...	L3.5X3...	.526	0	6	.012	18.916	z47...	28.793	- Code check based o...	H1..	
6	CROSS...	L3.5X3...	.964	18.9...	2	.012	18.916	z47...	28.793	- Code check based o...	H1..	
7	CROSS...	L5X5X5	.311	33.1...	2	.019	0	z41....	28.793	- Code check based o...	H2..	
8	CROSS...	L5X5X5	.055	0	4	.020	0	z41....	28.793	- Code check based o...	H2..	
9	HORZ1	L5X5X5	.137	6.755	4	.008	13.509	z618..	28.793	- Code check based o...	H1..	
10	HORZ2	L5X5X5	.139	6.755	4	.008	13.509	z618..	28.793	- Code check based o...	H1..	
11	HORZ3	L5X5X5	.080	6.755	4	.008	13.509	z618..	28.793	- Code check based o...	H1..	
12	HORZ4	L5X5X5	.093	6.755	4	.008	13.509	z618..	28.793	- Code check based o...	H1..	
13	HORZ5	L5X5X5	.042	6.755	4	.009	13.509	z618..	28.793	- Code check based o...	H1..	
14	HORZ6	L5X5X5	.139	13.5...	2	.009	13.509	z618..	28.793	- Code check based o...	H1..	
15	HORZ7	L5X5X5	.067	0	6	.009	13.509	z618..	28.793	- Code check based o...	H1..	
16	HORZ8	L5X5X5	.084	13.5...	2	.009	13.509	z618..	28.793	- Code check based o...	H1..	
17	HORZ9	L5X5X5	.061	0	6	.009	13.509	z618..	28.793	- Code check based o...	H1..	
18	HORZ10	L5X5X5	.056	13.5...	2	.009	13.509	z618..	28.793	- Code check based o...	H1..	
19	HORZ11	TU8X4X5	.095	0	6	.025	13.5	y236..	36.791	40.47	40.....	H1..
20	LEG1	W24X68	.930	.625	6	.060	0	y439..	39.99	49.987	36.....	H1..
21	LEG2	W24X68	.983	1.25	6	.068	0	y439..	39.99	49.987	36.....	H1..
22	LEG_W...	new	.473	0	6	.080	0	y435..	39.99	49.987	39.....	H1..
23	LEG_W...	new	.495	0	6	.087	0	y435..	39.99	49.987	39.....	H1..
24	WT1	WT6X15	.207	5.045	6	.007	0	y419..	39.99	28.322	28...1 1 1	H1..
25	WT2	WT6X15	.315	5.256	2	.006	10.091	y419..	39.99	28.322	28...1 1 1	H1..
26	WT3	WT6X15	.362	4.835	2	.005	0	y619..	39.99	28.322	28...1 1 1	H1..
27	WT4	WT6X15	.230	4.94	4	.005	10.091	y419..	39.99	28.322	28...1 1 1	H1..
28	WT5	WT6X15	.540	5.045	6	.007	0	y619..	39.99	28.322	28...1 1 1	H1..
29	WT6	WT6X15	.602	5.045	6	.006	10.091	y419..	39.99	28.322	28...1 1 1	H1..
30	WT7	WT6X15	.393	4.94	4	.007	0	y619..	39.99	28.322	28...1 1 1	H1..
31	WT8	WT6X15	.441	4.94	4	.006	10.091	y419..	39.99	28.322	28...1 1 1	H1..
32	WT9	WT6X15	.572	5.045	6	.006	0	y219..	39.99	28.322	28...1 1 1	H1..
33	WT10	WT6X15	.523	5.045	6	.007	10.091	z219..	39.99	28.322	28...1 1 1	H1..
34	WT11	WT6X15	.445	5.151	4	.006	10.091	y619..	39.99	28.322	28...1 1 1	H1..
35	WT12	WT6X15	.480	4.94	4	.006	0	z219..	39.99	28.322	28...1 1 1	H1..
36	WT13	WT6X15	.476	5.045	6	.011	0	z219..	39.99	28.322	28...1 1 1	H1..
37	WT14	WT6X15	.474	5.045	6	.010	10.091	y219..	39.99	28.322	28...1 1 1	H1..
38	WT15	WT6X15	.629	4.94	4	.009	10.091	y219..	39.99	28.322	28...1 1 1	H1..
39	WT16	WT6X15	.644	4.94	4	.009	0	z219..	39.99	28.322	28...1 1 1	H1..
40	WT17	WT6X15	.678	5.045	6	.012	0	z219..	39.99	28.322	28...1 1 1	H1..
41	WT18	WT6X15	.682	5.045	6	.012	0	y219..	39.99	28.322	28...1 1 1	H1..
42	WT19	WT6X15	.313	4.94	4	.015	10.091	y219..	39.99	28.322	28...1 1 1	H1..
43	WT20	WT6X15	.331	4.94	4	.016	0	z219..	39.99	28.322	28...1 1 1	H1..
44	Mast1	HSS18...	.841	0	4	.018	0	z29..	33.592	36.951	36...1.....	H1..
45	Mast2	HSS18...	.720	3.438	4	.011	17.474	z233..	33.592	36.951	36...1.....	H1..



Company : Centek Engineering  
 Designer : TJJ/CFC  
 Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

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**Envelope AISC ASD Steel Code Checks (Continued)**

Member	Shape	Code Check	Loc[ft]	LC	Sh...	Loc[ft]	.....	Fa...	Ft [ksj]	Fb y-y [ksj]	Fb.....	AS..
46	Mast3	HSS18...	.532	17.1..	4	.043	17.188	231..	33.592	36.951	36..	H1..
47	Mast4	HSS18...	.271	0	4	.016	0	428..	33.592	36.951	36..	.6H1..
48	Horz 12	TU8X4X5	.094	0	6	.025	13.5	y236..	36.791	40.47	40..	H1..

Company : Centek Engineering  
 Designer : TJJ/CFC  
 Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

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**Joint Reactions**

LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]	
1	1	BOTLEG1	-12.496	-107.492	-1.22	50.805	.025	96.599
2	1	BOTMAST	-4.365	17.251	-.028	-.807	.071	51.363
3	1	BOTLEG2	-12.221	148.792	1.248	-55.139	.024	96.218
4	1	Totals:	-29.081	58.551	0			
5	1	COG (ft):	X: 8.586	Y: 50.83	Z: .971			

Company : Centek Engineering  
Designer : TJL/CFC  
Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

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### Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	2	BOTLEG1	-14.733	-132.304	-1.401	60.429	.028	113.593
2	2	BOTMAST	-5.113	13.309	-.038	-.846	.082	60.159
3	2	BOTLEG2	-14.276	161.83	1.439	-64.606	.028	112.453
4	2	Totals:	-34.122	42.835	0			
5	2	COG (ft):	X: 8.977	Y: 50.421	Z: 1.048			

Company : Centek Engineering  
 Designer : TJJ/CFC  
 Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

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**Joint Reactions**

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	3	BOTLEG1	-4.309	-189.314	-17.256	-509.209	-.004	24.686
2	3	BOTMAST	-.028	431.842	-2.431	-79.189	.009	.234
3	3	BOTLEG2	4.337	-183.977	-18.758	-544.836	.01	-22.793
4	3	Totals:	0	58.551	-38.445			
5	3	COG (ft):	X: 7.401	Y: 50.83	Z: .971			

Company : Centek Engineering  
Designer : TJL/CFC  
Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

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### Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	4	BOTLEG1	-5.003	-224.997	-19.874	-585.176	-.004	28.719
2	4	BOTMAST	-.035	490.899	-2.803	-91.112	.011	.265
3	4	BOTLEG2	5.038	-223.067	-21.717	-628.929	.012	-26.475
4	4	Totals:	0	42.835	-44.393			
5	4	COG (ft):	X: 7.111	Y: 50.421	Z: 1.048			

Company : Centek Engineering  
Designer : TJJ/CFC  
Job Number : 12044.CO2

82' Sign Structure with 111' Pipe Mast

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### Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	5	BOTLEG1	4.532	224.749	17.241	504.697	0	-26.041
2	5	BOTMAST	.039	-396.89	2.457	78.458	-.018	-.242
3	5	BOTLEG2	-4.571	230.693	18.746	541.269	-.013	24.219
4	5	Totals:	0	58.551	38.445			
5	5	COG (ft):	X: 7.401	Y: 50.83	Z: .971			

Company : Centek Engineering  
Designer : TJJ/CFC  
Job Number : 12044.CO2

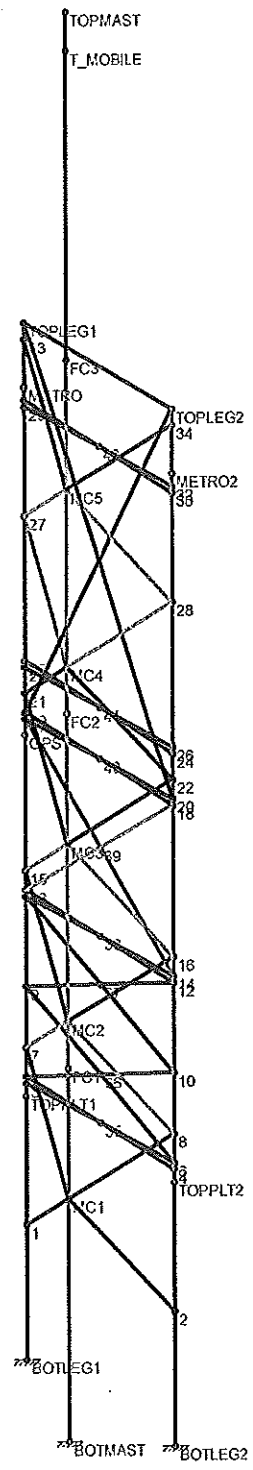
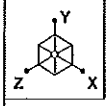
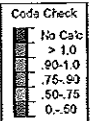
82' Sign Structure with 111' Pipe Mast

June 14, 2012  
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### Joint Reactions

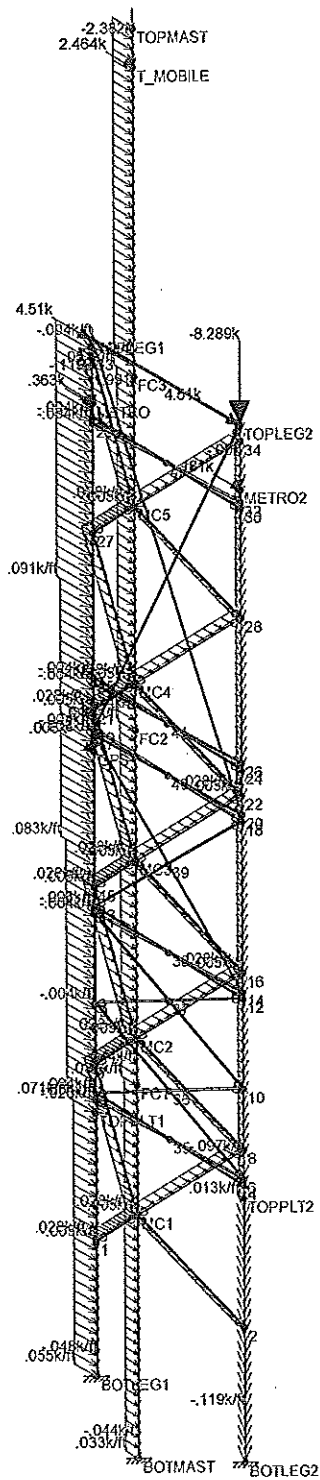
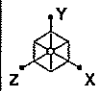
	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	6	BOTLEG1	5.184	251.939	19.857	580.793	0	-29.889
2	6	BOTMAST	.047	-463.717	2.833	90.556	-.022	-.323
3	6	BOTLEG2	-5.231	254.614	21.703	625.675	-.016	27.567
4	6	Totals:	0	42.835	44.393			
5	6	COG (ft):	X: 7.111	Y: 50.421	Z: 1.048			



Solution: Envelope

Centek Engineering	82' Sign Structure with 111' Pipe Mast Unity Check	
TJL/CFC		June 14, 2012 at 5:28 PM
12044.CO2		82' Sign Structure.r3d



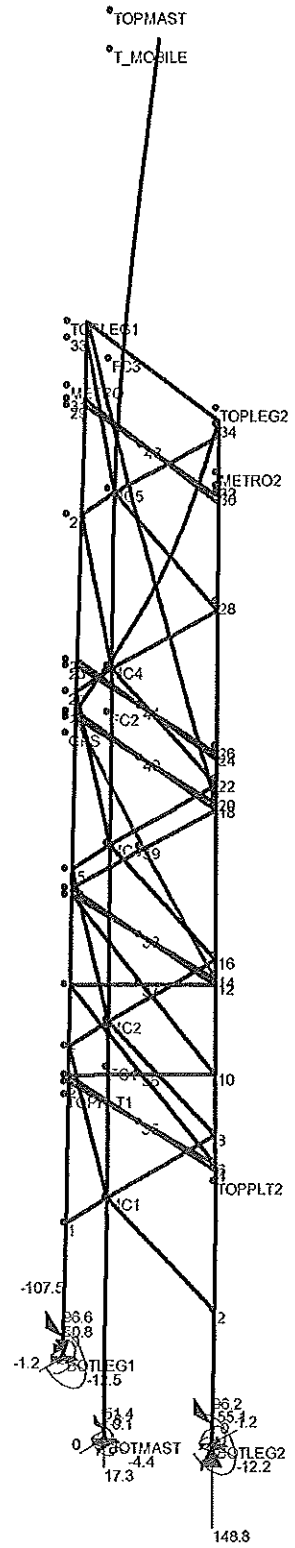


Loads: LC 1, TIA/EIA Wind + Ice in +X Direction

Centek Engineering	82' Sign Structure with 111' Pipe Mast LC # 1 Loads	June 14, 2012 at 5:29 PM
TJL/CFC		82' Sign Structure.r3d
12044.CO2		

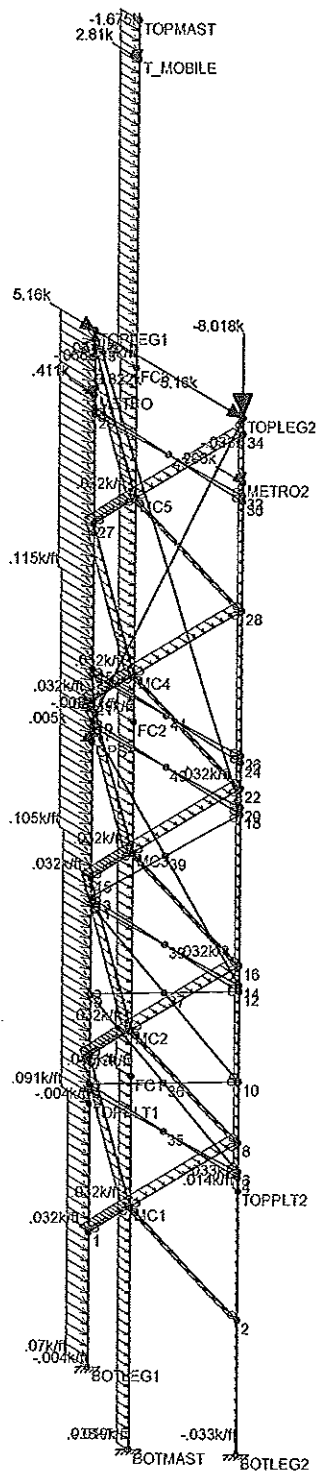


Code Check	
	No Calc
	> 1.0
	.90-1.0
	.75-.90
	.60-.75
	0-.60



Results for LC 1, TIA/EIA Wind + Ice in +X Direction  
 Z-moment Reaction units are k and k-ft

Centek Engineering	82' Sign Structure with 111' Pipe Mast LC # 1 Reactions and Deflected Shape	
TJL/CFC		June 14, 2012 at 5:32 PM
12044.CO2		82' Sign Structure.r3d

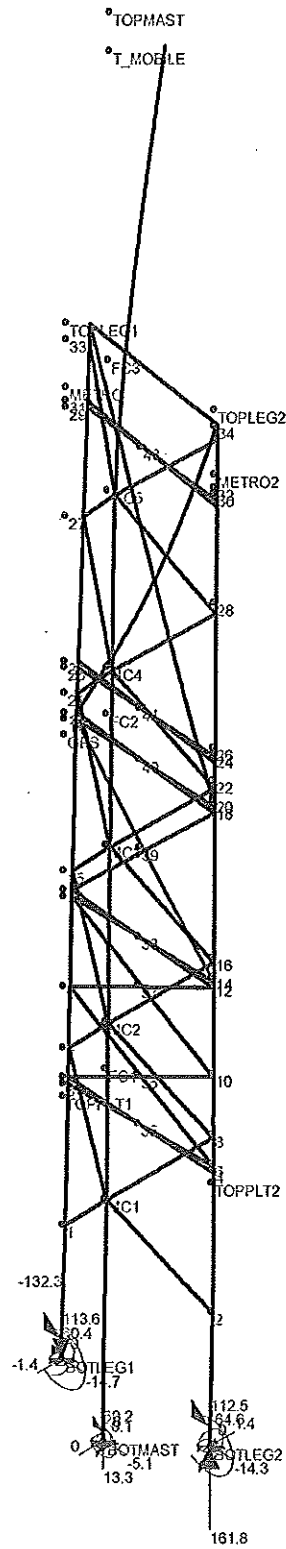


Loads: LC 2, TIA/EIA Wind in +X Direction

Centek Engineering	82' Sign Structure with 111' Pipe Mast LC # 2 Loads	
TJL/CFC		June 14, 2012 at 5:29 PM
12044.CO2		82' Sign Structure.r3d



Code Check	
No Cab	> 1.0
	.90-1.0
	.75-.90
	.60-.75
	0-.60



Results for LC 2, TIA/EIA Wind in +X Direction  
 Z-moment Reaction units are k and k-ft

Centek Engineering

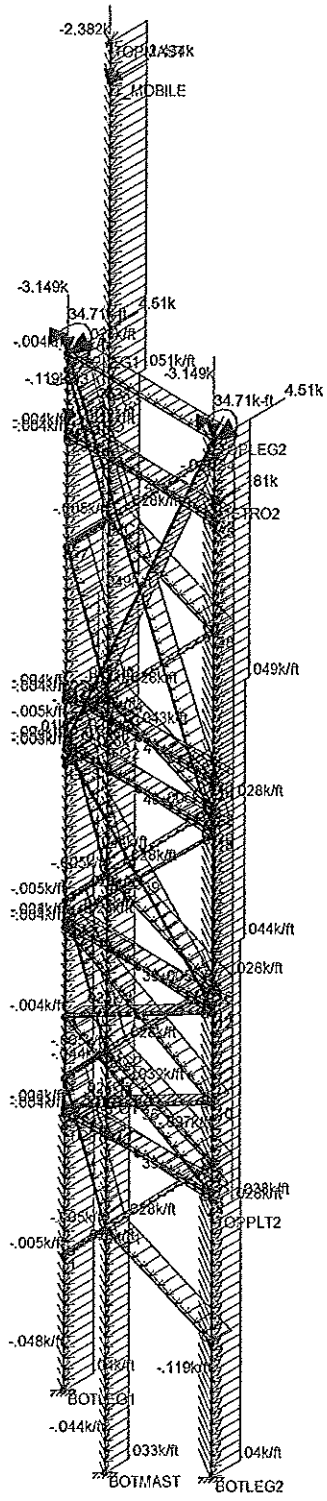
TJL/CFC

12044.CO2

82' Sign Structure with 111' Pipe Mast  
 LC # 2 Reactions and Deflected Shape

June 14, 2012 at 5:32 PM

82' Sign Structure.r3d



Loads: LC 3, TIA/EIA Wind + Ice in +Z Direction

Centek Engineering

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12044.CO2

82' Sign Structure with 111' Pipe Mast

LC # 3 Loads

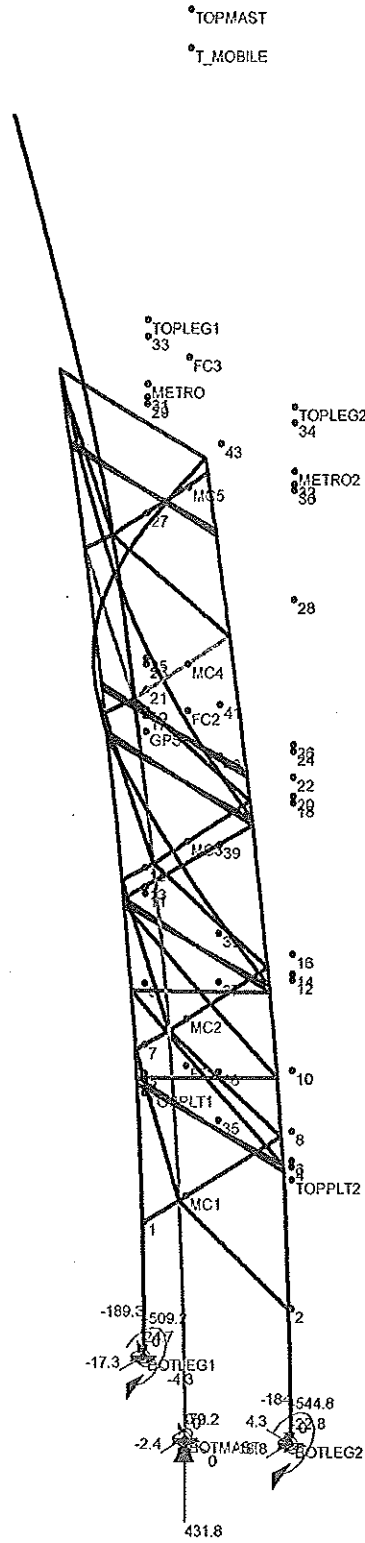
June 14, 2012 at 5:29 PM

82' Sign Structure.r3d



Code Check

No Calc
> 1.0
.50-1.0
.75-.99
.50-.75
0-.50



Results for LC 3, TIA/EIA Wind + Ice in +Z Direction  
 Z-moment Reaction units are k and k-ft

Centek Engineering

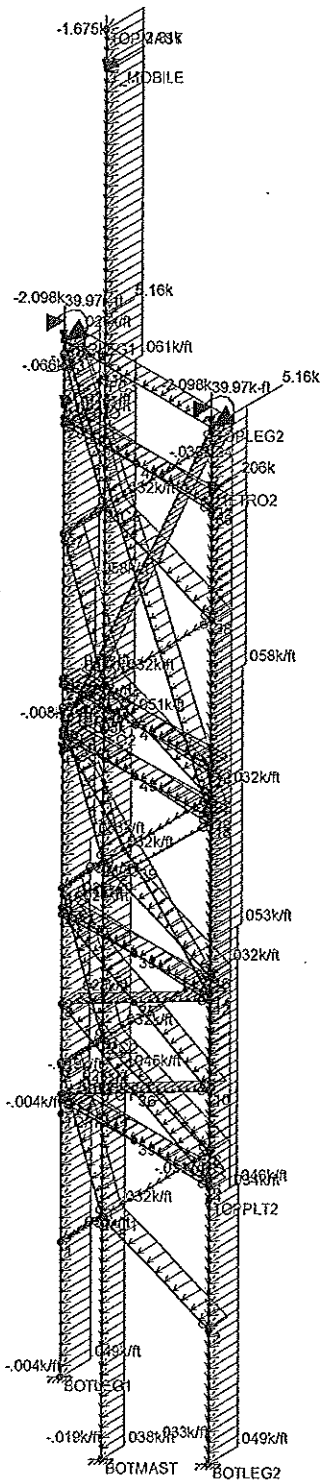
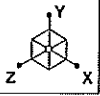
TJL/CFC

12044.CO2

82' Sign Structure with 111' Pipe Mast  
 LC # 3 Reactions and Deflected Shape

June 14, 2012 at 5:33 PM

82' Sign Structure.r3d



Loads: LC 4, TIA/EIA Wind in +Z Direction

Centek Engineering

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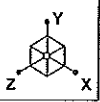
12044.CO2

82' Sign Structure with 111' Pipe Mast

LC # 4 Loads

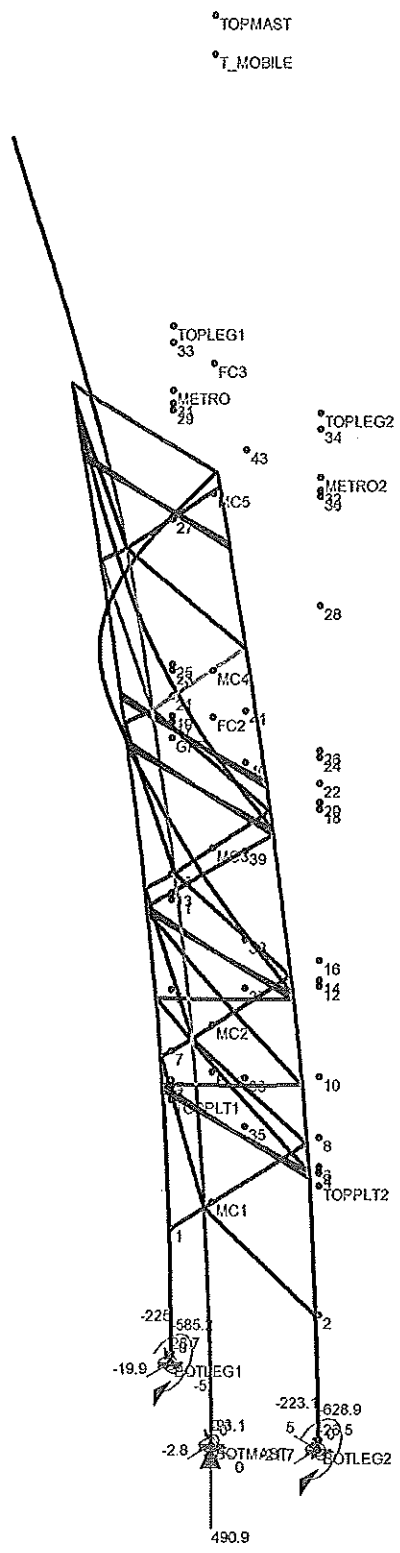
June 14, 2012 at 5:30 PM

82' Sign Structure.r3d



Code Check

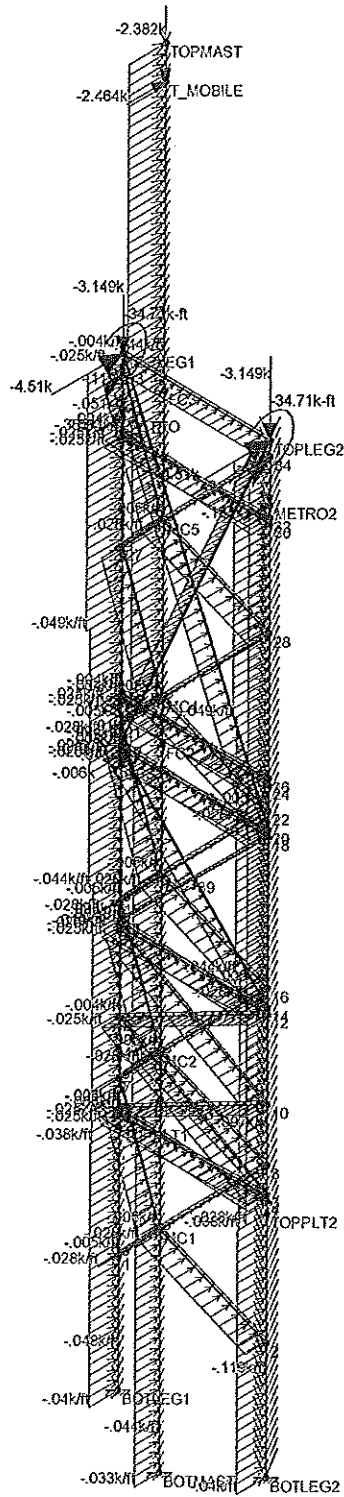
No Cat
> 1.0
.90-1.0
.75-.90
.50-.75
0-.50



Results for LC 4, TWEIA Wind in +Z Direction  
 Z-moment Reaction units are k and k-ft

Centek Engineering	82' Sign Structure with 111' Pipe Mast LC # 4 Reactions and Deflected Shape	June 14, 2012 at 5:34 PM
TJL/CFC		82' Sign Structure.r3d
12044.CO2		





Loads: LC 5, TIA/EIA Wind + Ice in -Z' Direction

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TJL/CFC

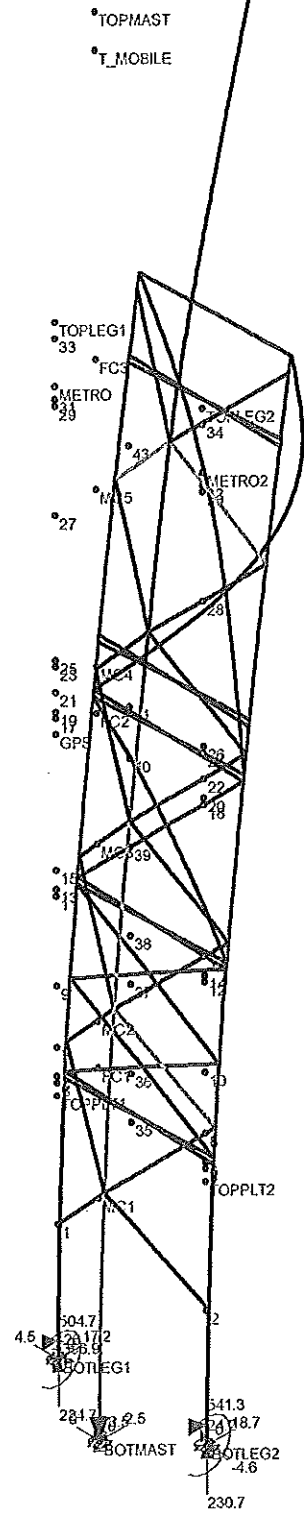
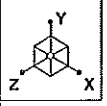
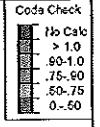
12044.CO2

82' Sign Structure with 111' Pipe Mast

LC # 5 Loads

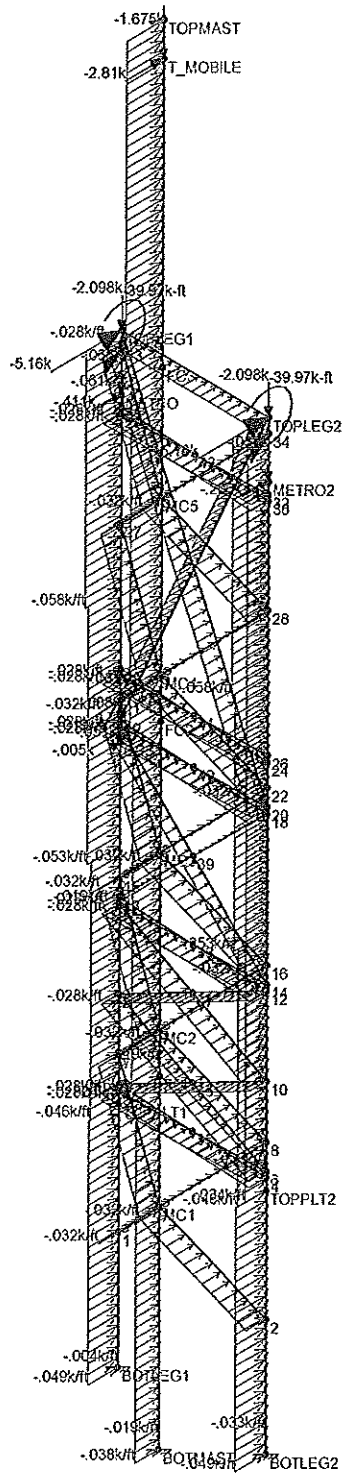
June 14, 2012 at 5:30 PM

82' Sign Structure.r3d



Results for LC 5, TIA/EIA Wind + Ice in -Z' Direction  
 Z-moment Reaction units are k and k-ft

Centek Engineering		
TJL/CFC	82' Sign Structure with 111' Pipe Mast	June 14, 2012 at 5:35 PM
12044.CO2	LC # 5 Reactions and Deflected Shape	82' Sign Structure.r3d



Loads: LC 6, TIA/EIA Wind In -Z' Direction

Centek Engineering

TJL/CFC

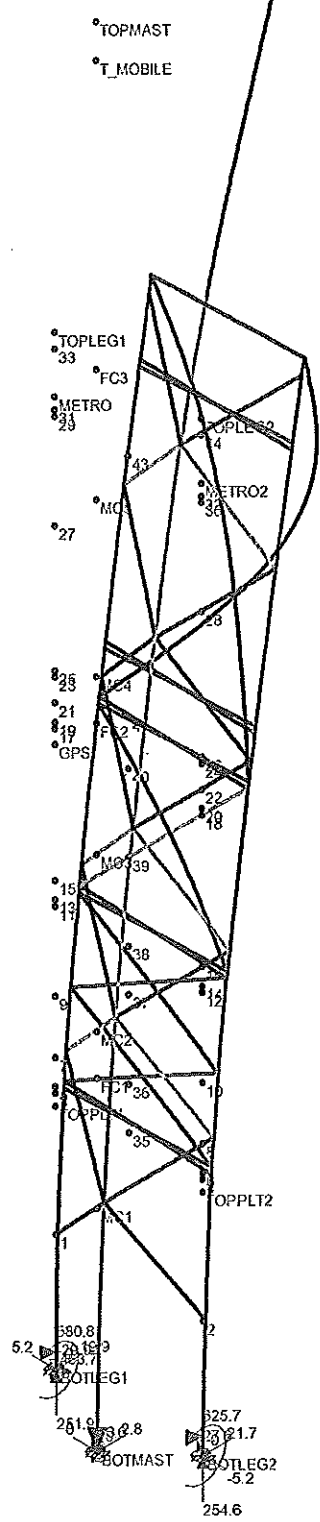
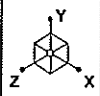
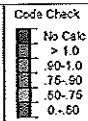
12044.CO2

82' Sign Structure with 111' Pipe Mast

LC # 6 Loads

June 14, 2012 at 5:31 PM

82' Sign Structure.r3d



Results for LC 6, TIA/EIA Wind in -Z Direction  
 Z-moment Reaction units are k and k-ft

Centek Engineering	82' Sign Structure with 111' Pipe Mast LC # 6 Reactions and Deflected Shape	June 14, 2012 at 5:36 PM
TJL/CFC		82' Sign Structure.r3d
12044.CO2		

Beam: **Mast2**

Shape: **HSS18X0.5**

Material: **A500 Gr.42**

Length: **27.5 ft**

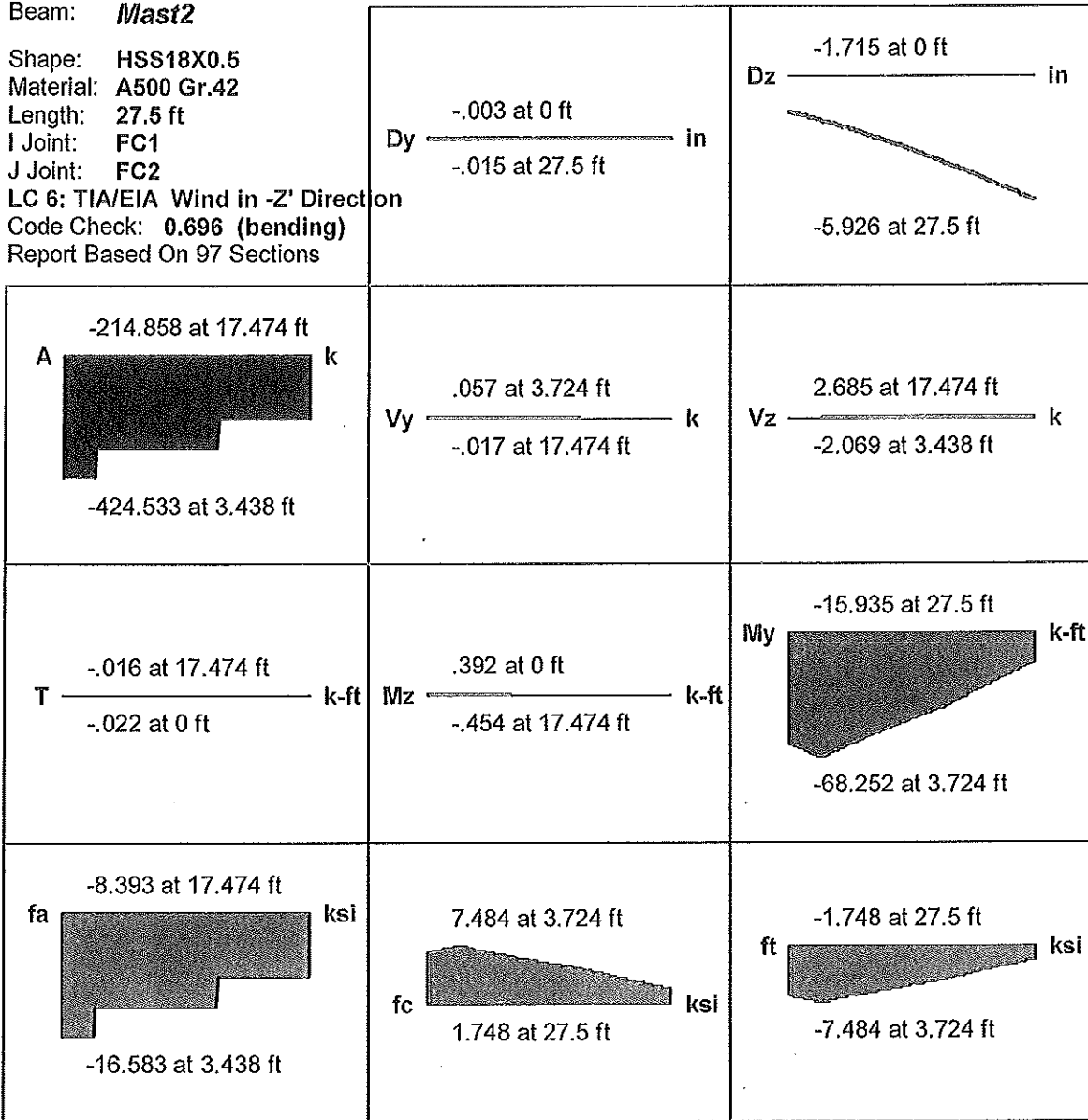
I Joint: **FC1**

J Joint: **FC2**

LC 6: TIA/EIA Wind in -Z' Direction

Code Check: **0.696 (bending)**

Report Based On 97 Sections



**AISC 9th: ASD Code Check**

Max Bending Check	<b>0.696</b>	Max Shear Check	<b>0.009 (s)</b>
Location	<b>3.438 ft</b>	Location	<b>17.474 ft</b>
Equation	<b>H2-1</b>	Max Defl Ratio	<b>L/78</b>

**Compact**

Allowables Increase: **1.333**

Fy	<b>42 ksi</b>	Cm	<b>.85</b>	z-z	<b>.942</b>
Fa	<b>33.084 ksi</b>	Lb	<b>3.625 ft</b>		<b>3.625 ft</b>
Ft	<b>33.592 ksi</b>	KL/r	<b>7.013</b>		<b>7.013</b>
Fby	<b>36.951 ksi</b>	Sway	<b>No</b>		<b>No</b>
Fbz	<b>36.951 ksi</b>				
Fvy	<b>22.394 ksi</b>	L Comp Flange	<b>27.5 ft</b>		
Fvz	<b>22.394 ksi</b>	Torque Length	<b>NC</b>		
Cb	<b>1</b>				

Subject:

ANCHOR BOLT AND BASEPLATE MAST

Location:

Cromwell, CT

Rev. 0: 6/13/12

Prepared by: T.J.L. Checked by: C.F.C.  
Job No. 12044.CO2**Anchor Bolt and Base Plate Analysis:****Input Data:**Tower Reactions:

Overturing Moment =	OM := 91-ft-kips	(Input From Risa-3D LC #6)
Shear Force =	Shear := 3-kips	(Input From Risa-3D LC #6)
Axial Force =	Axial := -464-kips	(Input From Risa-3D LC #6)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 10
Diameter of Bolt Circle =	D <sub>bc</sub> := 24-in
Bolt "Column" Distance =	l := 3-in
Bolt Ultimate Strenght =	F <sub>u</sub> := 100-ksi
Bolt Yeild Strenght =	F <sub>y</sub> := 75-ksi
Bolt Modulus =	E := 29000-ksi
Diameter of Anchor Bolts =	D := 1.75-in
Threads per Inch =	n := 5

Base Plate Data:

Use ASTM A572 Mod 50

Plate Yield Strength =	F <sub>ybp</sub> := 50-ksi
Base Plate Thickness =	t <sub>bp</sub> := 2.0-in
Base Plate Diameter =	D <sub>bp</sub> := 30-in
Outer Pole Diameter =	D <sub>pole</sub> := 18-in

**Geometric Layout Data:**

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:  $R_{bc} := \frac{D_{bc}}{2} = 12\text{-in}$

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

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

$d_1 = 7.05\text{-in}$	$d_6 = -7.05\text{-in}$
$d_2 = 11.41\text{-in}$	$d_7 = -11.41\text{-in}$
$d_3 = 11.41\text{-in}$	$d_8 = -11.41\text{-in}$
$d_4 = 7.05\text{-in}$	$d_9 = -7.05\text{-in}$
$d_5 = 0.00\text{-in}$	$d_{10} = -0.00\text{-in}$

Critical Distances For Bending in Plate:

Outer Pole Radius =  $R_{pole} := \frac{D_{pole}}{2} = 9\text{-in}$

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

$MA_1 = 0.00\text{-in}$	$MA_6 = 0.00\text{-in}$
$MA_2 = 2.41\text{-in}$	$MA_7 = 0.00\text{-in}$
$MA_3 = 2.41\text{-in}$	$MA_8 = 0.00\text{-in}$
$MA_4 = 0.00\text{-in}$	$MA_9 = 0.00\text{-in}$
$MA_5 = 0.00\text{-in}$	$MA_{10} = 0.00\text{-in}$

Effective Width of Baseplate for Bending =  $W_{eff} := .9 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 21.6\text{-in}$

**Anchor Bolt Analysis:**

Calculated Anchor Bolt Properties:

Polar Moment of Inertia =  $I_p := \sum (d_i)^2 = 720 \cdot \text{in}^2$

Gross Area of Bolt =  $A_g := \frac{\pi}{4} \cdot D^2 = 2.405 \cdot \text{in}^2$

Net Area of Bolt =  $A_n := \frac{\pi}{4} \cdot \left( D - \frac{0.9743 \cdot \text{in}}{n} \right)^2 = 1.899 \cdot \text{in}^2$

Net Diameter =  $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 1.555 \cdot \text{in}$

Radius of Gyration of Bolt =  $r := \frac{D_n}{4} = 0.389 \cdot \text{in}$

Section Modulus of Bolt =  $S_x := \frac{\pi \cdot D_n^3}{32} = 0.369 \cdot \text{in}^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force =  $T_{\text{Max}} := OM \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 64.6 \cdot \text{kips}$

Allowable Tensile Force =  $T_{\text{ALL.Gross}} := 1.333 \cdot (0.33 \cdot A_g \cdot F_u) = 105.8 \cdot \text{kips}$  (1.333 increase allowed per TIA/EIA)

$T_{\text{ALL.Net}} := 1.333 \cdot (0.60 \cdot A_n \cdot F_y) = 113.939 \cdot \text{kips}$  (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity =  $\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} = 56.7\%$  Bolts are "upset bolts". Use net area per AISC

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 =  $M_x := \left( \frac{\text{Shear}}{N} \right) \cdot l = 0.075 \cdot \text{ft} \cdot \text{kips}$

Maximum Bending Stress =  $f_{bx} := \frac{M_x}{S_x} = 2.4 \cdot \text{ksi}$

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



Check Combined Stress Requirement:

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

$$l := \begin{cases} 1 & \text{if } l > 2 \cdot D_n = 0 \text{ in} \\ 0 & \text{otherwise} \end{cases}$$

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := 0M \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = -28.2 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = -14.8 \text{ ksi}$$

$$K := 0.65$$

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

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

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 =

$$\left( \frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = -24.8 \%$$

Condition 2 =

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

$$\text{Condition2} = \text{"OK"}$$

**Base Plate Analysis:**

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

$C_1 = 57.1\text{-kips}$	$C_6 = 35.7\text{-kips}$
$C_2 = 63.7\text{-kips}$	$C_7 = 29.1\text{-kips}$
$C_3 = 63.7\text{-kips}$	$C_8 = 29.1\text{-kips}$
$C_4 = 57.1\text{-kips}$	$C_9 = 35.7\text{-kips}$
$C_5 = 46.4\text{-kips}$	$C_{10} = 46.4\text{-kips}$

Maximum Bending Stress in Plate = 
$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{(W_{eff} t_{bp})^2} = 21.3\text{ ksi}$$

Allowable Bending Stress in Plate = 
$$F_{bp} := 1.33 \cdot 0.75 \cdot F_y = 49.9\text{ ksi}$$

Plate Bending Stresse % of Capacity = 
$$\frac{f_{bp}}{F_{bp}} = 42.8\%$$

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

Condition3 = "OK"

**Flange Bolt and Plate Analysis:**

**Input Data:**

Tower Reactions:

Overturing Moment = OM := 68-ft-kips (Input From Risa-3D LC #6)  
Shear Force = Shear := 3-kips (Input From Risa-3D LC #6)  
Axial Force = Axial := -425-kips (Input From Risa-3D LC #6)

Flange Bolt Data:

Use ASTM A325

Number of Flange Bolts = N := 20  
Diameter of Bolt Circle =  $D_{bc}$  := 21.0-in  
Bolt "Column" Distance = l := .125-in  
Bolt Ultimate Strenght =  $F_u$  := 120-ksi  
Bolt Yield Strenght =  $F_y$  := 92-ksi  
Bolt Modulus = E := 29000-ksi  
Diameter of Flange Bolts = D := 1.00-in  
Threads per Inch = n := 8

Plate Data:

Use ASTM A572 Mod 50

Plate Yield Strength =  $F_{y_{bp}}$  := 50-ksi  
Plate Thickness =  $t_{bp}$  := 1.25-in  
Plate Diameter =  $D_{bp}$  := 24.00-in  
Outer Pole Diameter =  $D_{pole}$  := 18.00-in

**Geometric Layout Data:**

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:  $R_{bc} := \frac{D_{bc}}{2} = 10.5\text{-in}$

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

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

$d_1 = 3.24\text{-in}$	$d_6 = 9.99\text{-in}$
$d_2 = 6.17\text{-in}$	$d_7 = 8.49\text{-in}$
$d_3 = 8.49\text{-in}$	$d_8 = 6.17\text{-in}$
$d_4 = 9.99\text{-in}$	$d_9 = 3.24\text{-in}$
$d_5 = 10.50\text{-in}$	$d_{10} = 0.00\text{-in}$

Critical Distances For Bending in Plate:

Outer Pole Radius =  $R_{pole} := \frac{D_{pole}}{2} = 9\text{-in}$

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

$MA_1 = 0.00\text{-in}$	$MA_6 = 0.99\text{-in}$
$MA_2 = 0.00\text{-in}$	$MA_7 = 0.00\text{-in}$
$MA_3 = 0.00\text{-in}$	$MA_8 = 0.00\text{-in}$
$MA_4 = 0.99\text{-in}$	$MA_9 = 0.00\text{-in}$
$MA_5 = 1.50\text{-in}$	$MA_{10} = 0.00\text{-in}$

Effective Width of plate for Bending =  $W_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 12.7\text{-in}$

**Flange Bolt Analysis:**

Calculated Flange Bolt Properties:

Polar Moment of Inertia =  $I_p := \sum_1 (d_i)^2 = 1102.5 \cdot \text{in}^2$

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

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

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

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

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

Check Flange Bolt Tension Force:

Maximum Tensile Force =  $T_{\text{Max}} := OM \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 29 \cdot \text{kips}$

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

Bolt Tension % of Capacity =  $\frac{T_{\text{Max}}}{T_{\text{ALL.Gross}}} = 0.7$

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

Condition1 = "OK"

Check Flange Bolt Bending Stress:

Maximum Bending Moment =  $M_x := \left( \frac{\text{Shear}}{N} \right) \cdot l = 1.562 \times 10^{-3} \cdot \text{ft} \cdot \text{kips}$

Maximum Bending Stress =  $f_{bx} := \frac{M_x}{S_x} = 0.3 \cdot \text{ksi}$

Allowable Bending Stress =  $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 73.6 \cdot \text{ksi}$  (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

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

$$l := \begin{cases} 1 & \text{if } l > 2 \cdot D_n = 0 \text{ in} \\ 0 & \text{otherwise} \end{cases}$$

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

Check Flange Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = -13.5 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = -22.3 \text{ ksi}$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{F_y}} = 78.881$$

$$F_a := \begin{cases} \frac{\left[ 1 - \frac{\left( \frac{K \cdot l}{r} \right)^2}{2 \cdot C_c^2} \right] \cdot F_y}{\frac{5}{3} + \frac{3 \left( \frac{K \cdot l}{r} \right)}{8 \cdot C_c} - \frac{\left( \frac{K \cdot l}{r} \right)^3}{8 \cdot C_c^3}} & \text{if } \frac{K \cdot l}{r} \leq C_c = 55.2 \text{ ksi} \\ \frac{12 \cdot \pi^2 \cdot E}{23 \cdot \left( \frac{K \cdot l}{r} \right)^2} & \text{if } \frac{K \cdot l}{r} > C_c \end{cases}$$

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 73.6 \text{ ksi} \quad (1.333 \text{ increase allowed per TIA/EIA})$$

Combined Stress % of Capacity =

$$\left( \frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = -0.302$$

Condition 2 =

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

Condition 2 = "OK"

**Plate Analysis:**

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

$C_1 = 23.7$ -kips	$C_6 = 28.6$ -kips
$C_2 = 25.8$ -kips	$C_7 = 27.5$ -kips
$C_3 = 27.5$ -kips	$C_8 = 25.8$ -kips
$C_4 = 28.6$ -kips	$C_9 = 23.7$ -kips
$C_5 = 29.0$ -kips	$C_{10} = 21.3$ -kips

Maximum Bending Stress in Plate = 
$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{(W_{eff} t_{bp})^2} = 30.2 \text{ ksi}$$

Allowable Bending Stress in Plate = 
$$F_{bp} := 1.33 \cdot 0.75 \cdot F_y = 49.9 \text{ ksi}$$

Plate Bending Stresse % of Capacity = 
$$\frac{f_{bp}}{F_{bp}} = 0.606$$

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

Condition3 = "Ok"

**CEN TEK** engineering

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Branford, CT 06405 F: (203) 488-8587

Subject:

ANCHOR BOLT AND BASE PLATE ANALYSIS

Location:

Cromwell, CT

Rev. 0: 6/13/12

Prepared by: T.J.L. Checked by: C.F.C.  
Job No. 12044.CO2

## Anchor Bolt and Base Plate Analysis:

### Input Data:

#### Tower Reactions:

Overturing Moment =	OM := 630-ft kips	(Input From Risa-3D LC # 4)
Shear Force =	Shear := 22 kips	(Input From Risa-3D LC # 4)
Axial Force =	Axial := -224 kips	(Input From Risa-3D LC # 4)

#### Anchor Bolt Data:

Use ASTM A36

Number of Anchor Bolts =	$N_b := 20$	(User Input)
Bolt Ultimate Strength =	$F_u := 58$ ksi	(User Input)
Bolt Yield Strength =	$F_y := 36$ ksi	(User Input)
Bolt Modulus =	$E := 29000$ ksi	(User Input)
Diameter of Anchor Bolts =	$D_b := 1.5$ in	(User Input)
Threads per Inch =	$n_b := 6$	(User Input)

#### Base Plate Data:

Use ASTM 36

Plate Yield Strength =	$F_{y_{bp}} := 36$ ksi	(User Input)
Base Plate Thickness =	$t_{bp} := 1.5$ in	(User Input)



**Geometric Layout Data:**

Distance from Bolts to Centroid of Pole:

$d_1 := 17.125\text{in}$  (User Input)

$d_2 := 11.25\text{in}$  (User Input)

$d_3 := 4.9375\text{in}$  (User Input)

Number of Bolts at Distance:

$N_1 := 12$

$N_2 := 4$

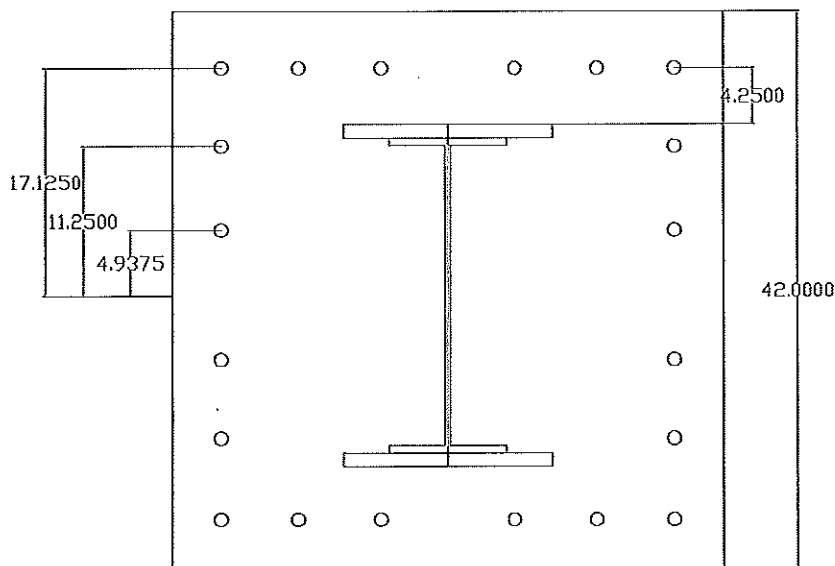
$N_3 := 4$

Critical Distances For Bending in Plate:

$ma_1 := 4.25\text{in}$  (User Input)

Effective Width of Baseplate for Bending =

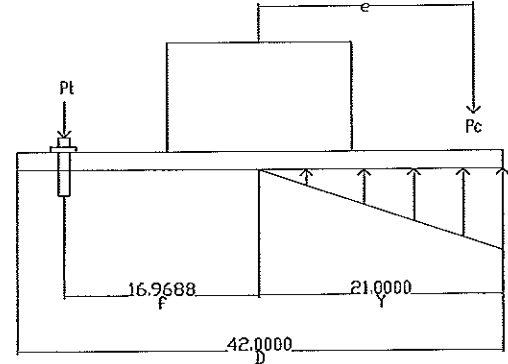
$B_{\text{eff}} := 42\text{in}$  (User Input)



**ANCHOR BOLT AND PLATE GEOMETRY**

**Base Plate Analysis:**

Length of Base Plate =  $D := 42\text{in}$   
 Width of Base Plate =  $B := 42\text{in}$   
 Length of Stress Distribution =  $Y := 21\text{in}$   
 Distance from NA to Bolts in Tension =  $f := 17\text{in}$



Modular Ratio =

$$n := \frac{E_s}{57 \sqrt{E_c}} = 9.29$$

Area of Steel in Tension Zone =

$$A_s := 7.5 \cdot \text{in}^2$$

$$K_1 := \frac{6nA_s}{B} = 0.829 \text{ft}$$

Eccentricity =

$$e := \frac{\left( K_1 f^2 + K_1 \frac{D}{2} \cdot f - K_1 \cdot f \cdot Y + \frac{3}{2} \cdot D \cdot Y^2 - Y^3 \right)}{\left( 3 \cdot Y^2 + K_1 Y - K_1 \frac{D}{2} - K_1 f \right)} = 18.546 \text{in}$$

Compression Force =

$$P_c := \frac{OM}{e} = 408 \text{kips}$$

Uplift Force =

$$P_t := -P_c \left[ \frac{\left( \frac{D}{2} - \frac{Y}{3} - e \right)}{\left( \frac{D}{2} - \frac{Y}{3} + f \right)} \right] = 60 \text{kips}$$

Bearing Force on Grout =

$$\sigma_c := 2 \cdot \frac{(P_c + P_t)}{Y \cdot B} = 1060 \text{psi}$$

Total Uplift Force =

$$F_{\text{axial}} := P_t - 6 \cdot \frac{\text{Axial}}{N} = 127 \text{kips}$$

Applied Bending Stress in Plate =

$$f_{bp} := \frac{6 \cdot (F_{\text{axial}} \cdot m_1)}{B_{\text{eff}} \cdot t_{bp}^2} = 34.26 \text{ksi}$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot F_y = 35.9 \text{ ksi}$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 0.95$$

Check Plate Bending Stress

$$\text{Plate\_Bending\_Stress} := \text{if} \left( \frac{f_{bp}}{F_{bp}} < 1.00, \text{"OK"}, \text{"Overstressed"} \right)$$

$$\text{Plate\_Bending\_Stress} = \text{"OK"}$$

Allowable Bearing Capacity of Grout =

$$\sigma_{all} := 3000 \text{ psi}$$

Bearing Percent of Capacity =

$$\frac{\sigma_c}{\sigma_{all}} = 0.35$$

$$\text{Grout\_Bearing\_Capacity} := \text{if} (\sigma_{all} > \sigma_c, \text{"OK"}, \text{"NG"})$$

$$\text{Grout\_Bearing\_Capacity} = \text{"OK"}$$

**Anchor Bolt Analysis:**

Calculated Anchor Bolt Properties:

Polar Moment of Inertia =

$$I_p := [(d_1)^2 \cdot N_1 + (d_2)^2 \cdot N_2 + (d_3)^2 \cdot N_3] = 4123 \cdot \text{in}^2$$

Gross Area of Bolt =

$$A_g := \frac{\pi}{4} \cdot D_b^2 = 1.767 \cdot \text{in}^2$$

Net Area of Bolt =

$$A_n := \frac{\pi}{4} \cdot \left( D_b - \frac{0.9743 \cdot \text{in}}{n_b} \right)^2 = 1.405 \cdot \text{in}^2$$

Net Diameter =

$$D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 1.338 \cdot \text{in}$$

Radius of Gyration of Bolt =

$$r := \frac{D_n}{4} = 0.334 \cdot \text{in}$$

Section Modulus of Bolt =

$$S_x := \frac{\pi \cdot D_n^3}{32} = 0.235 \cdot \text{in}^3$$

Check Anchor Bolt Tension Force:

Maximum Tensile Force =

$$T_{\text{Max}} := \frac{P_t}{6} - \frac{A_{\text{axial}}}{N} = 21.2 \cdot \text{kips}$$

Allowable Tensile Force (Gross Area) =

$$T_{\text{ALL.Gross}} := 1.333 \cdot (0.33 \cdot A_g \cdot F_u) = 45.1 \cdot \text{kips}$$

(1.333 increase allowed per TIA/EIA)

Allowable Tensile Force (Net Area) =

$$T_{\text{ALL.Net}} := 1.333 \cdot (0.60 \cdot A_n \cdot F_y) = 40.5 \cdot \text{kips}$$

(1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} \cdot 100 = 52.3$$

Condition1 =

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

Bolt\_Tension = "OK"

Note Shear stress is negligible

**Foundation Check****Base Reactions:**

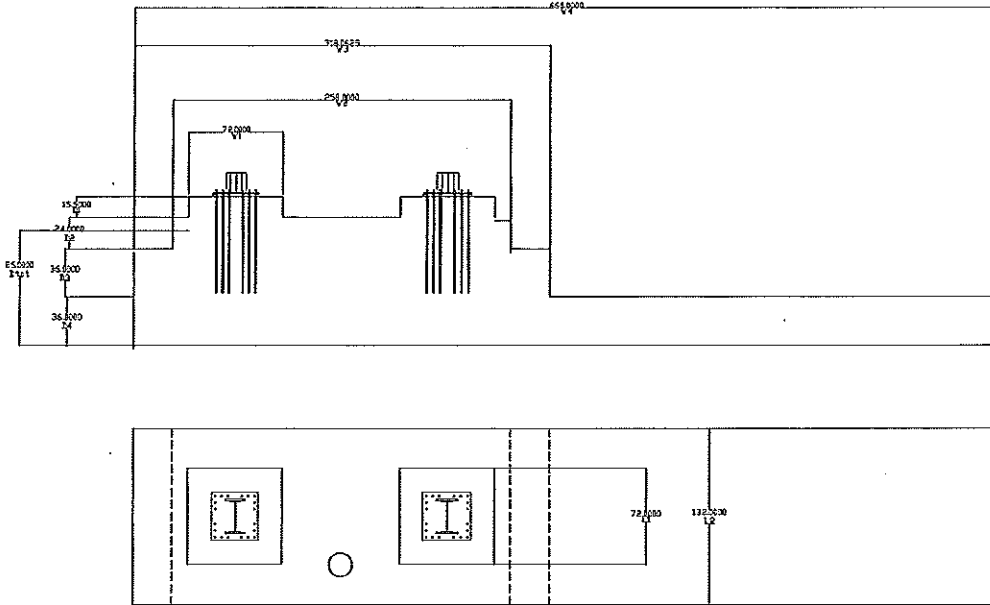
$OM_1 := 585\text{-kip-ft}$   
 $Axial_1 := -225\text{-kips}$   
 $Shear_1 := 20\text{-kips}$   
 $OM_2 := 629\text{-kip-ft}$   
 $Axial_2 := -223\text{-kips}$   
 $Shear_2 := 22\text{-kips}$   
 $OM_m := 91\text{-kip-ft}$   
 $Axial_m := 491\text{-kips}$   
 $Shear_m := 3\text{-kips}$

**Foundation Data:**

$D1 := 1.29\text{-ft}$   
 $D2 := 2\text{-ft}$   
 $D3 := 3\text{-ft}$   
 $D4 := 3\text{-ft}$   
 $D_{tot} := 7.17\text{-ft}$   
 $W1 := 6\text{-ft}$   
 $W2 := 21.5\text{-ft}$   
 $W3 := 26.5\text{-ft}$   
 $W4 := 55\text{-ft}$   
 $L1 := 6\text{-ft}$   
 $L2 := 11\text{-ft}$

**Material Data;**

$\gamma_{conc} := 150\text{-pcf}$   
 $\gamma_{soil} := 100\text{-pcf}$   
 $\phi_s := 30\text{-deg}$



Volume of Concrete =	$V_c := (D1 \cdot W1 \cdot L1) + (D2 \cdot W2 + D3 \cdot W3 + D4 \cdot W4) \cdot L2 = 3209 \text{ ft}^3$
Volume of Soil Above Footing =	$V_{s1} := [(D2 - 10 \text{ in}) \cdot (W3 - W2) + [(D2 - 10 \text{ in}) + D3] \cdot (W4 - W3)] \cdot L2 = 1370 \text{ ft}^3$
Volume of Soil Wedge at Back Face =	$V_{s2} := D_{tot}^2 \cdot W4 \cdot \tan(\Phi_s) = 1632 \text{ ft}^3$
Volume of Soil Wedge at Back Face Corners =	$V_{s3} := 2 \cdot \left[ \left( D_{tot} \right)^3 \cdot \frac{\tan(\Phi_s)}{3} \right] = 142 \text{ ft}^3$
Weight of Concrete =	$W_c := V_c \cdot \gamma_{conc} = 481 \text{ kips}$
Weight of Soil Above Footing =	$W_{s1} := V_{s1} \cdot \gamma_{soil} = 137 \text{ kips}$
Weight of Soil Wedge at Back Face =	$W_{s2} := V_{s2} \cdot \gamma_{soil} = 163 \text{ kips}$
Weight of Soil Wedge at Back Face Corners =	$W_{s3} := V_{s3} \cdot \gamma_{soil} = 14 \text{ kips}$

**CEN**TEK engineering

Centered on Solutions  
63-2 North Branford Road  
Branford, CT 06610  
www.centeke.com  
P: (203) 488-0580  
F: (203) 488-8587

Subject:

FOUNDATION

Location:

Cromwell, CT

Rev. 0: 06/14/12

Prepared by: T.J.L. Checked by: C.F.C.  
Job No. 12044.CO2

$$M_r := (W_c + W_{s1} + Axial_1 + Axial_2 + Axial_m) \cdot \frac{L2}{2} + (W_{s2} + W_{s3}) \left( L2 + \frac{D_{tot} \tan(\phi_s)}{2} \right) = 5957 \cdot \text{kip-ft}$$

$$M_{ot} := OM_1 + OM_2 + OM_m + (\text{Shear}_1 + \text{Shear}_2 + \text{Shear}_m) \cdot D_{tot} = 1628 \cdot \text{kip-ft}$$

$$FS := \frac{M_r}{M_{ot}} = 3.7$$

$$\text{Condition1} := \text{if} \left( \frac{M_r}{M_{ot}} > 2, \text{"OK"}, \text{"Overstressed"} \right)$$

Condition1 = "OK"









Section 16A - NEW PROPOSED SECTOR CELL INFORMATION (ALPHA) (OR DRAFT)									
ANTENNA CONFIG (FROM BACK)	ANTENNA 1 GSM, UMTS (150 / 1900) or LTE (700 / AWS)		ANTENNA 2 GSM, UMTS (150 / 1900) or LTE (700 / AWS)		ANTENNA 3 GSM, UMTS (150 / 1900) or LTE (700 / AWS)		ANTENNA 4 GSM, UMTS (150 / 1900) or LTE (700 / AWS)		ANTENNA 5 GSM, UMTS (150 / 1900) or LTE (700 / AWS)
TX/RX	Tx/Rx-Tx/Rx UMTS / 650	Tx/Rx-Tx/Rx UMTS / 1900			Tx/Rx-Tx/Rx LTE / 700	N/A	Tx/Rx-Tx/Rx GSM / 650	Tx/Rx-Tx/Rx GSM / 1900	
TECHNOLOGY	N/A		N/A		TOP		TOP		
HEIGHT LOCATION (Top/Bottom/None)	N/A		N/A		TOP		TOP		
FEEDERS TYPE	15.5" - Andrew	15.5" - Andrew					15.5" - Andrew	15.5" - Andrew	
FEEDER LENGTH (Feet)	110'	110'					110'	110'	
ANTENNA ATOLL									
ANTENNA MAKE - MODEL	7770				AMX-CD-16-65-00T-RET		7770		
ANTENNA VENDOR	Powerwave				KMW		Powerwave		
ANTENNA SIZE (H x W x D)	55.0 x 11.0 x 5.0				72.0 x 11.8 x 5.9		55.0 x 11.0 x 5.0		
ANTENNA WEIGHT	35				43.5		35		
ANTENNA GAIN	13.5 dB	16.5 dB					13.5 dB	16.5 dB	
AZIMUTH	30°				30°		33°		
RADIATION CENTER (Feet)	88"				88"		88"		
ANTENNA TIP HEIGHT	100"				101"		100"		
ELECTRICAL TILT (EO/ISO/1500/AWS)	2°	2°			TBD	TBD	2°	2°	
MECHANICAL DOWN TILT	0°				0°		0°		
FEEDER AMOUNT	2				1 Opto Fiber & 2 DC cables		2		
Antenna RET Motor (QTY/MODEL)	1 / Powerwave / 7020 (DB)				N/A / KMW / Built-in RET Equipment		1 / Powerwave / 7020 (DB)		
Antenna RET Splitter (QTY/MODEL)									
Antenna RET Earth (Grounding) Clamp (QTY/MODEL)									
Antenna RET Surge Arrester (QTY/MODEL)									
Antenna RET CONTROL UNIT (QTY/MODEL) usually per site							Powerwave / 7070		
DC BLOCK (QTY/MODEL)	N/A				TBD / 2 Ericsson RRU		N/A		
IMPA/NA (TYPE/MODEL)	N/A				TBD / 2 Ericsson RRU		N/A		
CURRENT RECTIFIERS FOR TMA (QTY/MODEL)	PolyPhaser / 1000660				PolyPhaser / 1000660		PolyPhaser / 1000660		
POU FOR TMA (QTY/MODEL) usually per site	LGP 12104 (1800 AND 650 Bypass TMA)				LGP 12104 (1800 AND 650 Bypass TMA)		LGP 12104 (1800 AND 650 Bypass TMA)		
SURGE ARRESTOR (QTY/MODEL)	N/A				N/A		N/A		
DUPLEXER (QTY/MODEL)	0 + 2 / Powerwave / LGP 21901				0 + 2 / Powerwave / LGP 21901		0 + 2 / Powerwave / LGP 21901		
HYBRID COMBINER (QTY/MODEL)	N/A				N/A		N/A		
DUPLEXER (QTY/MODEL)	N/A				N/A		N/A		
FILTER (QTY/MODEL)	N/A				N/A		N/A		
RAIT ATT MODULE	No RAIT	No RAIT			No RAIT	No RAIT	No RAIT	No RAIT	
FILTER or NARROW BAND LLC (QTY/MODEL)	N/A / No LLC	N/A / No LLC			N/A / No LLC	N/A / No LLC	N/A / No LLC	N/A / No LLC	
SCF/MCPA MODULE?	N/A	N/A			N/A	N/A	N/A	N/A	
Additional Component 1	Powerwave				Powerwave		Powerwave		
Additional Component 2	N/A				N/A		N/A		
Additional Component 3	Daisy chain to ANT4				RET connected to RRU for control		Home runs to BTS from ANT4		
MAGNETIC DECLINATION	-14°				-14°		-14°		
MATCHLINE POWER (Watts)	TBD	TBD			TBD	TBD	TBD	TBD	
ERP (Watts)	TBD	TBD			TBD	TBD	TBD	TBD	
Local Market Note 1	RRUs on existing OB.F, Jumps and RX								
Local Market Note 2									
Local Market Note 3									

Section 160 - NEW PROPOSED SECTOR CELL INFORMATION - DELTA					
ANTENNA CONFIG (FROM BACK)	ANTENNA 1 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 2 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 3 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 4 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 5 GSM, UMTS (150 / 1500) or LTE (100 / AWS)
FEEDS TYPE					
FEEDER LENGTH (Feet)					
ANTENNA ATTEN.					
ANTENNA MAKE - MODEL					
ANTENNA VENDOR					
ANTENNA SIZE (H x W x D)					
ANTENNA WEIGHT					
ANTENNA GAIN					
AZIMUTH					
RADIATION CENTER (Feet)					
ANTENNA TP HEIGHT					
ELECTRICAL TILT (Deg/SSO/1500/AWS)					
MECHANICAL DOWNTILT					
FEEDER AMOUNT					
Antenna RET Motor (QTY/MODEL)					
Antenna RET Splitter (QTY/MODEL)					
Antenna RET Earth (Grounding) Clamp (QTY/MODEL)					
Antenna RET Surge Arrestor (QTY/MODEL)					
Antenna RET CONTROL UNIT (QTY/MODEL) usually per site					
DC BLOCK (QTY/MODEL)					
TMA/TNA (TYPE/MODEL)					
CURRENT INJECTORS FOR TMA (QTY/MODEL)					
POU FOR TMAS (QTY/MODEL) usually per site					
SURGE ARRESTOR (QTY/MODEL)					
DUPLEXER (QTY/MODEL)					
HYBRID COUPLER (QTY/MODEL)					
COUPLER (QTY/MODEL)					
FILTER (QTY/MODEL)					
ISAT RT MODULE?					
TIPLEXER or NARROW BAND LLC (QTY/MODEL)					
SP7/TMCPA MODULE?					
Additional Component1					
Additional Component2					
Additional Component3					
MAGNETIC DECLINATION					
HAT/PLATE POWER (Watts)					
ERP (Watts)					
Local Market Note1					
Local Market Note2					
Local Market Note3					
Section 161 - NEW PROPOSED SECTOR CELL INFORMATION - EPSILON					
ANTENNA CONFIG (FROM BACK)	ANTENNA 1 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 2 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 3 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 4 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 5 GSM, UMTS (150 / 1500) or LTE (100 / AWS)
FEEDS TYPE					
FEEDER LENGTH (Feet)					
ANTENNA ATTEN.					
ANTENNA MAKE - MODEL					
ANTENNA VENDOR					
ANTENNA SIZE (H x W x D)					
ANTENNA WEIGHT					
ANTENNA GAIN					
AZIMUTH					
RADIATION CENTER (Feet)					
ANTENNA TP HEIGHT					
ELECTRICAL TILT (Deg/SSO/1500/AWS)					
MECHANICAL DOWNTILT					
FEEDER AMOUNT					
Antenna RET Motor (QTY/MODEL)					
Antenna RET Splitter (QTY/MODEL)					
Antenna RET Earth (Grounding) Clamp (QTY/MODEL)					
Antenna RET Surge Arrestor (QTY/MODEL)					
Antenna RET CONTROL UNIT (QTY/MODEL) usually per site					
DC BLOCK (QTY/MODEL)					
TMA/TNA (TYPE/MODEL)					
CURRENT INJECTORS FOR TMA (QTY/MODEL)					
POU FOR TMAS (QTY/MODEL) usually per site					
SURGE ARRESTOR (QTY/MODEL)					
DUPLEXER (QTY/MODEL)					
HYBRID COUPLER (QTY/MODEL)					
COUPLER (QTY/MODEL)					
FILTER (QTY/MODEL)					
ISAT RT MODULE?					
TIPLEXER or NARROW BAND LLC (QTY/MODEL)					
SP7/TMCPA MODULE?					
Additional Component1					
Additional Component2					
Additional Component3					
MAGNETIC DECLINATION					
HAT/PLATE POWER (Watts)					
ERP (Watts)					
Local Market Note1					
Local Market Note2					
Local Market Note3					
Section 162 - NEW PROPOSED SECTOR CELL INFORMATION - ZETA					
ANTENNA CONFIG (FROM BACK)	ANTENNA 1 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 2 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 3 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 4 GSM, UMTS (150 / 1500) or LTE (100 / AWS)	ANTENNA 5 GSM, UMTS (150 / 1500) or LTE (100 / AWS)
FEEDS TYPE					
FEEDER LENGTH (Feet)					
ANTENNA ATTEN.					
ANTENNA MAKE - MODEL					
ANTENNA VENDOR					
ANTENNA SIZE (H x W x D)					
ANTENNA WEIGHT					
ANTENNA GAIN					
AZIMUTH					
RADIATION CENTER (Feet)					
ANTENNA TP HEIGHT					
ELECTRICAL TILT (Deg/SSO/1500/AWS)					
MECHANICAL DOWNTILT					
FEEDER AMOUNT					
Antenna RET Motor (QTY/MODEL)					
Antenna RET Splitter (QTY/MODEL)					
Antenna RET Earth (Grounding) Clamp (QTY/MODEL)					
Antenna RET Surge Arrestor (QTY/MODEL)					
Antenna RET CONTROL UNIT (QTY/MODEL) usually per site					
DC BLOCK (QTY/MODEL)					
TMA/TNA (TYPE/MODEL)					
CURRENT INJECTORS FOR TMA (QTY/MODEL)					
POU FOR TMAS (QTY/MODEL) usually per site					
SURGE ARRESTOR (QTY/MODEL)					
DUPLEXER (QTY/MODEL)					
HYBRID COUPLER (QTY/MODEL)					
COUPLER (QTY/MODEL)					
FILTER (QTY/MODEL)					
ISAT RT MODULE?					
TIPLEXER or NARROW BAND LLC (QTY/MODEL)					
SP7/TMCPA MODULE?					
Additional Component1					
Additional Component2					
Additional Component3					
MAGNETIC DECLINATION					
HAT/PLATE POWER (Watts)					
ERP (Watts)					
Local Market Note1					
Local Market Note2					
Local Market Note3					

## AM-X-CD-16-65-00T-RET(6' 65° Dual Broadband Antenna)

Dual Band Electrical DownTilt Antenna

698 ~ 894MHz, X-pol., H65° / V12°

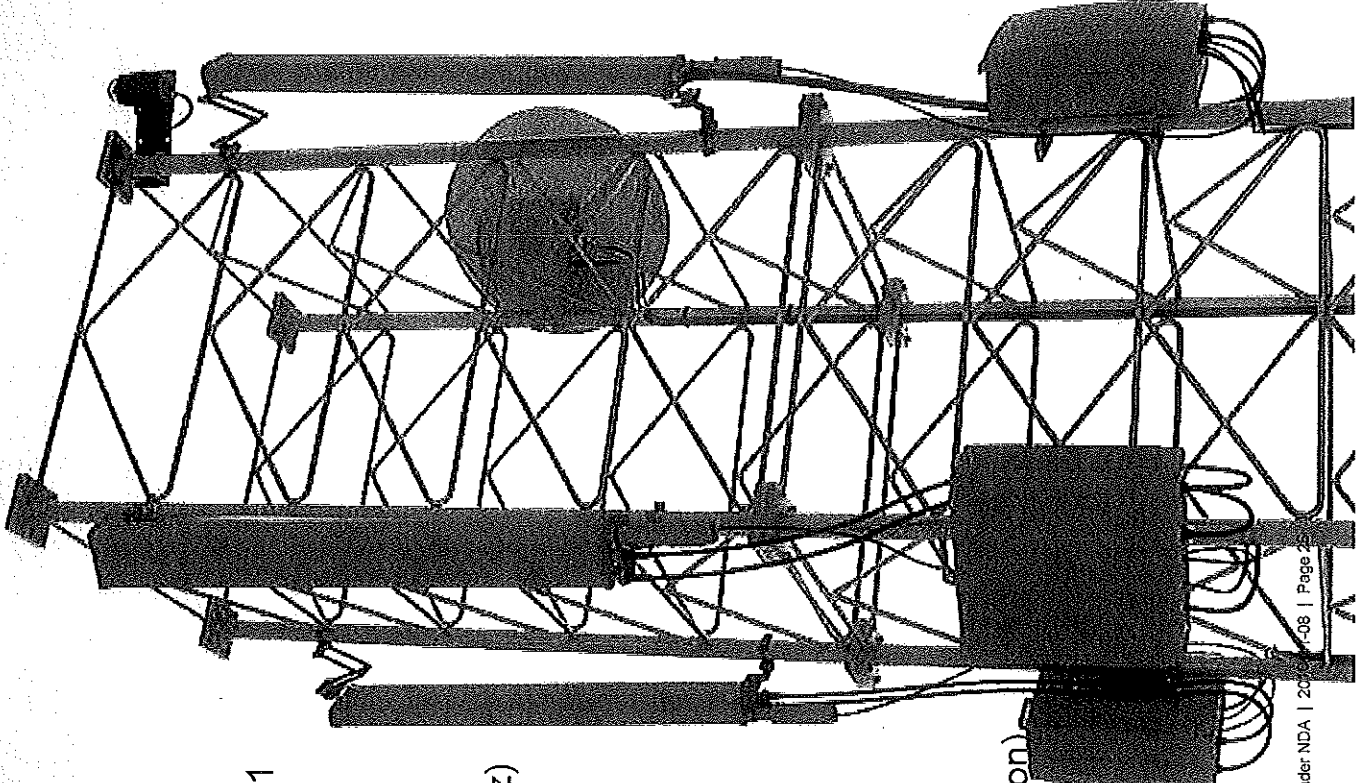
1710 ~ 2170MHz, X-pol., H65° / V6.0°

### Electrical Specification

Frequency Range	698~894MHz	1710~2170MHz
Impedance	50Ω	
Polarization	Dual, Slant ±45°	
Gain	15.5dBi / 13.35dBd @ 698-806MHz 16.0dBi / 13.85dBd @ 824-894MHz	17.3dBi / 15.15dBd @ 1710-1755MHz 17.4dBi / 15.25dBd @ 1850-1900MHz 17.1dBi / 14.95dBd @ 2110-2155MHz
Beamwidth	Horizontal	65° @ 698-806MHz 63° @ 824-894MHz
	Vertical	65° @ 1710-1755MHz 67° @ 1850-1900MHz 69° @ 2110-2155MHz
	12.3° @ 698-806MHz 11.5° @ 824-894MHz	6.5° @ 1710-1755MHz 6.0° @ 1850-1900MHz 5.7° @ 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° 15.0 dBi @ 0°	
First Upper Side Lobe Suppression	16dB	
Side Lobe Suppression	> 16 dB @ 0-6° Tilt > 18 dB @ 7-12° Tilt (Up to 10° from Boresight)	> 16 dB @ 0-6° Tilt > 18 dB @ 7-10° Tilt (Up to 10° from Boresight)
Passive Intermodulation	≤ -150 dBc @ 2x20w	
Input Maximum CW Power	500 W	300 W
Environmental Compliance	IP65 for Radome IP67 for Connectors	
RET Motor Configuration	Field Replaceable RET Electronic Control Module / 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)	11.8×5.9×72 inches (300×150×1829mm)
Weight (Without clamp)	48.5 lbs (22.0 kg)
Connector	4 x 7/16 DIN(F), Long Neck
Max Wind Speed	150 mph
Wind Load (@150 mph)	1891 N



**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**

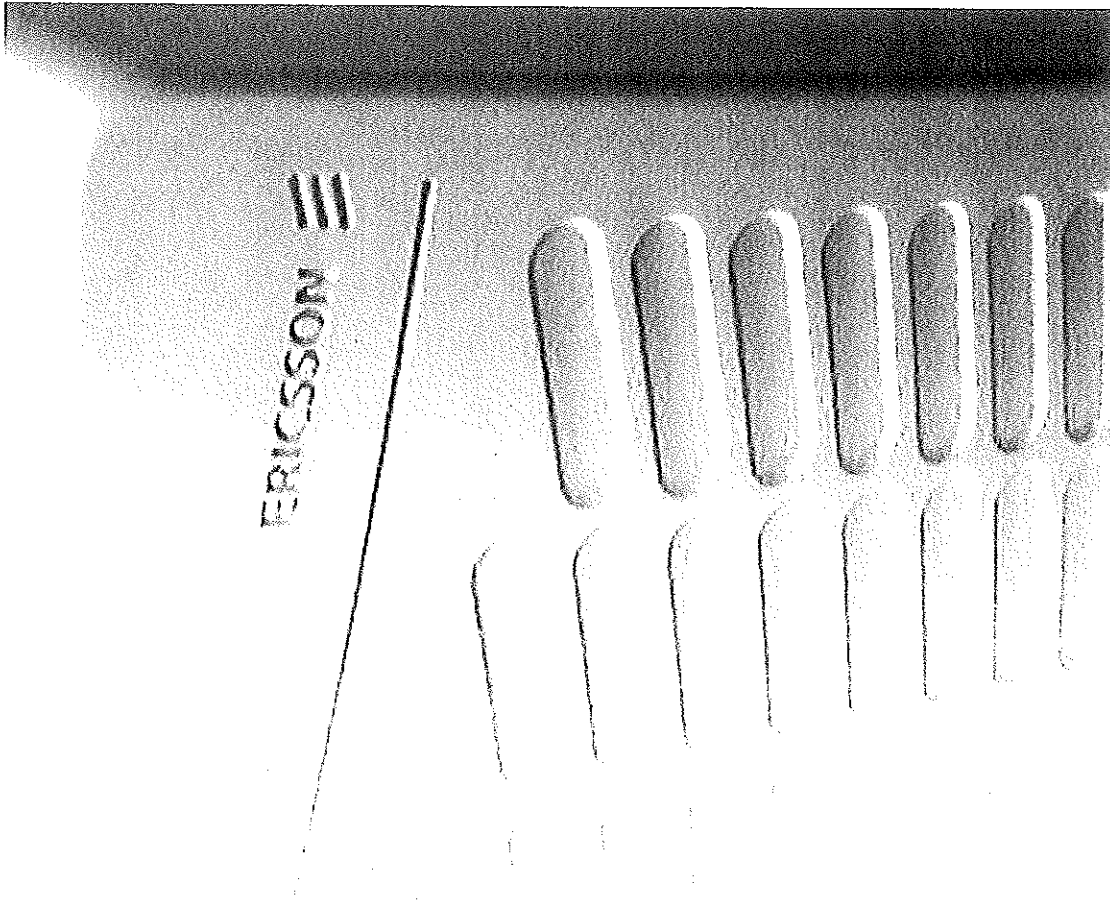
- ✓ Self Convection
- ✓ Temperature -40 to 131 F

**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

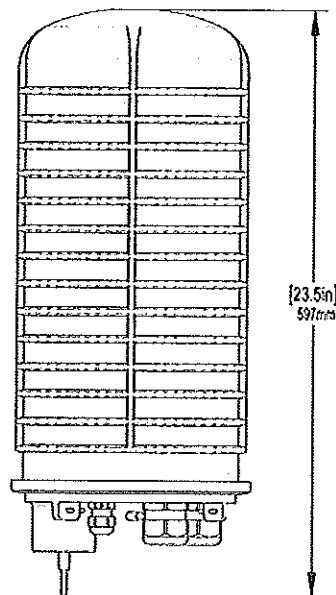
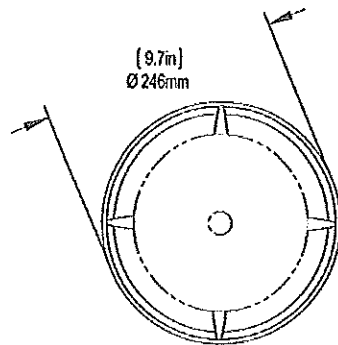
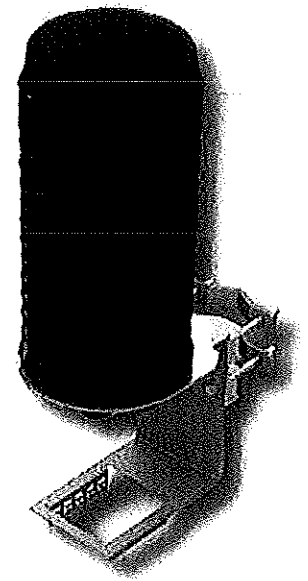
## DC6-48-60-18-8F

### 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.

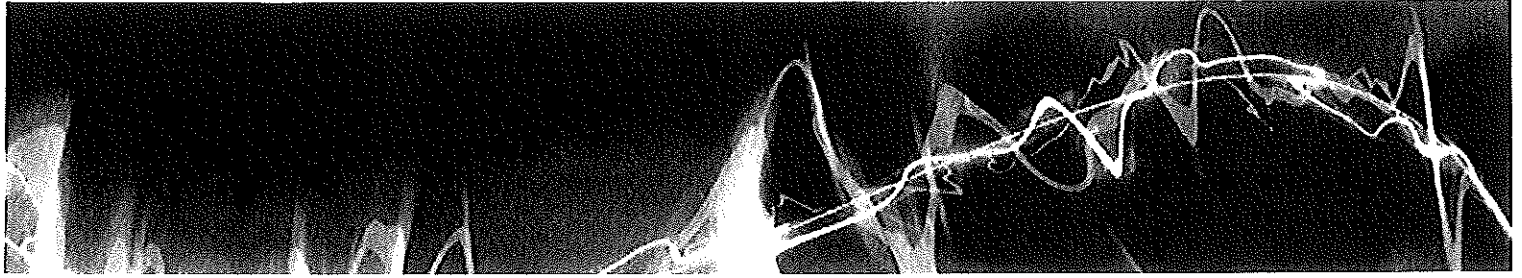
#### FEATURES

- 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

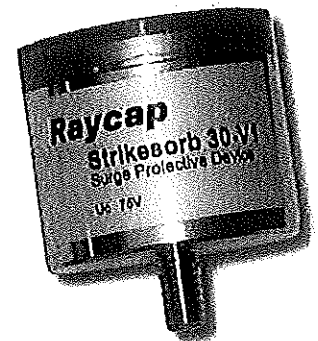
Electrical Specifications	
Model Number	DC6-48-60-18-8F
Nominal Operating Voltage	48 VDC
Nominal Discharge Current ( $I_n$ )	20 kA 8/20 $\mu$ s
Maximum Discharge Current ( $I_{max}$ ) per NEMA LS-1	60 kA 8/20 $\mu$ s
Maximum Continuous Operating Voltage ( $U_c$ )	75 VDC
Voltage Protection Rating	400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

Raycap, Inc. 806 W. Clearwater Loop • Post Falls • Idaho • 83854 • USA  
Phone 208.777.1166 • Toll Free 800.890.2569 • Fax 208.777.4466 • [www.raycapsurgeprotection.com](http://www.raycapsurgeprotection.com)



C Squared Systems, LLC  
65 Dartmouth Drive, Unit A3  
Auburn, NH 03032  
(603) 644-2800  
support@csquaredsystems.com

---

## Calculated Radio Frequency Emissions



CT5144 – Cromwell

100 Berlin Road, Cromwell, CT 06416

(a.k.a. Christian Hill Road)

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July 30, 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 sign structure with pipe mast located at 100 Berlin Road in Cromwell, CT. The coordinates of the tower are 41° 36' 20.5" N, 72° 42' 5.2" W.

AT&T is proposing the following modifications:

- 1) Install three 700 MHz LTE antennas (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:

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

Where:

EIRP = Effective Isotropic Radiated Power

R = 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 pattern 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
<i>Cingular UMTS</i>	102	1935	1	500	0.0173	1.0000	1.73%
<i>Cingular 800</i>	102	880	20	250	0.1728	0.5867	29.45%
<i>Cingular 1900</i>	102	1900	3	427	0.0443	1.0000	4.43%
Pocket	77	2130	3	631	0.1148	1.0000	11.48%
T-Mobile GSM	108	1945	8	191	0.0471	1.0000	4.71%
T-Mobile UMTS	108	2100	2	764	0.0471	1.0000	4.71%
Verizon	88	869	9	427	0.1784	0.5793	30.80%
Verizon	88	1970	3	270	0.0376	1.0000	3.76%
Verizon	88	757	1	878	0.0408	0.5047	8.08%
AT&T UMTS	98	880	2	565	0.0042	0.5867	0.72%
AT&T UMTS	98	1900	2	875	0.0066	1.0000	0.66%
AT&T LTE	98	734	1	1313	0.0049	0.4893	1.00%
AT&T GSM	98	880	1	283	0.0011	0.5867	0.18%
AT&T GSM	98	1900	4	525	0.0079	1.0000	0.79%
						<b>Total</b>	<b>66.89%</b>

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 7/27/2012. 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, Inc. Structural Analysis Report dated July 14, 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 **66.89% 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

July 30, 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

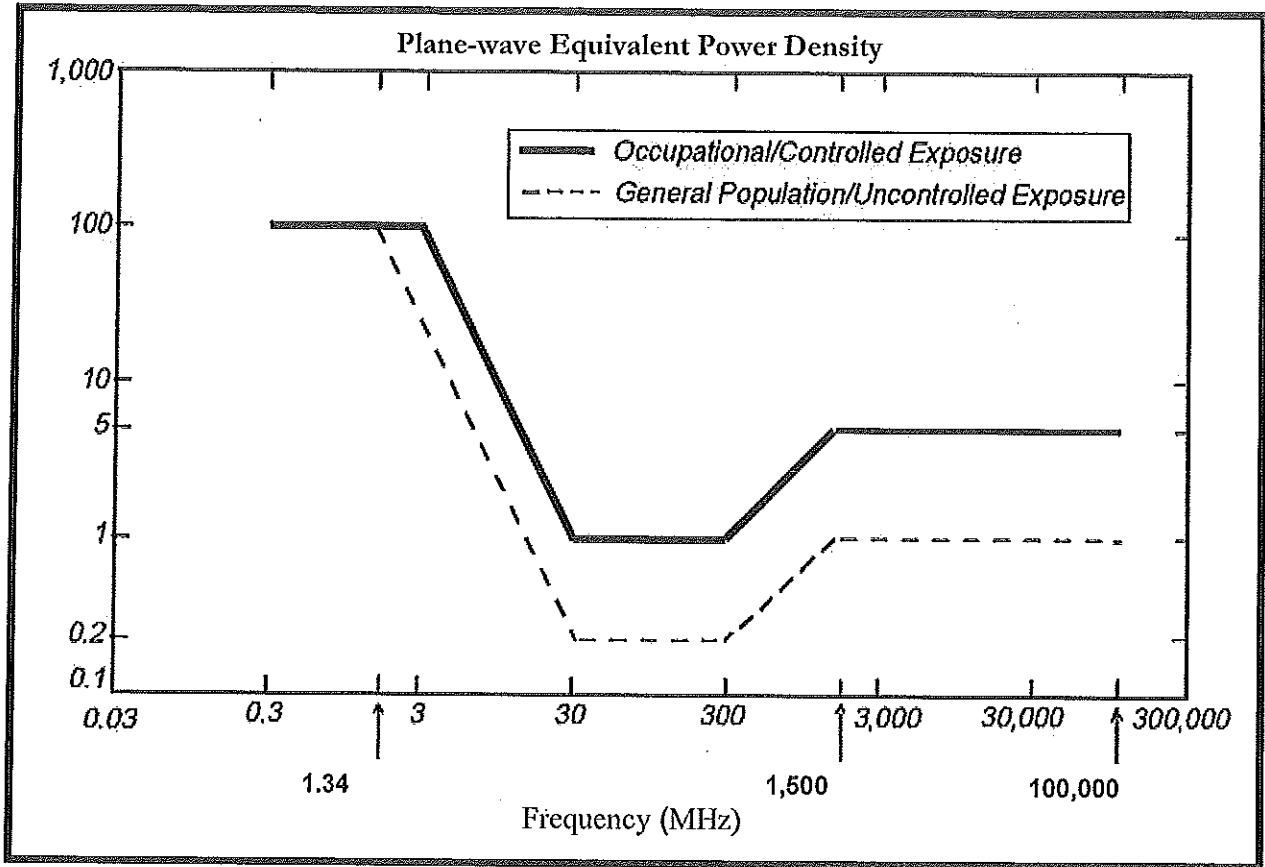
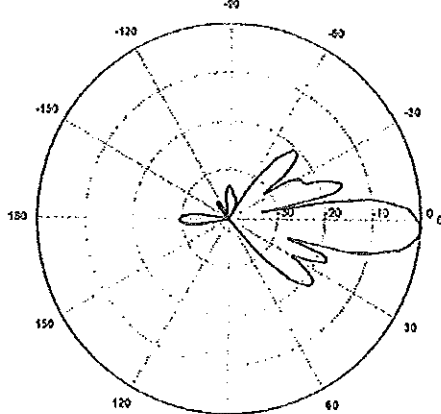
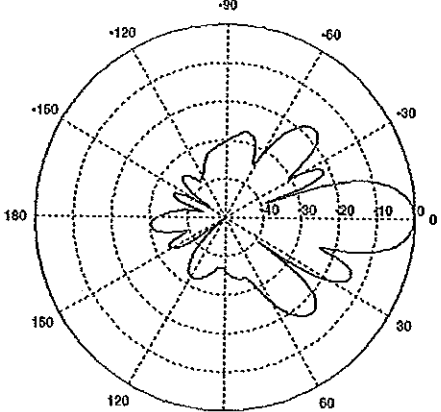
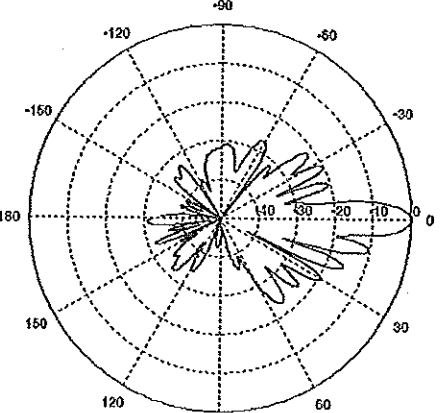


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

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

<p><b>700 MHz</b></p> <p>Manufacturer: KMW Communications            Model #: AM-X-CD-16-65-00T-RET            Frequency Band: 698-806 MHz            Gain: 13.4 dBd            Vertical Beamwidth: 12.3°            Horizontal Beamwidth: 65°            Polarization: Dual Slant <math>\pm 45^\circ</math>            Size L x W x D: 72.0" x 11.8" x 5.9"</p>	
<p><b>850 MHz</b></p> <p>Manufacturer: Powerwave            Model #: 7770            Frequency Band: 824-896 MHz            Gain: 11.5 dBd            Vertical Beamwidth: 15°            Horizontal Beamwidth: 82°            Polarization: Dual Linear <math>\pm 45^\circ</math>            Size L x W x D: 55.0" x 11.0" x 5.0"</p>	
<p><b>1900 MHz</b></p> <p>Manufacturer: Powerwave            Model #: 7770            Frequency Band: 1850-1990 MHz            Gain: 13.6 dBd            Vertical Beamwidth: 7°            Horizontal Beamwidth: 86°            Polarization: Dual Linear <math>\pm 45^\circ</math>            Size L x W x D: 55.0" x 11.0" x 5.0"</p>	

EM-CING-033-120824

HPC Wireless Services  
46 Mill Plain Rd.  
Floor 2  
Danbury, CT, 06811  
P.: 203.797.1112



August 22, 2012

RECEIVED  
AUG 24 2012

VIA OVERNIGHT COURIER

Connecticut Siting Council  
10 Franklin Square  
New Britain, Connecticut 06051  
Attn: Ms. Linda Roberts, Executive Director

CONNECTICUT  
SITING COUNCIL

Re: New Cingular Wireless PCS, LLC – Exempt Modification  
Christian Hill Road (100 Berlin Road), Cromwell, Connecticut

Dear Ms. Roberts:

This letter and attachments are submitted on behalf of New Cingular Wireless PCS, LLC ("AT&T"). AT&T is making modifications to certain existing sites in its Connecticut system in order to implement LTE technology. Please accept this letter and attachments as notification, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies ("R.S.C.A."), of construction that 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 the Town of Cromwell.

AT&T plans to modify the existing wireless communications facility controlled by Celco Partnership d/b/a Verizon Wireless and located off of Christian Hill Road (a/k/a 100 Berlin Road), Cromwell (coordinates 41°-36'-20.5" N, 72°-42'-04.93" W). Attached are a compound plan and elevation depicting the planned changes, and documentation of the structural sufficiency of the structure to accommodate the revised antenna configuration. Also included is a power density report 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 will add three (3) LTE panel antennas to the existing platform at a center line of approximately 98'. Six (6) RRUS (remote radio units) and a surge arrestor will be stack mounted to existing pipes behind the LTE antennas. AT&T will also place a DC power and fiber run from the equipment to the antennas along the existing coaxial cable

Ms. Linda Roberts

August 22, 2012

Page 2

run. These changes will not extend the height of the approximately 111' structure including antennas.

2. AT&T will stack two cabinets on a proposed 4' x 4' concrete pad adjacent to the existing AT&T equipment pad, and will mount a new GPS antenna to the existing steel canopy. These changes will be within the existing compound and will have no effect on the site boundaries.

3. The proposed changes will not increase the noise level at the existing facility by six (6) 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 on the attached report prepared by C Squared Systems, LLC, AT&T's operations at the site will result in a power density of approximately 3.35%; the combined site operations will result in a total power density of approximately 66.89%.

Please feel free to contact me by phone at (860) 798-7454 or by e-mail at [jgaudet@hpcwireless.com](mailto:jgaudet@hpcwireless.com) with questions concerning this matter. Thank you for your consideration.

Respectfully yours,

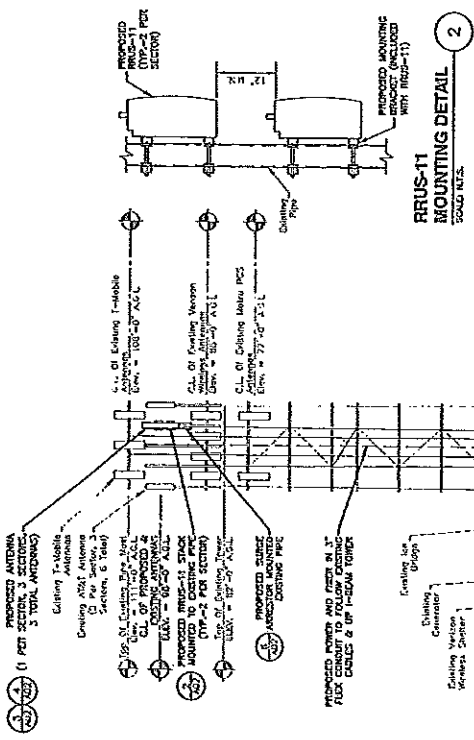


Jennifer Young Gaudet

Attachments

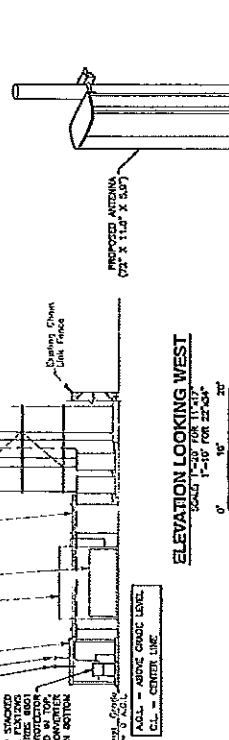
cc: Honorable Mertie Terry, First Selectman, Town of Cromwell  
Shaner SPE Associates, LLP (underlying property owner)





**CONCRETE PAD DETAIL**  
SCALE: 1/4" = 1'-0"

1. TOTAL AREA OF CONCRETE PAD IS 4'-4" x 18' 0" SQ. FT.



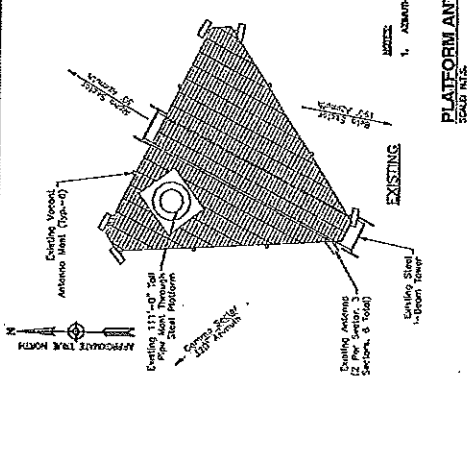
**ISOMETRIC ANTENNA DETAIL**  
SCALE: 1/4" = 1'-0"

1. PLACE SEE INTO FOR SPECIFIC ANTENNA MODEL.



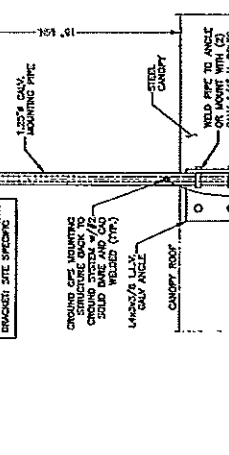
**GPS ANTENNA**  
SCALE: 1/4" = 1'-0"

1. GROUND ANTENNAS AND MOUNTS PER MANUFACTURER'S RECOMMENDATIONS AND ASSET STANDARDS.  
2. FIELD LOCATE GPS ANTENNA A MINIMUM OF 10 FEET FROM ANY OTHER ANTENNA WITH FIELD OFF APPROVAL.



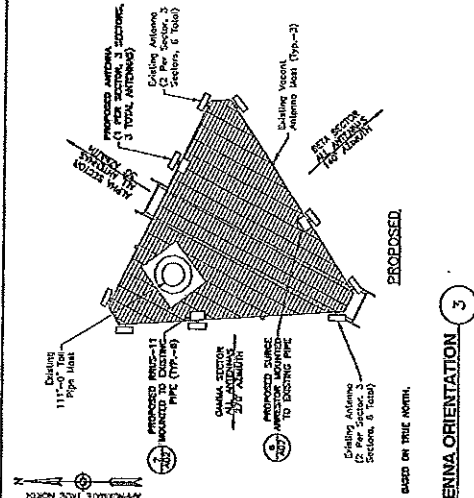
**PLATFORM ANTENNA ORIENTATION**  
SCALE: 1/4" = 1'-0"

1. ANTENNAS BASED ON TRUE NORTH.



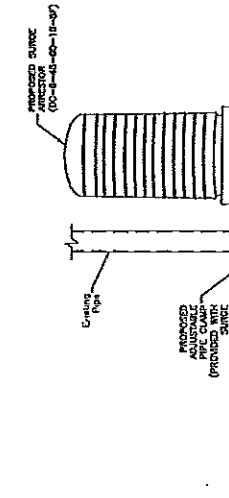
**SURGE ARRESTOR MOUNTING DETAIL**  
SCALE: 1/4" = 1'-0"

1. GROUND ANTENNAS AND MOUNTS PER MANUFACTURER'S RECOMMENDATIONS AND ASSET STANDARDS.  
2. FIELD LOCATE GPS ANTENNA A MINIMUM OF 10 FEET FROM ANY OTHER ANTENNA WITH FIELD OFF APPROVAL.



**PLATFORM ANTENNA ORIENTATION**  
SCALE: 1/4" = 1'-0"

1. ANTENNAS BASED ON TRUE NORTH.



**SURGE ARRESTOR MOUNTING DETAIL**  
SCALE: 1/4" = 1'-0"

1. GROUND ANTENNAS AND MOUNTS PER MANUFACTURER'S RECOMMENDATIONS AND ASSET STANDARDS.  
2. FIELD LOCATE GPS ANTENNA A MINIMUM OF 10 FEET FROM ANY OTHER ANTENNA WITH FIELD OFF APPROVAL.



**CONCRETE PAD DETAIL**  
SCALE: 1/4" = 1'-0"

1. TOTAL AREA OF CONCRETE PAD IS 4'-4" x 18' 0" SQ. FT.

REV	DESCRIPTION	DATE
0	AS SHOWN	08/07

**at&t**  
100 CHRISTIAN HILL ROAD  
CROMWELL, CT 06415

**NEWLINK**  
100 MARSHALL PLACE ROAD, 4TH FLOOR  
WINDSOR, CT 06095

**Dewberry**  
Dewberry Engineers Inc.  
600 WESTPORT ROAD  
SUITE 200  
WINDSOR, CT 06095  
PHONE: 860.238.8800  
FAX: 860.238.8810

**STATE OF CONNECTICUT**  
REGISTERED PROFESSIONAL ENGINEER  
NO. 28559  
DATE: 08/07/12  
ISSUED FOR CONSTRUCTION: 08/07/12  
PRELIMINARY SUBMISSION: 08/07/12  
REVISIONS: BY: [Signature]  
DESIGNED BY: CHN  
DRAWN BY: JTF  
SCALE: AS SHOWN

**ELEVATION & CONSTRUCTION DETAILS**

PROJECT NO.: 50048347/50048339  
DRAWING NUMBER: A02

---

**CEN TEK** engineering

Centered on Solutions<sup>SM</sup>

**Structural Analysis Report**

*82' Sign Structure w/ 111' Pipe Mast*

*Proposed AT&T Mobility  
Antenna Upgrade*

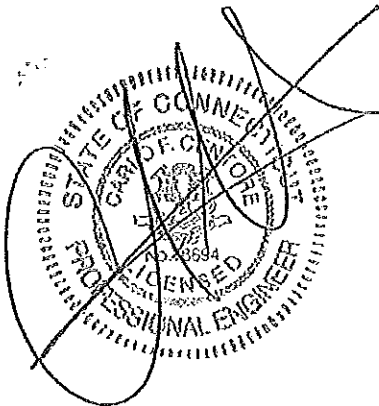
*AT&T Mobility Site Ref: CT5144*

*Verizon Site Ref: Cromwell SW*

*100 Berlin Road  
Cromwell, CT*

*Centek Project No. 12044.CO2*

*Date: June 14, 2012*



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



---

CEN TEK engineering, Inc.  
Structural Analysis – 82' Sign Structure  
AT&T Mobility Antenna Upgrade – CT5144  
Cromwell, CT  
June 14, 2012

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- TOWER CAPACITY.
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- ANTENNA CUT SHEETS

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CEN TEK engineering, Inc.  
Structural Analysis – 82' Sign Structure  
AT&T Mobility Antenna Upgrade – CT5144  
Cromwell, CT  
June 14, 2012

## Introduction

The purpose of this report is to summarize the results of the non-linear, P- $\Delta$  structural analysis of the antenna installation proposed by AT&T Mobility on the existing 82-ft sign structure located in Cromwell, Connecticut.

The host structure is a 82-ft sign structure with a 111-ft pipe mast. The existing structure geometry, member sizes and foundation system were obtained from a previous structural design report prepared by Centek (Formally Natcomm) job no. 10001.CO7 dated December 3, 2009. Antenna and appurtenance information were obtained from the aforementioned Centek structural analysis report, visual verification from grade by Centek personnel on April 26, 2012 and a RF data sheet.

The structure is made up of two (2) W24x68 vertical steel legs, one (1) HSS18x0.5 steel pipe mast, L5x5x5/16 horizontal and diagonal steel bracing and WT6x15 steel bracing.

AT&T proposes the installation of three (3) panel antennas, six (6) RRU's and one (1) Surge Arrestor mounted to the existing pipe masts on the Verizon Wireless 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 structure was designed to support several communication antennas. The existing, proposed and future loads considered in this analysis consist of the following:

- T-MOBILE: (Existing)  
Antennas: Six (6) RFS APX16DWV-16DWVS-E-A20 panel antennas and nine (9) Andrew OneBase Twin Dual Duplex TMA's on a low profile platform mounted on a 111-ft pipe mast with a RAD center elevation of 108-ft AGL.  
Coax Cables: Eighteen (18) 1-5/8"  $\varnothing$  coax cables, nine (9) within existing 111-ft pipe mast and nine (9) on the exterior of the pipe mast.
- VERIZON: (Existing To Remain)  
Antennas: Four (4) Decibel DB846F65ZAXY, two (2) Antel LPA-80080/6CF, three (3) Antel BXA-70063-6CF, and six (6) Decibel 948F85T2E-M\_2 panel antennas with a RAD center elevation of 88-ft AGL.  
Coax Cables: Eighteen (18) 1-5/8"  $\varnothing$  coax cables run on the exterior of the existing sign structure.
- MetroPCS (Existing)  
Antennas: Three (3) RFS APXV18-206517S-C panel antennas mounted to the steel flanges (legs) of the existing sign structure with a RAD center elevation of 77-ft AGL.  
Coax Cable: Six (6) 1-5/8"  $\varnothing$  coaxial cables vertically supported on the existing legs of the sign structure.

CEN TEK engineering, Inc.  
Structural Analysis – 82' Sign Structure  
AT&T Mobility Antenna Upgrade – CT5144  
Cromwell, CT  
June 14, 2012

- T-MOBILE (Existing/Reserved)  
Antennas: One (1) VIC-100 GPS antenna on a side arm mounted to the leg of the sign structure with a RAD center elevation of 50-ft AGL.  
Coax Cables: One (1) 1/2" Ø coax cable run on the exterior of the existing sign structure.
- AT&T: (Existing)  
Antennas: Six (6) Powerwave 7770.00 panel antennas and twelve (12) Powerwave LPG21401 TMA's mounted on pipe mounts to the existing Verizon Wireless low profile platform with a RAD center elevation of 98-ft AGL.  
Coax Cables: Twelve (12) 1-5/8" Ø coax cables run on the exterior of existing sign structure.
- AT&T (PROPOSED):  
Antennas: Three (3) KMW AM-X-CD-16-65-00T panel antennas, six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted on pipe mounts to the existing Verizon Wireless low profile platform with a RAD center elevation of 98-ft AGL.  
Coax Cables: One (1) fiber cable and two (2) dc control cables running on the exterior of existing sign structure.

### Primary Assumptions Used in the Analysis

- The structure's theoretical capacity not including any assessment of the condition of the tower.
- The structure carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Structure is properly installed and maintained.
- Structure is in plumb condition.
- Structure 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 structure 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 structure 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.

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## 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:	Middlesex; v = 85 mph (fastest mile)	[Section 16 of TIA/EIA-222-F-96]
	Cromwell; v = 100 mph (3 second gust) equivalent to v = 80 mph (fastest mile)	[Appendix K of the 2005 CT Building Code Supplement]
	<i>TIA/EIA-222-F and Appendix K wind speeds 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

<sup>1</sup> The 2005 Connecticut State Building Code as amended by the 2009 CT State Supplement. (CSBC)

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### Structure Capacity

Member stresses were calculated utilizing the structural analysis software RISA-3D. 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 6, per RISA-3D "Steel Code Checks", this structure was found to be at **98.3%** of its total capacity.

Tower Section	Location	Stress Ratio (percentage of capacity)	Result
Leg 2	1.25'	98.3%	PASS

### Foundation and Anchors

The existing foundation consists of an 55-ft long (approx) x 8.5-ft wide x 3-ft deep reinforced concrete strip footing with concrete column pedestals. The sub-grade conditions used in the analysis of the existing foundation were based on normal soil values as permitted by EIA/TIA-222-F Section 7.1.3. The base of the sign structure is connected to the foundation by means of (20) 1"Ø, (assumed ASTM A-615-75) anchor bolts embedded into the existing concrete foundation. The base of the communications pipe structure is connected to the foundation by means of (10) 1.75"Ø, ASTM A615-75 anchor bolts embedded into the existing concrete foundation.

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 foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2	Proposed Loading	Result
Reinf. Conc. Pad w/ Pedestals	OTM	2.0	3.7	PASS

Note: OTM denotes Overturning Moment

- The structure anchor bolts, base plate and flange plates were found to be within allowable limits.

Structure Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts (Mast)	Tension	56.7%	PASS
Base Plate (Mast)	Bending	42.8%	PASS
Flange Bolts	Tension	70.0%	PASS
Flange Plate	Bending	60.6%	PASS
Anchor Bolts (Leg)	Tension	52.3%	PASS
Base Plate (Leg)	Bending	95.0%	PASS

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June 14, 2012

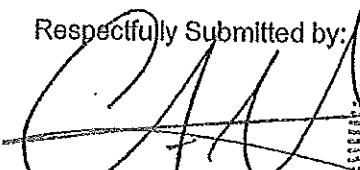
### Conclusion

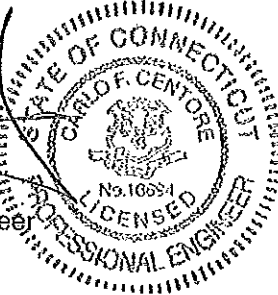
This analysis shows that the subject structure is adequate to support the proposed modified antenna configuration.

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

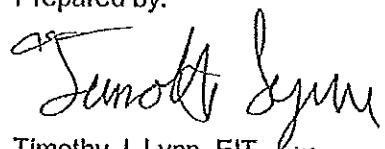
Please feel free to call with any questions or comments.

Respectfully Submitted by:

  
Carlo F. Centore, PE  
Principal ~ Structural Engineer



Prepared by:

  
Timothy J. Lynn, EIT  
Structural Engineer

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CEN TEK engineering, Inc.  
Structural Analysis – 82' Sign Structure  
AT&T Mobility Antenna Upgrade – CT5144  
Cromwell, CT  
June 14, 2012

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 CEN TEK 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 CEN TEK 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. CEN TEK engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

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CENTEK engineering, Inc.  
Structural Analysis – 82' Sign Structure  
AT&T Mobility Antenna Upgrade – CT5144  
Cromwell, CT  
June 14, 2012

## GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM ~ RISA-3D

RISA-3D Structural Analysis Program is an integrated structural analysis and design software package for buildings, bridges, tower structures, etc.

### Modeling Features:

- Comprehensive CAD-like graphic drawing/editing capabilities that let you draw, modify and load elements as well as snap, move, rotate, copy, mirror, scale, split, merge, mesh, delete, apply, etc.
- Versatile drawing grids (orthogonal, radial, skewed)
- Universal snaps and object snaps allow drawing without grids
- Versatile general truss generator
- Powerful graphic select/unselect tools including box, line, polygon, invert, criteria, spreadsheet selection, with locking
- Saved selections to quickly recall desired selections
- Modification tools that modify single items or entire selections
- Real spreadsheets with cut, paste, fill, math, sort, find, etc.
- Dynamic synchronization between spreadsheets and views so you can edit or view any data in the plotted views or in the spreadsheets
- Simultaneous view of multiple spreadsheets
- Constant in-stream error checking and data validation
- Unlimited undo/redo capability
- Generation templates for grids, disks, cylinders, cones, arcs, trusses, tanks, hydrostatic loads, etc.
- Support for all units systems & conversions at any time
- Automatic interaction with RISASection libraries
- Import DXF, RISA-2D, STAAD and ProSteel 3D files
- Export DXF, SDNF and ProSteel 3D files

### Analysis Features:

- Static analysis and P-Delta effects
- Multiple simultaneous dynamic and response spectra analysis using Gupta, CQC or SRSS mode combinations
- Automatic inclusion of mass offset (5% or user defined) for dynamic analysis
- Physical member modeling that does not require members to be broken up at intermediate joints
- State of the art 3 or 4 node plate/shell elements
- High-end automatic mesh generation — draw a polygon with any number of sides to create a mesh of well-formed quadrilateral (NOT triangular) elements.
- Accurate analysis of tapered wide flanges - web, top and bottom flanges may all taper independently
- Automatic rigid diaphragm modeling
- Area loads with one-way or two-way distributions
- Multiple simultaneous moving loads with standard AASHTO loads and custom moving loads for bridges, cranes, etc.
- Torsional warping calculations for stiffness, stress and design
- Automatic Top of Member offset modeling
- Member end releases & rigid end offsets
- Joint master-slave assignments
- Joints detachable from diaphragms



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*Cromwell, CT*  
*June 14, 2012*

- Enforced joint displacements
- 1-Way members, for tension only bracing, slipping, etc.
- 1-Way springs, for modeling soils and other effects
- Euler members that take compression up to their buckling load, then turn off.
- Stress calculations on any arbitrary shape
- Inactive members, plates, and diaphragms allows you to quickly remove parts of structures from consideration
- Story drift calculations provide relative drift and ratio to height
- Automatic self-weight calculations for members and plates
- Automatic subgrade soil spring generator

Graphics Features:

- Unlimited simultaneous model view windows
- Extraordinary "true to scale" rendering, even when drawing
- High-speed redraw algorithm for instant refreshing
- Dynamic scrolling stops right where you want
- Plot & print virtually everything with color coding & labeling
- Rotate, zoom, pan, scroll and snap views
- Saved views to quickly restore frequent or desired views
- Full render or wire-frame animations of deflected model and dynamic mode shapes with frame and speed control
- Animation of moving loads with speed control
- High quality customizable graphics printing

Design Features:

- Designs concrete, hot rolled steel, cold formed steel and wood
- ACI 1999/2002, BS 8110-97, CSA A23.3-94, IS456:2000, EC 2-1992 with consistent bar sizes through adjacent spans
- Exact integration of concrete stress distributions using parabolic or rectangular stress blocks
- Concrete beam detailing (Rectangular, T and L)
- Concrete column interaction diagrams
- Steel Design Codes: AISC ASD 9th, LRFD 2nd & 3rd, HSS Specification, CAN/CSA-S16.1-1994 & 2004, BS 5950-1-2000, IS 800-1984, Euro 3-1993 including local shape databases
- AISI 1999 cold formed steel design
- NDS 1991/1997/2001 wood design, including Structural Composite Lumber, multi-ply, full sawn
- Automatic spectra generation for UBC 1997, IBC 2000/2003
- Generation of load combinations: ASCE, UBC, IBC, BOCA, SBC, ACI
- Unbraced lengths for physical members that recognize connecting elements and full lengths of members
- Automatic approximation of K factors
- Tapered wide flange design with either ASD or LRFD codes
- Optimization of member sizes for all materials and all design codes, controlled by standard or user-defined lists of available sizes and criteria such as maximum depths
- Automatic calculation of custom shape properties
- Steel Shapes: AISC, HSS, CAN, ARBED, British, Euro, Indian, Chilean
- Light Gage Shapes: AISI, SSMA, Dale / Incor, Dietrich, MarinoWARE
- Wood Shapes: Complete NDS species/grade database
- Full seamless integration with RISAFoot (Ver 2 or better) for advanced footing design and detailing
- Plate force summation tool

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*Cromwell, CT*  
*June 14, 2012*

Results Features:

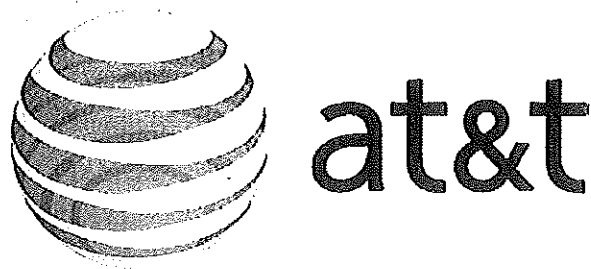
- Graphic presentation of color-coded results and plotted designs
- Color contours of plate stresses and forces with quadratic smoothing, the contours may also be animated
- Spreadsheet results with sorting and filtering of: reactions, member & joint deflections, beam & plate forces/stresses, optimized sizes, code designs, concrete reinforcing, material takeoffs, frequencies and mode shapes
- Standard and user-defined reports
- Graphic member detail reports with force/stress/deflection diagrams and detailed design calculations and expanded diagrams that display magnitudes at any dialed location
- Saved solutions quickly restore analysis and design results.



C Squared Systems, LLC  
65 Dartmouth Drive, Unit A3  
Auburn, NH 03032  
(603) 644-2800  
support@csquaredsystems.com

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## Calculated Radio Frequency Emissions



CT5144 – Cromwell

100 Berlin Road, Cromwell, CT 06416

(a.k.a. Christian Hill Road)

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July 30, 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 sign structure with pipe mast located at 100 Berlin Road in Cromwell, CT. The coordinates of the tower are 41° 36' 20.5" N, 72° 42' 5.2" W.

AT&T is proposing the following modifications:

- 1) Install three 700 MHz LTE antennas (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:

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

Where:

EIRP = Effective Isotropic Radiated Power

R = 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 pattern 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 UMTS	102	1935	1	500	0.0173	1.0000	1.73%
Cingular 800	102	880	20	250	0.1728	0.5867	29.45%
Cingular 1900	102	1900	3	427	0.0443	1.0000	4.43%
Pocket	77	2130	3	631	0.1148	1.0000	11.48%
T-Mobile GSM	108	1945	8	191	0.0471	1.0000	4.71%
T-Mobile UMTS	108	2100	2	764	0.0471	1.0000	4.71%
Verizon	88	869	9	427	0.1784	0.5793	30.80%
Verizon	88	1970	3	270	0.0376	1.0000	3.76%
Verizon	88	757	1	878	0.0408	0.5047	8.08%
AT&T UMTS	98	880	2	565	0.0042	0.5867	0.72%
AT&T UMTS	98	1900	2	875	0.0066	1.0000	0.66%
AT&T LTE	98	734	1	1313	0.0049	0.4893	1.00%
AT&T GSM	98	880	1	283	0.0011	0.5867	0.18%
AT&T GSM	98	1900	4	525	0.0079	1.0000	0.79%
						<b>Total</b>	<b>66.89%</b>

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 7/27/2012. 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, Inc. Structural Analysis Report dated July 14, 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 66.89% 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

July 30, 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

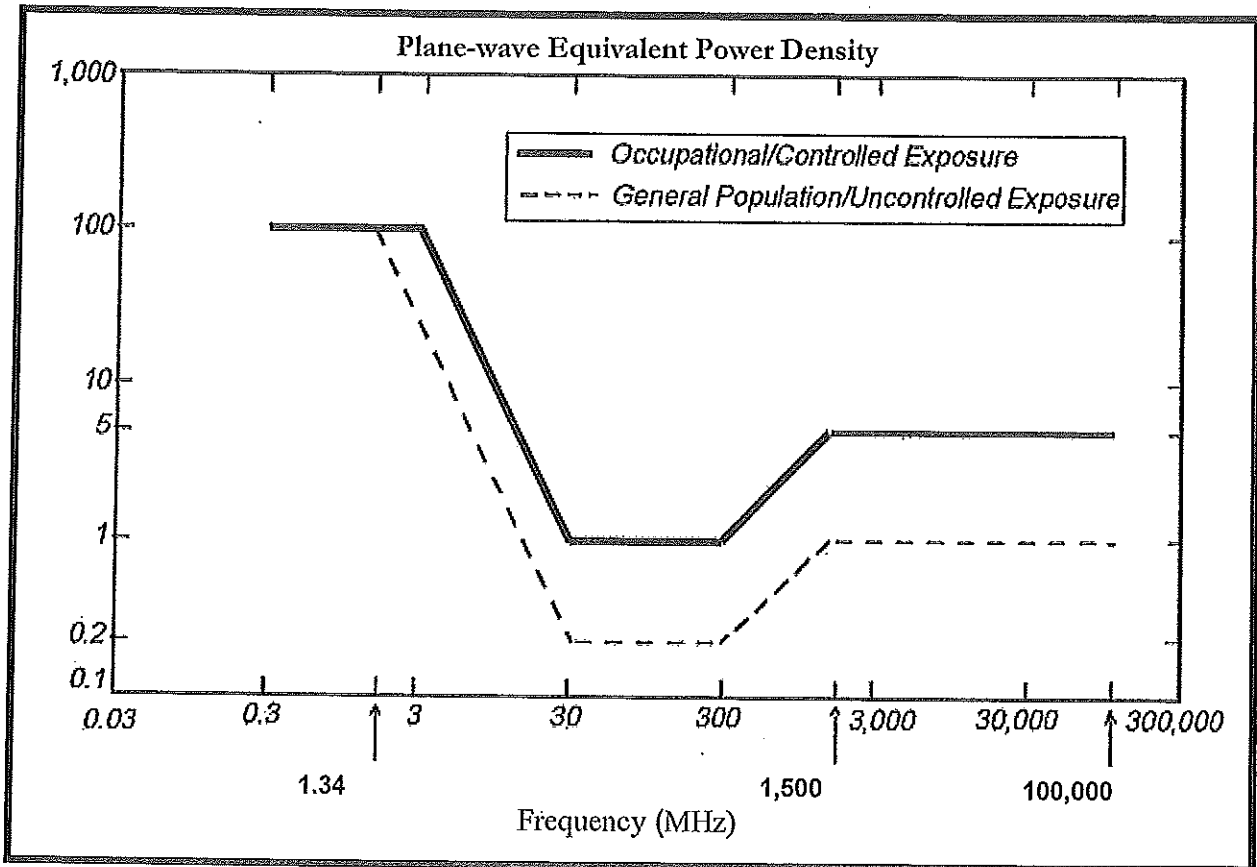
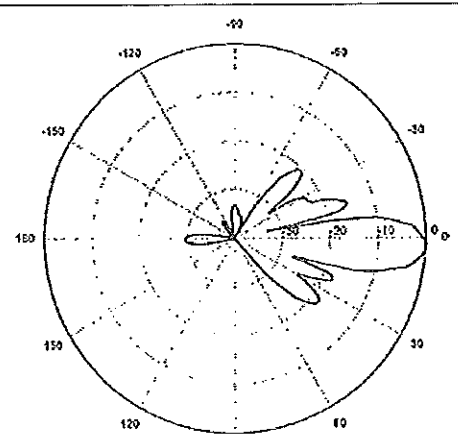
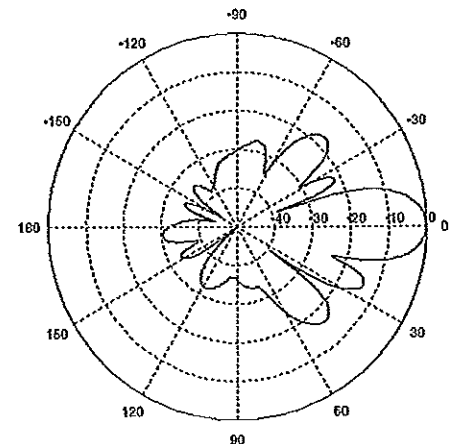
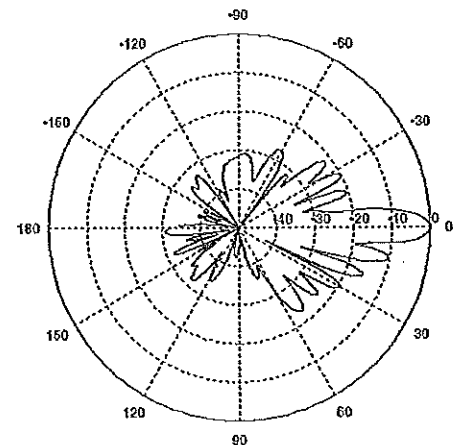


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

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

<p><b>700 MHz</b></p> <p>Manufacturer: KMW Communications            Model #: AM-X-CD-16-65-00T-RET            Frequency Band: 698-806 MHz            Gain: 13.4 dBd            Vertical Beamwidth: 12.3°            Horizontal Beamwidth: 65°            Polarization: Dual Slant ± 45°            Size L x W x D: 72.0" x 11.8" x 5.9"</p>	
<p><b>850 MHz</b></p> <p>Manufacturer: Powerwave            Model #: 7770            Frequency Band: 824-896 MHz            Gain: 11.5 dBd            Vertical Beamwidth: 15°            Horizontal Beamwidth: 82°            Polarization: Dual Linear ±45°            Size L x W x D: 55.0" x 11.0" x 5.0"</p>	
<p><b>1900 MHz</b></p> <p>Manufacturer: Powerwave            Model #: 7770            Frequency Band: 1850-1990 MHz            Gain: 13.6 dBd            Vertical Beamwidth: 7°            Horizontal Beamwidth: 86°            Polarization: Dual Linear ±45°            Size L x W x D: 55.0" x 11.0" x 5.0"</p>	

## Fontaine, Lisa

---

**From:** Coty, Veronica  
**Sent:** Monday, July 07, 2014 12:32 PM  
**To:** Fontaine, Lisa  
**Subject:** Cert of RECYCLE for PDC: Auction #1156842 - Battery - Laptop - Dell Rechargeable

**Importance:** High

### **CERTIFICATE OF RECYCLE to be entered on PDC for CREATIVE RECYCLING:**

Item has been posted and gone through the cycle and not been claimed and/or purchased. Item has little to no value, has been deemed SCRAP and meets the requirements as an item that Creative Recycling picks up. ***This now needs to be entered as Scrap on the PDC for Creative Recycling with a notation of this Public Surplus Auction number in the Additional Information Section*** per my notes in the closed auction section.

If you have any questions, please let me know. Thank you.

*Veronica Coty, F.A.O.  
DAS Surplus Dept.  
60 State Street  
Wethersfield, CT 06109  
860-257-6452  
[Veronica.Coty@ct.gov](mailto:Veronica.Coty@ct.gov)*



*Please consider the environment before printing this correspondence. Thank you.*