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PCS, LLC

Patton Dr.

, CT 06770

Phone: (203)-217-6200

Christopher Bisson

Real Estate Consultant

October 10, 2012

Hand Delivered

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

ORIGINAL

RECEIVED
OCT 15 2012

CONNECTICUT
SITING COUNCIL

RE: New Cingular Wireless PCS, LLC notice of intent to modify an existing telecommunications facility located at 856 Middletown Road, Colchester, CT 06415, know to AT&T as site CT2233.

Dear Ms. Roberts:

In order to accommodate technological changes, implement Uniform Mobile Telecommunications System ("UMTS") and/or Long Term Evolution ("LTE") capabilities, and enhance system performance in the state of Connecticut, New Cingular Wireless PCS, LLC ("AT&T") plans to modify the equipment configurations at many of its existing cell sites. Please accept this letter and attachments as notification, pursuant to R.C.S.A. Section 16-50j-73, of construction which constitutes an exempt modification pursuant to R.C.S.A. Section 16-50j-72(b)(2). In compliance with R.C.S.A. Section 16-50j-73, a copy of this letter and its attachments is being sent to the chief elected official of the municipality in which affected cell site is located.

UMTS offers services to mobile computer and phone users anywhere in the world. Based on the Global System for Mobile ("GSM") communication standard, UMTS is the planned worldwide standard for mobile users. UMTS, fully implemented, gives computer and phone users high-speed access to the internet as they travel. They have the same capabilities even when they roam, through both terrestrial wireless and satellite transmissions.

LTE is a new high-performance air interface for cellular mobile communications. It is designed to increase the capacity and speed of mobile telephone networks.

Attached is a summary of the planned modifications, including power density calculations reflecting the change in AT&T's operations at the site. Also included is documentation of the structural sufficiency of the tower to accommodate the revised antenna configuration based on the supplied structural modification plan dated 4/26/2012 requiring the restacking of the existing coaxial cables.

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

1. The height of the overall structure will not be affected.
2. The proposed changes will not extend the site boundaries. There will be no effect on the site compound as all proposed equipment will be located in the existing AT&T equipment shelter.
3. The proposed changes will not increase the noise level at the existing facility by 6 decibels or more.
4. Radio Frequency power density may increase due to the use of one or more GSM channels for UMTS transmissions. Moreover, LTE will utilize additional radio frequencies newly licensed by the FCC for cellular mobile communications. However, the changes 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.

For the foregoing reasons New Cingular Wireless PCS, LLC respectfully submits that the proposed changes at the referenced site constitute exempt modifications under R.C.S.A. Section 16-50j-72(b)(2).

Please feel free to call me at (203)-217-6200 or email CBisson@Transcendwireless.com with questions concerning this matter.
Thank you for your consideration.

Sincerely,

Christopher Bisson
Real Estate Consultant



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

Calculated Radio Frequency Emissions



at&t

CT2233

(Colchester South)

856 Middletown Road, Colchester, CT 06415

(a.k.a. Lot 13, Middletown Road)

October 5, 2012

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1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed modifications to the existing AT&T antenna arrays mounted on the monopole tower located at 856 Middletown Road in Colchester, CT. The coordinates of the tower are 41° 33' 5.86" N, 72° 25' 32.84" W.

AT&T is proposing the following modifications:

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

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

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

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

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter (mW/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:

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

Where:

EIRP = Effective Isotropic Radiated Power

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

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

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

4. Calculation Results

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

Carrier	Antenna Height (Feet)	Operating Frequency (MHz)	Number of Trans.	ERP Per Transmitter (Watts)	Power Density (mw/cm ²)	Limit	%MPE
<i>Cingular UITS</i>	<i>160</i>	<i>880</i>	<i>1</i>	<i>500</i>	<i>0.0070</i>	<i>0.5867</i>	<i>1.20%</i>
<i>Cingular</i>	<i>160</i>	<i>880</i>	<i>4</i>	<i>296</i>	<i>0.0166</i>	<i>0.5867</i>	<i>2.83%</i>
<i>Cingular</i>	<i>160</i>	<i>1900</i>	<i>2</i>	<i>427</i>	<i>0.0120</i>	<i>1.0000</i>	<i>1.20%</i>
Verizon cellular	180	869	9	370	0.0370	0.5793	6.38%
Verizon PCS	180	1970	7	265	0.0206	1.0000	2.06%
Verizon AWS	180	2145	1	662	0.0073	1.0000	0.73%
Verizon LTE	180	698	2	775	0.0172	0.4653	3.70%
AT&T UITS	160	880	2	565	0.0016	0.5867	0.27%
AT&T UITS	160	1900	2	875	0.0025	1.0000	0.25%
AT&T LTE	160	734	1	1615	0.0023	0.4893	0.46%
AT&T GSM	160	880	1	283	0.0004	0.5867	0.07%
AT&T GSM	160	1900	4	525	0.0029	1.0000	0.29%
						Total	14.21%

Table 1: Carrier Information^{1 2 3}

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

² 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.

³ Antenna height listed for AT&T is in reference to the Centek Engineering Structural Analysis dated September 28, 2012.

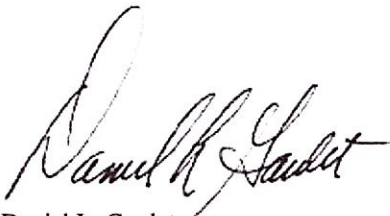
5. Conclusion

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 **14.21% 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

October 5, 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 Exposure⁴

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	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 Exposure⁵

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	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)

⁴ 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.

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

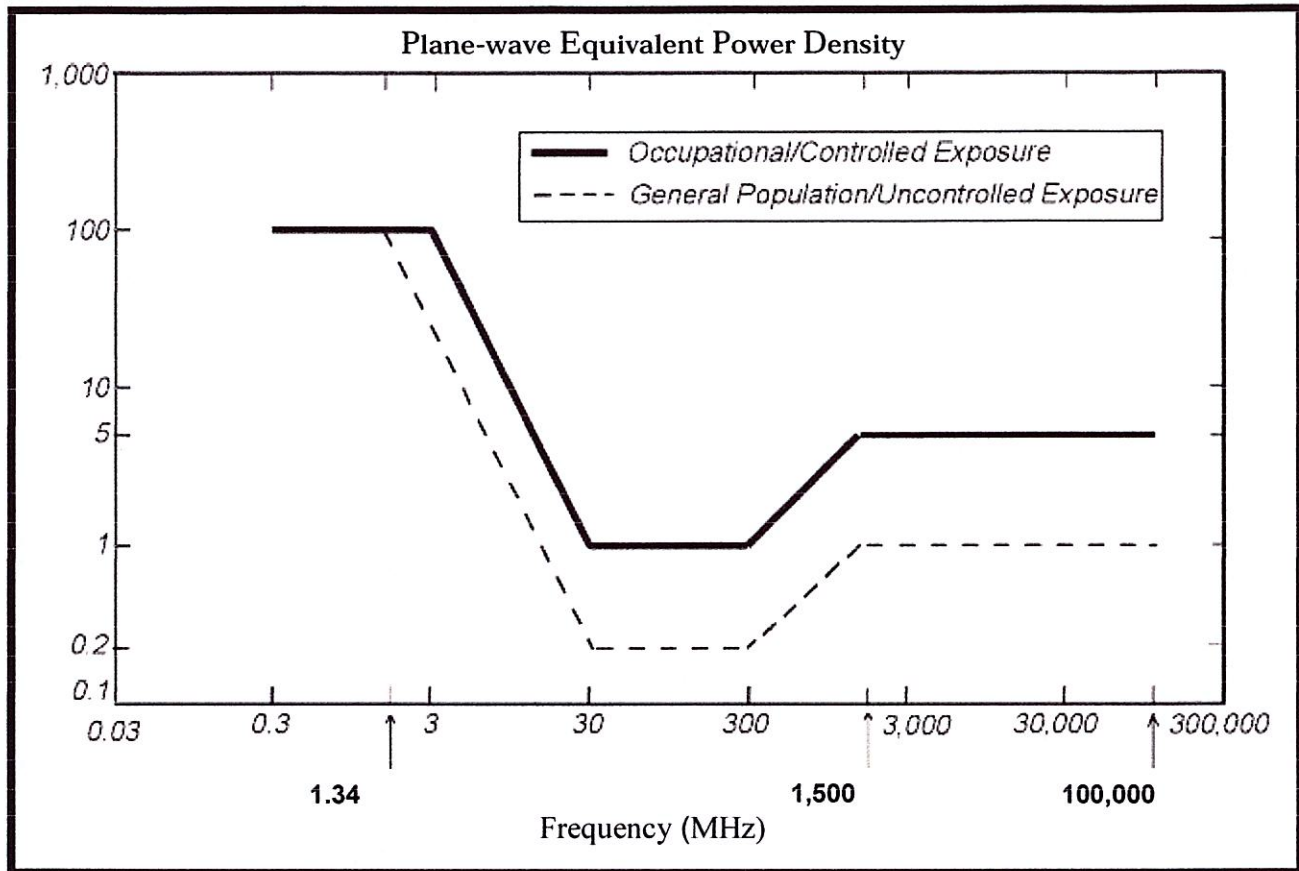
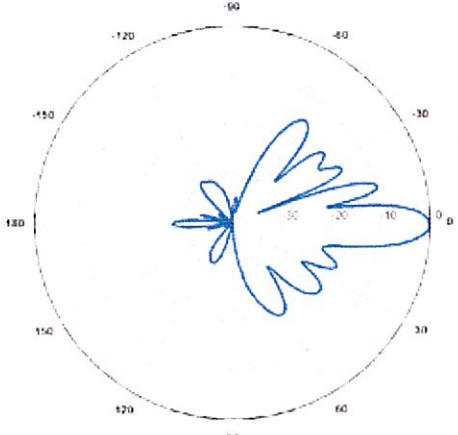
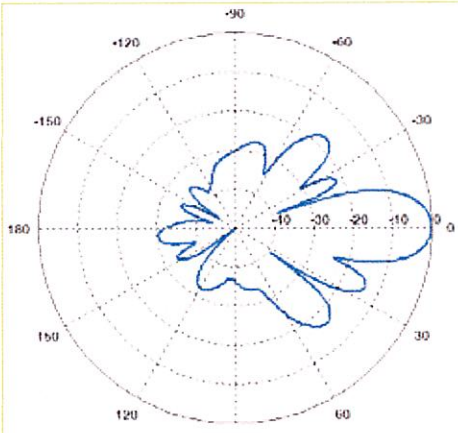
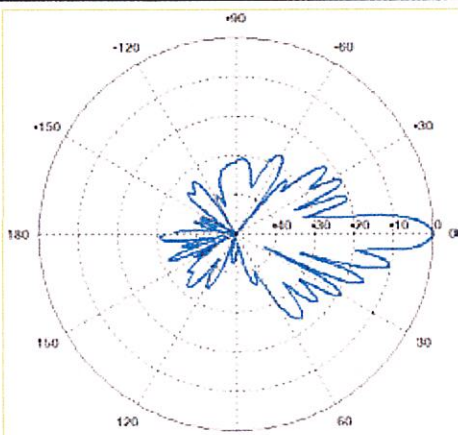


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

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

700 MHz Manufacturer: Powerwave Model #: P65-17-XLH-RR Frequency Band: 698-806 MHz Gain: 14.3 dBd Vertical Beamwidth: 8.4° Horizontal Beamwidth: 70° Polarization: Dual Linear $\pm 45^\circ$ Size L x W x D: 96.0" x 12.0" x 6.0"	
850 MHz Manufacturer: Powerwave Model #: 7770.00 Frequency Band: 824-896 MHz Gain: 11.5 dBd Vertical Beamwidth: 15° Horizontal Beamwidth: 82° Polarization: Dual Linear $\pm 45^\circ$ Size L x W x D: 55.0" x 11.0" x 5.0"	
1900 MHz Manufacturer: Powerwave Model #: 7770.00 Frequency Band: 1850-1990 MHz Gain: 13.4 dBd Vertical Beamwidth: 7° Horizontal Beamwidth: 86° Polarization: Dual Linear $\pm 45^\circ$ Size L x W x D: 55.0" x 11.0" x 5.0"	

Structural Analysis Report

180-ft Existing EEl Monopole

*Proposed AT&T Mobility
Antenna Upgrade*

AT&T Site Ref: CT2233

Verizon Site Ref: Colchester South

*856 Middletown Road
Colchester, CT*

Centek Project No. 12044.CO14

Date: September 28, 2012



Prepared for:

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

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Introduction

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

The host tower is a 180-ft tall, five-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI job no; 11294-E01), dated November 16, 2002. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned EEI design documents.

Antenna and appurtenance information were obtained from a previous structural analysis report prepared by Centek job no. 11074.CO23 dated November 30, 2011 and an AT&T tower site leasing form.

The tower is made up of five (5) tapered vertical sections consisting of A572-65 pole sections. The bottom four (4) vertical tower sections are slip joint connected and the top vertical tower section is flange connected. The diameter of the pole (flat-flat) is 14.5-in at the top and 60.5-in at the base.

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

Antenna and Appurtenance Summary

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

- VERIZON (RESERVED):
Antennas: Six (6) Antel LPA-80063-6CF panel antennas, six (6) Antel BXA-70063-6CF panel antennas, six (6) LPA-171063-12CF panel antennas and three (3) RRH's mounted to a 13-ft low profile platform with a RAD center elevation of 181-ft above grade.
Coax Cables: Twelve (12) 1-5/8" $\varnothing$ coax cables running on the inside of the existing tower. Six (6) 1-5/8" $\varnothing$ coax cables and one (1) 1-1/4" $\varnothing$ fiber cable banded to the exterior of the existing tower.
- AT&T (EXISTING TO REMAIN):
Antennas: Six (6) Powerwave 7770 panel antennas, six (6) Powerwave LGP21401 TMA's, six (6) Powerwave LGP21901 diplexers and three (3) Bias-T mounted on a 13-ft low profile platform with a RAD center elevation of 160-ft above existing grade.
Coax Cables: Twelve (12) 1-5/8" $\varnothing$ coax cables running on the inside of the existing tower.
- AT&T (EXISTING TO REMOVE):
Antennas: Three (3) CSS DUO1417-8686 panel antennas on a 13-ft low profile platform with a RAD center elevation of 160-ft above existing grade.

- **AT&T (RESERVED):**
Antennas: Three (3) Powerwave 7770 panel antennas on a 13-ft low profile platform with a RAD center elevation of 160-ft above existing grade.
- **AT&T (PROPOSED):**
Antennas: One (1) KMW AM-X-CD-14-65-00T-RET and two (2) Powerwave P65-17-XLH-RR panel antennas mounted on a 13-ft low profile platform with a RAD center elevation of 160-ft above grade level.
- **AT&T (PROPOSED):**
Antennas: Six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted to one (1) universal ring mount with a RAD center elevation of 159-ft above grade level.
Coax Cables: One (1) fiber cable and two (2) dc control cables running inside of the existing tower.

Primary Assumptions Used in the Analysis

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

A n a l y s i s

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 CSBC¹ 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.

T o w e r L o a d i n g

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

Basic Wind Speed:	New London; v = 85 mph (fastest mile)	[Section 16 of TIA/EIA-222-F-96]
	Colchester; v = 105 mph (3 second gust) equivalent to v = 85 mph (fastest mile)	[Appendix K of the 2005 CT Building Code Supplement]
	TIA/EIA-222-F and Appendix K wind speeds are equal.	
Load Cases:	<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

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

T o w e r C a p a c i t y

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

- Calculated stresses were found to be within allowable limits. In Load Case 1, per RISATower "Section Capacity Table", this tower was found to be at **97.7%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L1)	151.00'-179.00'	97.7%	PASS

F o u n d a t i o n a n d A n c h o r s

The existing foundation consists of a 8.0-ft Ø x 28.0-ft long reinforced concrete caisson. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; project no. 11294-E01 dated November 16, 2002. The base of the tower is connected to the foundation by means of (16) 2.25"Ø, ASTM A615-75 anchor bolts embedded approximately 7-ft into the concrete foundation structure.

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

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

Location	Vector	Proposed Reactions
Base	Shear	28 kips
	Compression	40 kips
	Moment	3485 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	Proposed Loading	Result
Reinforced Concrete Caisson	Moment Capacity	52.0%	PASS
	Lateral Deflection	0.76 in ⁽¹⁾	

Note 1: Lateral deflection typically limited to 1.0" for monopole tower structures.

CEN TEK Engineering, Inc.
Structural Analysis - 180-ft EEI Monopole
AT&T Antenna Upgrade – CT2233
Colchester, CT
September 28, 2012

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Flange Bolts	Tension	54.3%	PASS
Flange Plate	Bending	73.7%	PASS
Anchor Bolts	Compression	78.0%	PASS
Base Plate	Bending	89.0%	PASS

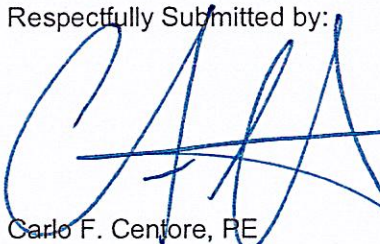
Conclusion

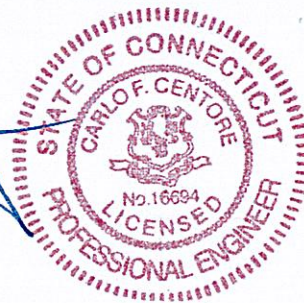
This analysis shows that the subject tower **is adequate** to support the proposed modified antenna configuration.

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:


Carlo F. Centore, PE
Principal ~ Structural Engineer



Prepared by:


Timothy J. Lynn, EIT
Structural Engineer

CEN TEK Engineering, Inc.
Structural Analysis - 180-ft EEI Monopole
AT&T Antenna Upgrade – CT2233
Colchester, CT
September 28, 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 Centek Engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provided to Centek Engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the "as new" condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. Centek Engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

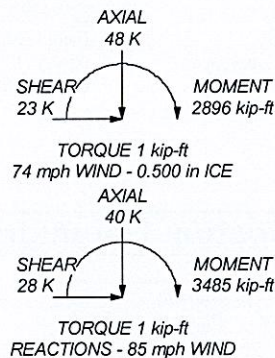
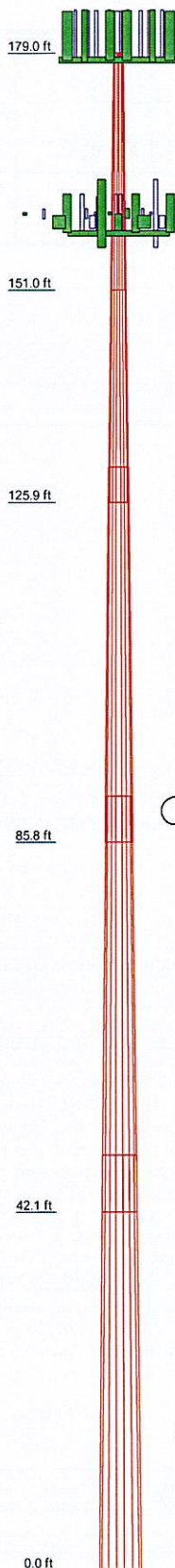
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

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

RISATower Features:

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

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	28.000	18	0.188					1.0
2	25.080	18	0.250	4.166	22.070	28.850		1.7
3	44.290	18	0.375	5.416	27.224	39.060	A572-65	5.9
4	49.080	18	0.375	6.750	36.863	49.990		8.6
5	48.882	18	0.438	47.435	60.500			12.4
								29.5



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
LPA-80063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Existing)	160
LPA-171063-12CF (Verizon - Reserved)	181	7770.00 (ATI - Existing)	160
BXA-70063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Existing)	160
BXA-70063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Existing)	160
LPA-171063-12CF (Verizon - Reserved)	181	(2) LGP21401 TMA (ATI - Existing)	160
LPA-80063/6CF (Verizon - Reserved)	181	(2) LGP21401 TMA (ATI - Existing)	160
LPA-80063/6CF (Verizon - Reserved)	181	(2) LGP21401 TMA (ATI - Existing)	160
LPA-171063-12CF (Verizon - Reserved)	181	(2) LGP21901 Diplexer (ATI - Existing)	160
BXA-70063/6CF (Verizon - Reserved)	181	(2) LGP21901 Diplexer (ATI - Existing)	160
BXA-70063/6CF (Verizon - Reserved)	181	Smart Bias T (ATI - Existing)	160
LPA-171063-12CF (Verizon - Reserved)	181	Smart Bias T (ATI - Existing)	160
LPA-80063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Reserved)	160
LPA-80063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Reserved)	160
LPA-171063-12CF (Verizon - Reserved)	181	7770.00 (ATI - Reserved)	160
BXA-70063/6CF (Verizon - Reserved)	181	AM-X-CD-14-65-00T-RET (ATI - Proposed)	160
BXA-70063/6CF (Verizon - Reserved)	181	P65-17-XLH-RR (ATI - Proposed)	160
LPA-171063-12CF (Verizon - Reserved)	181	P65-17-XLH-RR (ATI - Proposed)	160
LPA-80063/6CF (Verizon - Reserved)	181	(2) RRUS-11 (ATI - Proposed)	159
RRH (Verizon - Reserved)	181	(2) RRUS-11 (ATI - Proposed)	159
RRH (Verizon - Reserved)	181	(2) RRUS-11 (ATI - Proposed)	159
RRH (Verizon - Reserved)	181	DC6-48-60-18-8F Surge Arrestor (ATI - Proposed)	159
EEL 14-ft Low Profile Platform (Verizon - Existing)	178.5	13' Low Profile Platform (ATI - Existing)	158
7770.00 (ATI - Existing)	160	Valmont Uni-Tri Bracket (ATI - Proposed)	156

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 97.7%

Centek Engineering Inc.

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

Job: 12044.CO14 - CT2233

Project: 150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT

Client: AT&T Mobility

Drawn by: T.J.L.

App'd:

Code: TIA/EIA-222-F

Date: 09/28/12

Scale: NTS

Path:

J:\3044\1204400\W\CO14 - AT&T CT2233\Drawings\ERI\187 EEI Monopole - Colchester CT.dwg

Dwg No. E-1

<i>RISA</i>Tower <i>Centek Engineering Inc.</i> 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page	1 of 22
	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date	11:27:29 09/28/12
	Client	AT&T Mobility	Designed by	TJL

Tower Input Data

There is a pole section.

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

The following design criteria apply:

Basic wind speed of 85 mph.

Nominal ice thickness of 0.500 in.

Ice density of 56 pcf.

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

Temperature drop of 50 °F.

Deflections calculated using a wind speed of 50 mph.

Weld together tower sections have flange connections..

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

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

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

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

Pressures are calculated at each section.

Stress ratio used in pole design is 1.333.

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

Options

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

Tapered Pole Section Geometry

Section	Elevation	Section Length	Splice Length	Number of Sides	Top Diameter	Bottom Diameter	Wall Thickness	Bend Radius	Pole Grade
	ft	ft	ft		in	in	in	in	
L1	179.000-151.000	28.000	0.000	18	14.500	22.070	0.188	0.750	A572-65 (65 ksi)
L2	151.000-125.920	25.080	4.166	18	22.070	28.850	0.250	1.000	A572-65 (65 ksi)
L3	125.920-85.796	44.290	5.416	18	27.224	39.060	0.375	1.500	A572-65 (65 ksi)

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page	2 of 22
	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date	11:27:29 09/28/12
	Client	AT&T Mobility	Designed by	TJL

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L4	85.796-42.132	49.080	6.750	18	36.863	49.990	0.375	1.500	A572-65 (65 ksi)
L5	42.132-0.000	48.882		18	47.435	60.500	0.438	1.750	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in ²	I in ⁴	r in	C in	I/C in ³	J in ⁴	It/Q in ²	w in	w/t
L1	14.724	8.518	220.441	5.081	7.366	29.927	441.172	4.260	2.222	11.851
	22.410	13.023	787.837	7.768	11.212	70.270	1576.711	6.513	3.554	18.956
L2	22.410	17.314	1041.474	7.746	11.212	92.893	2084.319	8.659	3.444	13.777
	29.295	22.694	2345.214	10.153	14.656	160.020	4693.514	11.349	4.638	18.55
L3	28.774	31.957	2910.379	9.531	13.830	210.444	5824.588	15.981	4.131	11.017
	39.663	46.045	8705.695	13.733	19.842	438.740	17422.845	23.027	6.215	16.572
L4	38.902	43.429	7304.859	12.953	18.726	390.088	14619.331	21.719	5.828	15.541
	50.761	59.054	18366.002	17.613	25.395	723.216	36756.170	29.533	8.138	21.702
L5	49.998	65.261	18211.055	16.684	24.097	755.747	36446.073	32.637	7.578	17.322
	61.433	83.404	38013.044	21.322	30.734	1236.840	76076.106	41.710	9.878	22.578

Tower Elevation ft	Gusset Area (per face) ft ²	Gusset Thickness in	Gusset Grade	Adjust. Factor A _f	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 179.000-151.000				1	1	1		
L2 151.000-125.920				1	1	1		
L3 125.920-85.796				1	1	1		
L4 85.796-42.132				1	1	1		
L5 42.132-0.000				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C _A A _A ft ² /ft	Weight klf
1 5/8 (Verizon - Existing)	C	No	Inside Pole	178.000 - 3.000	12	No Ice 1/2" Ice	0.000 0.001
1 5/8 (AT&T - Existing)	C	No	Inside Pole	160.000 - 3.000	12	No Ice 1/2" Ice	0.000 0.001
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	178.000 - 3.000	1	No Ice 1/2" Ice	0.198 0.003
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	178.000 - 3.000	5	No Ice 1/2" Ice	0.000 0.003

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page	3 of 22
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	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_{AA} ft ² /ft	Weight klf
HYBRIFLEX 1-1/4" (Verizon - Reserved)	C	No	CaAa (Out Of Face)	178.000 - 3.000	1	No Ice	0.000	0.001
RG6-Fiber	C	No	Inside Pole	160.000 - 3.000	1	1/2" Ice	0.000	0.003
(AT&T - Proposed)						No Ice	0.000	0.001
#8 AWG Copper Wire	C	No	Inside Pole	160.000 - 3.000	2	1/2" Ice	0.000	0.001
(AT&T - Proposed)						No Ice	0.000	0.000
						1/2" Ice	0.000	0.000

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft ²	A_F ft ²	C_{AA} In Face ft ²	C_{AA} Out Face ft ²	Weight K
L1	179.000-151.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	5.346	0.663
L2	151.000-125.920	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	4.966	0.843
L3	125.920-85.796	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	7.945	1.348
L4	85.796-42.132	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	8.645	1.467
L5	42.132-0.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	7.748	1.315

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft ²	A_F ft ²	C_{AA} In Face ft ²	C_{AA} Out Face ft ²	Weight K
L1	179.000-151.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	8.046	0.941
L2	151.000-125.920	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	7.474	1.101
L3	125.920-85.796	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	11.957	1.762
L4	85.796-42.132	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	13.012	1.917
L5	42.132-0.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	11.661	1.718

Discrete Tower Loads

<i>RISA</i>Tower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page 4 of 22
	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date 11:27:29 09/28/12
	Client	AT&T Mobility	Designed by TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K
LPA-80063/6CF (Verizon - Reserved)	A	From Face	3.000 6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-171063-12CF (Verizon - Reserved)	A	From Face	3.000 4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
BXA-70063/6CF (Verizon - Reserved)	A	From Face	3.000 1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
BXA-70063/6CF (Verizon - Reserved)	A	From Face	3.000 -1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
LPA-171063-12CF (Verizon - Reserved)	A	From Face	3.000 -4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
LPA-80063/6CF (Verizon - Reserved)	A	From Face	3.000 -6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-80063/6CF (Verizon - Reserved)	B	From Face	3.000 6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-171063-12CF (Verizon - Reserved)	B	From Face	3.000 4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
BXA-70063/6CF (Verizon - Reserved)	B	From Face	3.000 1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
BXA-70063/6CF (Verizon - Reserved)	B	From Face	3.000 -1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
LPA-171063-12CF (Verizon - Reserved)	B	From Face	3.000 -4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
LPA-80063/6CF (Verizon - Reserved)	B	From Face	3.000 -6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-80063/6CF (Verizon - Reserved)	C	From Face	3.000 6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-171063-12CF (Verizon - Reserved)	C	From Face	3.000 4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
BXA-70063/6CF (Verizon - Reserved)	C	From Face	3.000 1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
BXA-70063/6CF (Verizon - Reserved)	C	From Face	3.000 -1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
LPA-171063-12CF (Verizon - Reserved)	C	From Face	3.000 -4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
LPA-80063/6CF (Verizon - Reserved)	C	From Face	3.000 -6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
RRH (Verizon - Reserved)	A	From Face	3.000 0.000 0.000	0.000	181.000	No Ice 1/2" Ice	0.000 0.000	0.000 0.000	0.050 0.072

<i>RISATower</i> <i>Centek Engineering Inc.</i> 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page	5 of 22
	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date	11:27:29 09/28/12
	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
RRH (Verizon - Reserved)	B	From Face	3.000 0.000 0.000	0.000	181.000	No Ice 1/2" Ice	0.000 0.000	0.000 0.000	0.050 0.072
RRH (Verizon - Reserved)	C	From Face	3.000 0.000 0.000	0.000	181.000	No Ice 1/2" Ice	0.000 0.000	0.000 0.000	0.050 0.072
EEI 14-ft Low Profile Platform (Verizon - Existing)	C	None		0.000	178.500	No Ice 1/2" Ice	16.500 20.000	16.500 20.000	1.550 1.800
7770.00 (AT&T - Existing)	A	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	A	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	B	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	B	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	C	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	C	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
(2) LGP21401 TMA (AT&T - Existing)	A	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21401 TMA (AT&T - Existing)	B	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21401 TMA (AT&T - Existing)	C	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21901 Diplexer (AT&T - Existing)	A	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
(2) LGP21901 Diplexer (AT&T - Existing)	B	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
(2) LGP21901 Diplexer (AT&T - Existing)	C	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
Smart Bias T (AT&T - Existing)	A	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.156 0.212	0.078 0.121	0.002 0.003
Smart Bias T (AT&T - Existing)	B	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.156 0.212	0.078 0.121	0.002 0.003
Smart Bias T (AT&T - Existing)	C	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.156 0.212	0.078 0.121	0.002 0.003
13' Low Profile Platform (AT&T - Existing)	C	None		0.000	158.000	No Ice 1/2" Ice	15.700 20.100	15.700 20.100	1.300 1.765
7770.00	A	From Face	3.000	0.000	160.000	No Ice	5.882	2.928	0.035

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	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
(AT&T - Reserved)			-2.000 0.000			1/2" Ice	6.314	3.273	0.068
7770.00 (AT&T - Reserved)	B	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Reserved)	C	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
AM-X-CD-14-65-00T-RET (AT&T - Proposed)	A	From Face	3.000 2.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.507 5.899	2.828 3.137	0.037 0.069
P65-17-XLH-RR (AT&T - Proposed)	B	From Face	3.000 2.000 0.000	0.000	160.000	No Ice 1/2" Ice	11.467 12.083	6.800 7.384	0.062 0.124
P65-17-XLH-RR (AT&T - Proposed)	C	From Face	3.000 2.000 0.000	0.000	160.000	No Ice 1/2" Ice	11.467 12.083	6.800 7.384	0.062 0.124
(2) RRUS-11 (AT&T - Proposed)	A	From Face	1.000 2.000 0.000	0.000	159.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
(2) RRUS-11 (AT&T - Proposed)	B	From Face	1.000 2.000 0.000	0.000	159.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
(2) RRUS-11 (AT&T - Proposed)	C	From Face	1.000 2.000 0.000	0.000	159.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
DC6-48-60-18-8F Surge Arrestor (AT&T - Proposed)	C	From Face	0.500 0.000 0.000	0.000	159.000	No Ice 1/2" Ice	2.228 2.447	2.228 2.447	0.020 0.039
Valmont Uni-Tri Bracket (AT&T - Proposed)	C	None		0.000	156.000	No Ice 1/2" Ice	1.750 1.940	1.750 1.940	0.290 0.306

Tower Pressures - No Ice

$$G_H = 1.690$$

Section Elevation ft	z ft	K _Z	q _z ksf	A _G ft ²	F a c e	A _F ft ²	A _R ft ²	A _{leg} ft ²	Leg %	C _{AA} In Face ft ²	C _{AA} Out Face ft ²
L1 179.000-151.0 00	164.034	1.581	0.029	42.665	A	0.000	42.665	42.665	100.00	0.000	0.000
					B	0.000	42.665		100.00	0.000	0.000
					C	0.000	42.665		100.00	0.000	5.346
L2 151.000-125.9 20	137.903	1.505	0.028	53.211	A	0.000	53.211	53.211	100.00	0.000	0.000
					B	0.000	53.211		100.00	0.000	0.000
					C	0.000	53.211		100.00	0.000	4.966
L3 125.920-85.79 6	105.065	1.392	0.026	112.677	A	0.000	112.677	112.677	100.00	0.000	0.000
					B	0.000	112.677		100.00	0.000	0.000
					C	0.000	112.677		100.00	0.000	7.945
L4 63.538	63.538	1.206	0.022	160.649	A	0.000	160.649	160.649	100.00	0.000	0.000

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	Client	AT&T Mobility	Designed by	TJL

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²			
85.796-42.132					B	0.000	160.649		100.00	0.000	0.000
					C	0.000	160.649		100.00	0.000	8.645
L5	20.345	1	0.018	192.646	A	0.000	192.646	192.646	100.00	0.000	0.000
42.132-0.000					B	0.000	192.646		100.00	0.000	0.000
					C	0.000	192.646		100.00	0.000	7.748

Tower Pressure - With Ice

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	t _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	in	ft ²		ft ²	ft ²	ft ²			
L1	164.034	1.581	0.022	0.500	44.998	A	0.000	44.998	44.998	100.00	0.000	0.000
179.000-151.000						B	0.000	44.998		100.00	0.000	0.000
						C	0.000	44.998		100.00	0.000	8.046
L2	137.903	1.505	0.021	0.500	55.301	A	0.000	55.301	55.301	100.00	0.000	0.000
151.000-125.920						B	0.000	55.301		100.00	0.000	0.000
						C	0.000	55.301		100.00	0.000	7.474
L3	105.065	1.392	0.019	0.500	116.020	A	0.000	116.020	116.020	100.00	0.000	0.000
125.920-85.796						B	0.000	116.020		100.00	0.000	0.000
						C	0.000	116.020		100.00	0.000	11.957
L4	63.538	1.206	0.017	0.500	164.288	A	0.000	164.288	164.288	100.00	0.000	0.000
85.796-42.132						B	0.000	164.288		100.00	0.000	0.000
						C	0.000	164.288		100.00	0.000	13.012
L5	20.345	1	0.014	0.500	196.157	A	0.000	196.157	196.157	100.00	0.000	0.000
42.132-0.000						B	0.000	196.157		100.00	0.000	0.000
						C	0.000	196.157		100.00	0.000	11.661

Tower Pressure - Service

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²			
L1	164.034	1.581	0.010	42.665	A	0.000	42.665	42.665	100.00	0.000	0.000
179.000-151.000					B	0.000	42.665		100.00	0.000	0.000
					C	0.000	42.665		100.00	0.000	5.346
L2	137.903	1.505	0.010	53.211	A	0.000	53.211	53.211	100.00	0.000	0.000
151.000-125.920					B	0.000	53.211		100.00	0.000	0.000
					C	0.000	53.211		100.00	0.000	4.966
L3	105.065	1.392	0.009	112.677	A	0.000	112.677	112.677	100.00	0.000	0.000
125.920-85.796					B	0.000	112.677		100.00	0.000	0.000
					C	0.000	112.677		100.00	0.000	7.945
L4	63.538	1.206	0.008	160.649	A	0.000	160.649	160.649	100.00	0.000	0.000
85.796-42.132					B	0.000	160.649		100.00	0.000	0.000
					C	0.000	160.649		100.00	0.000	8.645
L5	20.345	1	0.006	192.646	A	0.000	192.646	192.646	100.00	0.000	0.000
42.132-0.000					B	0.000	192.646		100.00	0.000	0.000

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Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²			
					C	0.000	192.646		100.00	0.000	7.748

Tower Forces - No Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1 179.000-151.000	0.663	1.026	A	1	0.65	1	1	1	42.665	1.635	0.058	C
			B	1	0.65	1	1	1	42.665			
			C	1	0.65	1	1	1	42.665			
L2 151.000-125.920	0.843	1.707	A	1	0.65	1	1	1	53.211	1.860	0.074	C
			B	1	0.65	1	1	1	53.211			
			C	1	0.65	1	1	1	53.211			
L3 125.920-85.796	1.348	5.878	A	1	0.65	1	1	1	112.677	3.527	0.088	C
			B	1	0.65	1	1	1	112.677			
			C	1	0.65	1	1	1	112.677			
L4 85.796-42.132	1.467	8.558	A	1	0.65	1	1	1	160.649	4.239	0.097	C
			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5 42.132-0.000	1.315	12.364	A	1	0.65	1	1	1	192.646	4.156	0.099	C
			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	1249.170 kip-ft	15.417		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1 179.000-151.000	0.663	1.026	A	1	0.65	1	1	1	42.665	1.635	0.058	C
			B	1	0.65	1	1	1	42.665			
			C	1	0.65	1	1	1	42.665			
L2 151.000-125.920	0.843	1.707	A	1	0.65	1	1	1	53.211	1.860	0.074	C
			B	1	0.65	1	1	1	53.211			
			C	1	0.65	1	1	1	53.211			
L3 125.920-85.796	1.348	5.878	A	1	0.65	1	1	1	112.677	3.527	0.088	C
			B	1	0.65	1	1	1	112.677			
			C	1	0.65	1	1	1	112.677			
L4 85.796-42.132	1.467	8.558	A	1	0.65	1	1	1	160.649	4.239	0.097	C
			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5 42.132-0.000	1.315	12.364	A	1	0.65	1	1	1	192.646	4.156	0.099	C
			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	1249.170 kip-ft	15.417		

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Tower Forces - No Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.663	1.026	A	1	0.65	1	1	1	42.665	1.635	0.058	C
179.000-151.0			B	1	0.65	1	1	1	42.665			
00			C	1	0.65	1	1	1	42.665			
L2	0.843	1.707	A	1	0.65	1	1	1	53.211	1.860	0.074	C
151.000-125.9			B	1	0.65	1	1	1	53.211			
20			C	1	0.65	1	1	1	53.211			
L3	1.348	5.878	A	1	0.65	1	1	1	112.677	3.527	0.088	C
125.920-85.79			B	1	0.65	1	1	1	112.677			
6			C	1	0.65	1	1	1	112.677			
L4	1.467	8.558	A	1	0.65	1	1	1	160.649	4.239	0.097	C
85.796-42.132			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5	1.315	12.364	A	1	0.65	1	1	1	192.646	4.156	0.099	C
42.132-0.000			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	1249.170 kip-ft	15.417		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.663	1.026	A	1	0.65	1	1	1	42.665	1.635	0.058	C
179.000-151.0			B	1	0.65	1	1	1	42.665			
00			C	1	0.65	1	1	1	42.665			
L2	0.843	1.707	A	1	0.65	1	1	1	53.211	1.860	0.074	C
151.000-125.9			B	1	0.65	1	1	1	53.211			
20			C	1	0.65	1	1	1	53.211			
L3	1.348	5.878	A	1	0.65	1	1	1	112.677	3.527	0.088	C
125.920-85.79			B	1	0.65	1	1	1	112.677			
6			C	1	0.65	1	1	1	112.677			
L4	1.467	8.558	A	1	0.65	1	1	1	160.649	4.239	0.097	C
85.796-42.132			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5	1.315	12.364	A	1	0.65	1	1	1	192.646	4.156	0.099	C
42.132-0.000			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	1249.170 kip-ft	15.417		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	

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	Client	AT&T Mobility	Designed by TJL

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.941	1.351	A	1	0.65	1	1	1	44.998	1.382	0.049	C
179.000-151.0			B	1	0.65	1	1	1	44.998			
00			C	1	0.65	1	1	1	44.998			
L2	1.101	2.109	A	1	0.65	1	1	1	55.301	1.532	0.061	C
151.000-125.9			B	1	0.65	1	1	1	55.301			
20			C	1	0.65	1	1	1	55.301			
L3	1.762	6.725	A	1	0.65	1	1	1	116.020	2.847	0.071	C
125.920-85.79			B	1	0.65	1	1	1	116.020			
6			C	1	0.65	1	1	1	116.020			
L4	1.917	9.761	A	1	0.65	1	1	1	164.288	3.368	0.077	C
85.796-42.132			B	1	0.65	1	1	1	164.288			
			C	1	0.65	1	1	1	164.288			
L5	1.718	13.804	A	1	0.65	1	1	1	196.157	3.263	0.077	C
42.132-0.000			B	1	0.65	1	1	1	196.157			
			C	1	0.65	1	1	1	196.157			
Sum Weight:	7.439	33.749						OTM	1017.484 kip-ft	12.392		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.941	1.351	A	1	0.65	1	1	1	44.998	1.382	0.049	C
179.000-151.0			B	1	0.65	1	1	1	44.998			
00			C	1	0.65	1	1	1	44.998			
L2	1.101	2.109	A	1	0.65	1	1	1	55.301	1.532	0.061	C
151.000-125.9			B	1	0.65	1	1	1	55.301			
20			C	1	0.65	1	1	1	55.301			
L3	1.762	6.725	A	1	0.65	1	1	1	116.020	2.847	0.071	C
125.920-85.79			B	1	0.65	1	1	1	116.020			
6			C	1	0.65	1	1	1	116.020			
L4	1.917	9.761	A	1	0.65	1	1	1	164.288	3.368	0.077	C
85.796-42.132			B	1	0.65	1	1	1	164.288			
			C	1	0.65	1	1	1	164.288			
L5	1.718	13.804	A	1	0.65	1	1	1	196.157	3.263	0.077	C
42.132-0.000			B	1	0.65	1	1	1	196.157			
			C	1	0.65	1	1	1	196.157			
Sum Weight:	7.439	33.749						OTM	1017.484 kip-ft	12.392		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.941	1.351	A	1	0.65	1	1	1	44.998	1.382	0.049	C
179.000-151.0			B	1	0.65	1	1	1	44.998			
00			C	1	0.65	1	1	1	44.998			

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	Client	AT&T Mobility	Designed by	TJL

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L2	1.101	2.109	A	1	0.65	1	1	1	55.301	1.532	0.061	C
151.000-125.9			B	1	0.65	1	1	1	55.301			
20			C	1	0.65	1	1	1	55.301			
L3	1.762	6.725	A	1	0.65	1	1	1	116.020	2.847	0.071	C
125.920-85.79			B	1	0.65	1	1	1	116.020			
6			C	1	0.65	1	1	1	116.020			
L4	1.917	9.761	A	1	0.65	1	1	1	164.288	3.368	0.077	C
85.796-42.132			B	1	0.65	1	1	1	164.288			
			C	1	0.65	1	1	1	164.288			
L5	1.718	13.804	A	1	0.65	1	1	1	196.157	3.263	0.077	C
42.132-0.000			B	1	0.65	1	1	1	196.157			
			C	1	0.65	1	1	1	196.157			
Sum Weight:	7.439	33.749						OTM	1017.484 kip-ft	12.392		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.941	1.351	A	1	0.65	1	1	1	44.998	1.382	0.049	C
179.000-151.0			B	1	0.65	1	1	1	44.998			
00			C	1	0.65	1	1	1	44.998			
L2	1.101	2.109	A	1	0.65	1	1	1	55.301	1.532	0.061	C
151.000-125.9			B	1	0.65	1	1	1	55.301			
20			C	1	0.65	1	1	1	55.301			
L3	1.762	6.725	A	1	0.65	1	1	1	116.020	2.847	0.071	C
125.920-85.79			B	1	0.65	1	1	1	116.020			
6			C	1	0.65	1	1	1	116.020			
L4	1.917	9.761	A	1	0.65	1	1	1	164.288	3.368	0.077	C
85.796-42.132			B	1	0.65	1	1	1	164.288			
			C	1	0.65	1	1	1	164.288			
L5	1.718	13.804	A	1	0.65	1	1	1	196.157	3.263	0.077	C
42.132-0.000			B	1	0.65	1	1	1	196.157			
			C	1	0.65	1	1	1	196.157			
Sum Weight:	7.439	33.749						OTM	1017.484 kip-ft	12.392		

Tower Forces - Service - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.663	1.026	A	1	0.65	1	1	1	42.665	0.566	0.020	C
179.000-151.0			B	1	0.65	1	1	1	42.665			
00			C	1	0.65	1	1	1	42.665			
L2	0.843	1.707	A	1	0.65	1	1	1	53.211	0.644	0.026	C
151.000-125.9			B	1	0.65	1	1	1	53.211			
20			C	1	0.65	1	1	1	53.211			

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Section Elevation ft	Add Weight K	Self Weight K	F a c e	e	C _F	R _R	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
L3 125.920-85.79 6	1.348	5.878	A	1	0.65	1	1	1	112.677	1.220	0.030	C
L4 85.796-42.132	1.467	8.558	B	1	0.65	1	1	1	112.677	1.467	0.034	C
L5 42.132-0.000	1.315	12.364	C	1	0.65	1	1	1	112.677	1.438	0.034	C
Sum Weight:	5.636	29.533	A	1	0.65	1	1	1	160.649	5.335		
			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
								OTM	432.239 kip-ft			

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	F a c e	e	C _F	R _R	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
L1 179.000-151.0 00	0.663	1.026	A	1	0.65	1	1	1	42.665	0.566	0.020	C
L2 151.000-125.9 20	0.843	1.707	B	1	0.65	1	1	1	42.665	0.644	0.026	C
L3 125.920-85.79 6	1.348	5.878	C	1	0.65	1	1	1	42.665	1.220	0.030	C
L4 85.796-42.132	1.467	8.558	A	1	0.65	1	1	1	53.211	1.467	0.034	C
L5 42.132-0.000	1.315	12.364	B	1	0.65	1	1	1	53.211	1.438	0.034	C
Sum Weight:	5.636	29.533	C	1	0.65	1	1	1	112.677	5.335		
			A	1	0.65	1	1	1	112.677			
			B	1	0.65	1	1	1	112.677			
			C	1	0.65	1	1	1	160.649			
								OTM	432.239 kip-ft			

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	F a c e	e	C _F	R _R	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
L1 179.000-151.0 00	0.663	1.026	A	1	0.65	1	1	1	42.665	0.566	0.020	C
L2 151.000-125.9 20	0.843	1.707	B	1	0.65	1	1	1	42.665	0.644	0.026	C
L3 125.920-85.79 6	1.348	5.878	C	1	0.65	1	1	1	42.665	1.220	0.030	C
			A	1	0.65	1	1	1	53.211			
			B	1	0.65	1	1	1	53.211			
			C	1	0.65	1	1	1	53.211			
			A	1	0.65	1	1	1	112.677			
			B	1	0.65	1	1	1	112.677			
			C	1	0.65	1	1	1	112.677			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L4 85.796-42.132	1.467	8.558	A	1	0.65	1	1	1	160.649	1.467	0.034	C
			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5 42.132-0.000	1.315	12.364	A	1	0.65	1	1	1	192.646	1.438	0.034	C
			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	432.239 kip-ft	5.335		

Tower Forces - Service - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1 179.000-151.0	0.663	1.026	A	1	0.65	1	1	1	42.665	0.566	0.020	C
			B	1	0.65	1	1	1	42.665			
			C	1	0.65	1	1	1	42.665			
L2 151.000-125.9	0.843	1.707	A	1	0.65	1	1	1	53.211	0.644	0.026	C
			B	1	0.65	1	1	1	53.211			
			C	1	0.65	1	1	1	53.211			
L3 125.920-85.79	1.348	5.878	A	1	0.65	1	1	1	112.677	1.220	0.030	C
			B	1	0.65	1	1	1	112.677			
			C	1	0.65	1	1	1	112.677			
L4 85.796-42.132	1.467	8.558	A	1	0.65	1	1	1	160.649	1.467	0.034	C
			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5 42.132-0.000	1.315	12.364	A	1	0.65	1	1	1	192.646	1.438	0.034	C
			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	432.239 kip-ft	5.335		

Force Totals

Load Case	Vertical Forces	Sum of Forces X	Sum of Forces Z	Sum of Overturning Moments, M _x	Sum of Overturning Moments, M _z	Sum of Torques
	K	K	K	kip-ft	kip-ft	kip-ft
Leg Weight	29.533					
Bracing Weight	0.000					
Total Member Self-Weight	29.533			0.118	-0.058	
Total Weight	39.741			0.118	-0.058	
Wind 0 deg - No Ice		0.042	-27.768	-3376.465	-6.816	0.352
Wind 30 deg - No Ice		13.896	-24.069	-2927.468	-1690.300	0.817
Wind 45 deg - No Ice		19.630	-19.665	-2392.266	-2386.923	0.973
Wind 60 deg - No Ice		24.026	-13.920	-1694.026	-2920.885	1.063
Wind 90 deg - No Ice		27.719	-0.042	-6.641	-3368.836	1.024
Wind 120 deg - No Ice		23.984	13.847	1682.556	-2914.126	0.711
Wind 135 deg - No Ice		19.570	19.605	2382.943	-2377.365	0.475
Wind 150 deg - No Ice		13.823	24.026	2920.945	-1678.594	0.207

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Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 180 deg - No Ice		-0.042	27.768	3376.700	6.701	-0.352
Wind 210 deg - No Ice		-13.896	24.069	2927.703	1690.185	-0.817
Wind 225 deg - No Ice		-19.630	19.665	2392.501	2386.807	-0.973
Wind 240 deg - No Ice		-24.026	13.920	1694.262	2920.769	-1.063
Wind 270 deg - No Ice		-27.719	0.042	6.876	3368.721	-1.024
Wind 300 deg - No Ice		-23.984	-13.847	-1682.321	2914.011	-0.711
Wind 315 deg - No Ice		-19.570	-19.605	-2382.708	2377.250	-0.475
Wind 330 deg - No Ice		-13.823	-24.026	-2920.709	1678.479	-0.207
Member Ice	4.216					
Total Weight Ice	48.151			0.253	-0.127	
Wind 0 deg - Ice		0.031	-22.585	-2770.985	-5.069	0.289
Wind 30 deg - Ice		11.301	-19.575	-2402.181	-1387.173	0.657
Wind 45 deg - Ice		15.967	-15.992	-1962.803	-1959.148	0.779
Wind 60 deg - Ice		19.544	-11.319	-1389.646	-2397.619	0.848
Wind 90 deg - Ice		22.549	-0.031	-4.689	-2765.659	0.812
Wind 120 deg - Ice		19.513	11.266	1381.593	-2392.678	0.559
Wind 135 deg - Ice		15.923	15.948	1956.320	-1952.160	0.370
Wind 150 deg - Ice		11.248	19.544	2397.745	-1378.614	0.156
Wind 180 deg - Ice		-0.031	22.585	2771.491	4.815	-0.289
Wind 210 deg - Ice		-11.301	19.575	2402.687	1386.919	-0.657
Wind 225 deg - Ice		-15.967	15.992	1963.309	1958.894	-0.779
Wind 240 deg - Ice		-19.544	11.319	1390.152	2397.365	-0.848
Wind 270 deg - Ice		-22.549	0.031	5.195	2765.405	-0.812
Wind 300 deg - Ice		-19.513	-11.266	-1381.087	2392.423	-0.559
Wind 315 deg - Ice		-15.923	-15.948	-1955.814	1951.905	-0.370
Wind 330 deg - Ice		-11.248	-19.544	-2397.239	1378.359	-0.156
Total Weight	39.741			0.118	-0.058	
Wind 0 deg - Service		0.015	-9.608	-1168.250	-2.396	0.122
Wind 30 deg - Service		4.808	-8.328	-1012.888	-584.917	0.283
Wind 45 deg - Service		6.792	-6.804	-827.697	-825.963	0.337
Wind 60 deg - Service		8.314	-4.817	-586.091	-1010.724	0.368
Wind 90 deg - Service		9.591	-0.015	-2.221	-1165.725	0.354
Wind 120 deg - Service		8.299	4.791	582.276	-1008.386	0.246
Wind 135 deg - Service		6.772	6.784	824.625	-822.655	0.164
Wind 150 deg - Service		4.783	8.314	1010.784	-580.866	0.072
Wind 180 deg - Service		-0.015	9.608	1168.485	2.281	-0.122
Wind 210 deg - Service		-4.808	8.328	1013.123	584.801	-0.283
Wind 225 deg - Service		-6.792	6.804	827.932	825.847	-0.337
Wind 240 deg - Service		-8.314	4.817	586.327	1010.609	-0.368
Wind 270 deg - Service		-9.591	0.015	2.456	1165.610	-0.354
Wind 300 deg - Service		-8.299	-4.791	-582.041	1008.271	-0.246
Wind 315 deg - Service		-6.772	-6.784	-824.389	822.540	-0.164
Wind 330 deg - Service		-4.783	-8.314	-1010.549	580.751	-0.072

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	179 - 151	Pole	Max Tension	18	0.000	0.000	0.000
			Max. Compression	18	-9.254	-0.127	-0.253
			Max. Mx	6	-4.532	-294.135	0.356
			Max. My	10	-4.522	0.369	-294.649
			Max. Vy	6	14.591	-294.135	0.356
			Max. Vx	10	14.640	0.369	-294.649
			Max. Torque	5			-1.048
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-11.892	-0.127	-0.253
			Max. Mx	6	-6.936	-614.958	1.240
L2	151 - 125.92	Pole	Max. My	10	-6.928	1.272	-616.517

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Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L3	125.92 - 85.796	Pole	Max. Vy	6	16.141	-614.958	1.240
			Max. Vx	10	16.191	1.272	-616.517
			Max. Torque	5			-1.046
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-19.750	-0.127	-0.253
			Max. Mx	6	-13.970	-1308.660	2.921
			Max. My	10	-13.965	2.971	-1312.184
			Max. Vy	6	19.594	-1308.660	2.921
			Max. Vx	10	19.644	2.971	-1312.184
			Max. Torque	5			-1.041
L4	85.796 - 42.132	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-30.794	-0.127	-0.253
			Max. Mx	6	-23.938	-2221.032	4.766
			Max. My	10	-23.936	4.822	-2226.695
			Max. Vy	6	23.466	-2221.032	4.766
			Max. Vx	10	23.516	4.822	-2226.695
			Max. Torque	5			-1.036
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-48.151	-0.127	-0.253
			Max. Mx	6	-39.727	-3472.604	6.867
L5	42.132 - 0	Pole	Max. My	10	-39.727	6.924	-3480.692
			Max. Vy	6	27.739	-3472.604	6.867
			Max. Vx	10	27.788	6.924	-3480.692
			Max. Torque	5			-1.034

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	19	48.151	-0.031	22.585
	Max. H _x	14	39.741	27.719	-0.042
	Max. H _z	2	39.741	-0.042	27.768
	Max. M _x	2	3480.446	-0.042	27.768
	Max. M _z	6	3472.604	-27.719	0.042
	Max. Torsion	13	1.027	24.026	-13.920
	Min. Vert	1	39.741	0.000	0.000
	Min. H _x	6	39.741	-27.719	0.042
	Min. H _z	10	39.741	0.042	-27.768
	Min. M _x	10	-3480.692	0.042	-27.768
	Min. M _z	14	-3472.487	27.719	-0.042
	Min. Torsion	5	-1.034	-24.026	13.920

Tower Mast Reaction Summary

Load Combination	Vertical K	Shear _x K	Shear _z K	Overturning Moment, M _x kip-ft	Overturning Moment, M _z kip-ft	Torque kip-ft
Dead Only	39.741	0.000	0.000	0.118	-0.058	0.000
Dead+Wind 0 deg - No Ice	39.741	0.042	-27.768	-3480.446	-7.038	0.337
Dead+Wind 30 deg - No Ice	39.741	13.896	-24.069	-3017.621	-1742.347	0.791

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Load Combination	Vertical K	Shear _x K	Shear _z K	Overturning Moment, M _x kip-ft	Overturning Moment, M _z kip-ft	Torque kip-ft
Dead+Wind 45 deg - No Ice	39.741	19.630	-19.665	-2465.948	-2460.419	0.945
Dead+Wind 60 deg - No Ice	39.741	24.026	-13.920	-1746.218	-3010.830	1.034
Dead+Wind 90 deg - No Ice	39.741	27.719	-0.042	-6.867	-3472.604	0.997
Dead+Wind 120 deg - No Ice	39.741	23.984	13.847	1734.385	-3003.903	0.690
Dead+Wind 135 deg - No Ice	39.741	19.570	19.605	2456.355	-2450.598	0.460
Dead+Wind 150 deg - No Ice	39.741	13.823	24.026	3010.927	-1730.290	0.199
Dead+Wind 180 deg - No Ice	39.741	-0.042	27.768	3480.692	6.924	-0.343
Dead+Wind 210 deg - No Ice	39.741	-13.896	24.069	3017.860	1742.239	-0.791
Dead+Wind 225 deg - No Ice	39.741	-19.630	19.665	2466.181	2460.311	-0.941
Dead+Wind 240 deg - No Ice	39.741	-24.026	13.920	1746.447	3010.719	-1.027
Dead+Wind 270 deg - No Ice	39.741	-27.719	0.042	7.095	3472.487	-0.990
Dead+Wind 300 deg - No Ice	39.741	-23.984	-13.847	-1734.150	3003.776	-0.690
Dead+Wind 315 deg - No Ice	39.741	-19.570	-19.605	-2456.115	2450.471	-0.464
Dead+Wind 330 deg - No Ice	39.741	-13.823	-24.026	-3010.683	1730.166	-0.205
Dead+Ice+Temp	48.151	0.000	0.000	0.253	-0.127	0.000
Dead+Wind 0 deg+Ice+Temp	48.151	0.031	-22.585	-2892.364	-5.307	0.275
Dead+Wind 30 deg+Ice+Temp	48.151	11.301	-19.575	-2507.406	-1447.940	0.633
Dead+Wind 45 deg+Ice+Temp	48.151	15.967	-15.992	-2048.788	-2044.967	0.753
Dead+Wind 60 deg+Ice+Temp	48.151	19.544	-11.319	-1450.531	-2502.647	0.822
Dead+Wind 90 deg+Ice+Temp	48.151	22.549	-0.031	-4.906	-2886.823	0.788
Dead+Wind 120 deg+Ice+Temp	48.151	19.513	11.266	1442.124	-2497.507	0.542
Dead+Wind 135 deg+Ice+Temp	48.151	15.923	15.948	2042.038	-2037.684	0.359
Dead+Wind 150 deg+Ice+Temp	48.151	11.248	19.544	2502.803	-1439.004	0.151
Dead+Wind 180 deg+Ice+Temp	48.151	-0.031	22.585	2892.913	5.036	-0.279
Dead+Wind 210 deg+Ice+Temp	48.151	-11.301	19.575	2507.948	1447.676	-0.633
Dead+Wind 225 deg+Ice+Temp	48.151	-15.967	15.992	2049.326	2044.702	-0.751
Dead+Wind 240 deg+Ice+Temp	48.151	-19.544	11.319	1451.066	2502.380	-0.818
Dead+Wind 270 deg+Ice+Temp	48.151	-22.549	0.031	5.438	2886.547	-0.784
Dead+Wind 300 deg+Ice+Temp	48.151	-19.513	-11.266	-1441.585	2497.225	-0.542
Dead+Wind 315 deg+Ice+Temp	48.151	-15.923	-15.948	-2041.494	2037.402	-0.361
Dead+Wind 330 deg+Ice+Temp	48.151	-11.248	-19.544	-2502.256	1438.724	-0.155
Dead+Wind 0 deg - Service	39.741	0.015	-9.608	-1206.466	-2.482	0.120
Dead+Wind 30 deg - Service	39.741	4.808	-8.328	-1046.026	-604.057	0.279
Dead+Wind 45 deg - Service	39.741	6.792	-6.804	-854.777	-852.987	0.333
Dead+Wind 60 deg - Service	39.741	8.314	-4.817	-605.268	-1043.793	0.364
Dead+Wind 90 deg - Service	39.741	9.591	-0.015	-2.295	-1203.861	0.351
Dead+Wind 120 deg - Service	39.741	8.299	4.791	601.328	-1041.376	0.244
Dead+Wind 135 deg - Service	39.741	6.772	6.784	851.607	-849.568	0.163
Dead+Wind 150 deg - Service	39.741	4.783	8.314	1043.859	-599.867	0.071
Dead+Wind 180 deg - Service	39.741	-0.015	9.608	1206.718	2.359	-0.121
Dead+Wind 210 deg - Service	39.741	-4.808	8.328	1046.277	603.935	-0.279
Dead+Wind 225 deg - Service	39.741	-6.792	6.804	855.027	852.865	-0.333
Dead+Wind 240 deg - Service	39.741	-8.314	4.817	605.518	1043.670	-0.364
Dead+Wind 270 deg - Service	39.741	-9.591	0.015	2.545	1203.737	-0.350
Dead+Wind 300 deg - Service	39.741	-8.299	-4.791	-601.077	1041.251	-0.244
Dead+Wind 315 deg - Service	39.741	-6.772	-6.784	-851.356	849.443	-0.163
Dead+Wind 330 deg - Service	39.741	-4.783	-8.314	-1043.607	599.743	-0.072

Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.000	-39.741	0.000	0.000	39.741	0.000	0.000%
2	0.042	-39.741	-27.768	-0.042	39.741	27.768	0.000%
3	13.896	-39.741	-24.069	-13.896	39.741	24.069	0.000%
4	19.630	-39.741	-19.665	-19.630	39.741	19.665	0.000%
5	24.026	-39.741	-13.920	-24.026	39.741	13.920	0.000%

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Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
6	27.719	-39.741	-0.042	-27.719	39.741	0.042	0.000%
7	23.984	-39.741	13.847	-23.984	39.741	-13.847	0.000%
8	19.570	-39.741	19.605	-19.570	39.741	-19.605	0.000%
9	13.823	-39.741	24.026	-13.823	39.741	-24.026	0.000%
10	-0.042	-39.741	27.768	0.042	39.741	-27.768	0.000%
11	-13.896	-39.741	24.069	13.896	39.741	-24.069	0.000%
12	-19.630	-39.741	19.665	19.630	39.741	-19.665	0.000%
13	-24.026	-39.741	13.920	24.026	39.741	-13.920	0.000%
14	-27.719	-39.741	0.042	27.719	39.741	-0.042	0.000%
15	-23.984	-39.741	-13.847	23.984	39.741	13.847	0.000%
16	-19.570	-39.741	-19.605	19.570	39.741	19.605	0.000%
17	-13.823	-39.741	-24.026	13.823	39.741	24.026	0.000%
18	0.000	-48.151	0.000	0.000	48.151	0.000	0.000%
19	0.031	-48.151	-22.585	-0.031	48.151	22.585	0.000%
20	11.301	-48.151	-19.575	-11.301	48.151	19.575	0.000%
21	15.967	-48.151	-15.992	-15.967	48.151	15.992	0.000%
22	19.544	-48.151	-11.319	-19.544	48.151	11.319	0.000%
23	22.549	-48.151	-0.031	-22.549	48.151	0.031	0.000%
24	19.513	-48.151	11.266	-19.513	48.151	-11.266	0.000%
25	15.923	-48.151	15.948	-15.923	48.151	-15.948	0.000%
26	11.248	-48.151	19.544	-11.248	48.151	-19.544	0.000%
27	-0.031	-48.151	22.585	0.031	48.151	-22.585	0.000%
28	-11.301	-48.151	19.575	11.301	48.151	-19.575	0.000%
29	-15.967	-48.151	15.992	15.967	48.151	-15.992	0.000%
30	-19.544	-48.151	11.319	19.544	48.151	-11.319	0.000%
31	-22.549	-48.151	0.031	22.549	48.151	-0.031	0.000%
32	-19.513	-48.151	-11.266	19.513	48.151	11.266	0.000%
33	-15.923	-48.151	-15.948	15.923	48.151	15.948	0.000%
34	-11.248	-48.151	-19.544	11.248	48.151	19.544	0.000%
35	0.015	-39.741	-9.608	-0.015	39.741	9.608	0.000%
36	4.808	-39.741	-8.328	-4.808	39.741	8.328	0.000%
37	6.792	-39.741	-6.804	-6.792	39.741	6.804	0.000%
38	8.314	-39.741	-4.817	-8.314	39.741	4.817	0.000%
39	9.591	-39.741	-0.015	-9.591	39.741	0.015	0.000%
40	8.299	-39.741	4.791	-8.299	39.741	-4.791	0.000%
41	6.772	-39.741	6.784	-6.772	39.741	-6.784	0.000%
42	4.783	-39.741	8.314	-4.783	39.741	-8.314	0.000%
43	-0.015	-39.741	9.608	0.015	39.741	-9.608	0.000%
44	-4.808	-39.741	8.328	4.808	39.741	-8.328	0.000%
45	-6.792	-39.741	6.804	6.792	39.741	-6.804	0.000%
46	-8.314	-39.741	4.817	8.314	39.741	-4.817	0.000%
47	-9.591	-39.741	0.015	9.591	39.741	-0.015	0.000%
48	-8.299	-39.741	-4.791	8.299	39.741	4.791	0.000%
49	-6.772	-39.741	-6.784	6.772	39.741	6.784	0.000%
50	-4.783	-39.741	-8.314	4.783	39.741	8.314	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00055781
3	Yes	6	0.00000001	0.00003453
4	Yes	6	0.00000001	0.00003326
5	Yes	6	0.00000001	0.00003294
6	Yes	4	0.00000001	0.00084268

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7	Yes	6	0.00000001	0.00003433
8	Yes	6	0.00000001	0.00003321
9	Yes	6	0.00000001	0.00003355
10	Yes	4	0.00000001	0.00021858
11	Yes	6	0.00000001	0.00003314
12	Yes	6	0.00000001	0.00003325
13	Yes	6	0.00000001	0.00003473
14	Yes	5	0.00000001	0.00004093
15	Yes	6	0.00000001	0.00003313
16	Yes	6	0.00000001	0.00003322
17	Yes	6	0.00000001	0.00003391
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00033520
20	Yes	6	0.00000001	0.00013413
21	Yes	6	0.00000001	0.00014461
22	Yes	6	0.00000001	0.00013007
23	Yes	5	0.00000001	0.00033938
24	Yes	6	0.00000001	0.00013301
25	Yes	6	0.00000001	0.00014381
26	Yes	6	0.00000001	0.00013106
27	Yes	5	0.00000001	0.00033337
28	Yes	6	0.00000001	0.00013060
29	Yes	6	0.00000001	0.00014461
30	Yes	6	0.00000001	0.00013467
31	Yes	5	0.00000001	0.00034442
32	Yes	6	0.00000001	0.00012989
33	Yes	6	0.00000001	0.00014374
34	Yes	6	0.00000001	0.00013183
35	Yes	4	0.00000001	0.00010870
36	Yes	5	0.00000001	0.00011625
37	Yes	5	0.00000001	0.00012907
38	Yes	5	0.00000001	0.00010825
39	Yes	4	0.00000001	0.00020722
40	Yes	5	0.00000001	0.00011440
41	Yes	5	0.00000001	0.00012750
42	Yes	5	0.00000001	0.00011045
43	Yes	4	0.00000001	0.00008935
44	Yes	5	0.00000001	0.00010933
45	Yes	5	0.00000001	0.00012911
46	Yes	5	0.00000001	0.00011735
47	Yes	4	0.00000001	0.00023242
48	Yes	5	0.00000001	0.00010811
49	Yes	5	0.00000001	0.00012729
50	Yes	5	0.00000001	0.00011204

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	179 - 151	46.708	44	3.124	0.005
L2	151 - 125.92	30.168	44	2.395	0.004
L3	130.086 - 85.796	21.023	44	1.778	0.002
L4	91.212 - 42.132	9.384	44	1.077	0.001
L5	48.882 - 0	2.461	44	0.473	0.000

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Critical Deflections and Radius of Curvature - Service Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
181.000	LPA-80063/6CF	44	46.708	3.124	0.005	7960
178.500	EEI 14-ft Low Profile Platform	44	46.393	3.111	0.005	7960
160.000	7770.00	44	35.079	2.646	0.004	2093
159.000	(2) RRUS-11	44	34.506	2.620	0.004	1989
158.000	13' Low Profile Platform	44	33.940	2.593	0.004	1894
156.000	Valmont Uni-Tri Bracket	44	32.826	2.538	0.004	1729

Maximum Tower Deflections - Design Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	179 - 151	134.065	10	8.975	0.015
L2	151 - 125.92	86.745	11	6.888	0.010
L3	130.086 - 85.796	60.510	11	5.118	0.005
L4	91.212 - 42.132	27.040	11	3.104	0.002
L5	48.882 - 0	7.096	11	1.363	0.001

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
181.000	LPA-80063/6CF	10	134.065	8.975	0.016	2882
178.500	EEI 14-ft Low Profile Platform	10	133.163	8.940	0.016	2882
160.000	7770.00	11	100.799	7.608	0.012	755
159.000	(2) RRUS-11	11	99.161	7.531	0.012	716
158.000	13' Low Profile Platform	11	97.540	7.454	0.012	682
156.000	Valmont Uni-Tri Bracket	11	94.353	7.297	0.012	622

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L _u	Kl/r	F _a	A	Actual P	Allow. P _a	Ratio P
	ft		ft	ft		ksi	in ²	K	K	P _a
L1	179 - 151 (1)	TP22.07x14.5x0.188	28.000	0.000	0.0	39.000	13.023	-4.516	507.890	0.009
L2	151 - 125.92 (2)	TP28.85x22.07x0.25	25.080	0.000	0.0	39.000	21.800	-6.924	850.218	0.008
L3	125.92 - 85.796 (3)	TP39.06x27.224x0.375	44.290	0.000	0.0	39.000	44.322	-13.962	1728.560	0.008
L4	85.796 - 42.132 (4)	TP49.99x36.863x0.375	49.080	0.000	0.0	39.000	45.806	-16.254	1786.450	0.009

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Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	F _a ksi	A in ²	Actual P K	Allow. P _a K	Ratio P P _a
L5	42.132 - 0 (5)	TP60.5x47.435x0.438	48.882	0.000	0.0	39.000	67.767	-27.086	2642.900	0.010

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M _x kip-ft	Actual f _{bx} ksi	Allow. F _{bx} ksi	Ratio f _{bx} F _{bx}	Actual M _y kip-ft	Actual f _{by} ksi	Allow. F _{by} ksi	Ratio f _{by} F _{by}
L1	179 - 151 (1)	TP22.07x14.5x0.188	294.832	50.348	39.000	1.291	0.000	0.000	39.000	0.000
L2	151 - 125.92 (2)	TP28.85x22.07x0.25	617.222	50.176	39.000	1.287	0.000	0.000	39.000	0.000
L3	125.92 - 85.796 (3)	TP39.06x27.224x0.375	1313.875	38.798	39.000	0.995	0.000	0.000	39.000	0.000
L4	85.796 - 42.132 (4)	TP49.99x36.863x0.375	1463.625	40.452	39.000	1.037	0.000	0.000	39.000	0.000
L5	42.132 - 0 (5)	TP60.5x47.435x0.438	2390.617	35.192	39.000	0.902	0.000	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f _v ksi	Allow. F _v ksi	Ratio f _v F _v	Actual T kip-ft	Actual f _{vt} ksi	Allow. F _{vt} ksi	Ratio f _{vt} F _{vt}
L1	179 - 151 (1)	TP22.07x14.5x0.188	14.665	1.126	26.000	0.087	0.801	0.067	26.000	0.003
L2	151 - 125.92 (2)	TP28.85x22.07x0.25	16.216	0.744	26.000	0.057	0.797	0.032	26.000	0.001
L3	125.92 - 85.796 (3)	TP39.06x27.224x0.375	19.669	0.444	26.000	0.034	0.794	0.011	26.000	0.000
L4	85.796 - 42.132 (4)	TP49.99x36.863x0.375	20.618	0.450	26.000	0.034	0.793	0.011	26.000	0.000
L5	42.132 - 0 (5)	TP60.5x47.435x0.438	24.420	0.360	26.000	0.027	0.792	0.006	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P P _a	Ratio f _{bx} F _{bx}	Ratio f _{by} F _{by}	Ratio f _v F _v	Ratio f _{vt} F _{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	179 - 151 (1)	0.009	1.291	0.000	0.087	0.003	1.302	1.333	H1-3+VT ✓
L2	151 - 125.92 (2)	0.008	1.287	0.000	0.057	0.001	1.296	1.333	H1-3+VT ✓
L3	125.92 - 85.796 (3)	0.008	0.995	0.000	0.034	0.000	1.003	1.333	H1-3+VT ✓
L4	85.796 - 42.132 (4)	0.009	1.037	0.000	0.034	0.000	1.047	1.333	H1-3+VT ✓
L5	42.132 - 0 (5)	0.010	0.902	0.000	0.027	0.000	0.913	1.333	H1-3+VT ✓

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Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
							✓		

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	SF* P_{allow} K	% Capacity	Pass Fail
L1	179 - 151	Pole	TP22.07x14.5x0.188	1	-4.516	677.017	97.7	Pass
L2	151 - 125.92	Pole	TP28.85x22.07x0.25	2	-6.924	1133.341	97.2	Pass
L3	125.92 - 85.796	Pole	TP39.06x27.224x0.375	3	-13.962	2304.170	75.3	Pass
L4	85.796 - 42.132	Pole	TP49.99x36.863x0.375	4	-16.254	2381.338	78.5	Pass
L5	42.132 - 0	Pole	TP60.5x47.435x0.438	5	-27.086	3522.986	68.5	Pass
							Summary	
							Pole (L1)	97.7 Pass
							RATING =	97.7 Pass

Flange Bolt and Flange Plate Analysis:

Input Data:

Tower Reactions:

Overturing Moment =	OM := 295-ft-kips	(Input From RisaTower)
Shear Force =	Shear := 15-kips	(Input From RisaTower)
Axial Force =	Axial := 9.5-kips	(Input From RisaTower)

Flange Bolt Data:

Use ASTM A325

Number of Flange Bolts =	N := 24	(User Input)
Diameter of Bolt Circle =	D _{bc} := 25.75-in	(User Input)
Bolt Ultimate Strength =	F _u := 120-ksi	(User Input)
Bolt Yield Strength =	F _y := 92-ksi	(User Input)
Bolt Modulus =	E := 29000-ksi	(User Input)
Diameter of Flange Bolts =	D := 1.0-in	(User Input)
Threads per Inch =	n := 8	(User Input)

Flange Plate Data:

Use ASTM A572 GR. 60

Plate Yield Strength =	F _{ybp} := 60-ksi	(User Input)
Flange Plate Thickness =	t _{bp} := 1.0-in	(User Input)
Flange Plate Diameter =	D _{bp} := 29.0-in	(User Input)
Outer Pole Diameter =	D _{pole} := 22.07-in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 12.875\text{-in}$

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

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

$d_1 = 3.33\text{-in}$	$d_7 = 12.44\text{-in}$
$d_2 = 6.44\text{-in}$	$d_8 = 11.15\text{-in}$
$d_3 = 9.10\text{-in}$	$d_9 = 9.10\text{-in}$
$d_4 = 11.15\text{-in}$	$d_{10} = 6.44\text{-in}$
$d_5 = 12.44\text{-in}$	$d_{11} = 3.33\text{-in}$
$d_6 = 12.88\text{-in}$	$d_{12} = 0.00\text{-in}$

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 11\text{-in}$

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

$MA_1 = 0.00\text{-in}$	$MA_7 = 1.40\text{-in}$
$MA_2 = 0.00\text{-in}$	$MA_8 = 0.12\text{-in}$
$MA_3 = 0.00\text{-in}$	$MA_9 = 0.00\text{-in}$
$MA_4 = 0.12\text{-in}$	$MA_{10} = 0.00\text{-in}$
$MA_5 = 1.40\text{-in}$	$MA_{11} = 0.00\text{-in}$
$MA_6 = 1.84\text{-in}$	$MA_{12} = 0.00\text{-in}$

Effective Width of Flangeplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 15.1\text{-in}$$

Flange Bolt Analysis:

Calculated Flange Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 1.989 \times 10^3 \cdot \text{in}^2$$

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 =

$$T_{\text{Max}} := \text{OM} \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 22.5 \cdot \text{kips}$$

Allowable Tensile Force =

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

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Gross}}} = 54.3 \cdot \%$$

Condition1 =

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

Condition1 = "OK"

Flange Plate Analysis:

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

$C_1 = 6.3\text{-kips}$

$C_7 = 22.5\text{-kips}$

$C_2 = 11.9\text{-kips}$

$C_8 = 20.2\text{-kips}$

$C_3 = 16.6\text{-kips}$

$C_9 = 16.6\text{-kips}$

$C_4 = 20.2\text{-kips}$

$C_{10} = 11.9\text{-kips}$

$C_5 = 22.5\text{-kips}$

$C_{11} = 6.3\text{-kips}$

$C_6 = 23.3\text{-kips}$

$C_{12} = 0.4\text{-kips}$

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot M A_i}{(B_{eff} t_{bp})^2} = 44.1\text{-ksi}$$

Allowable Bending Stress in Plate =

$F_{bp} := 1.33 \cdot 0.75 \cdot F_{ybp} = 59.9\text{-ksi}$

Plate Bending Stress % of Capacity =

$\frac{f_{bp}}{F_{bp}} = 73.7\%$

Condition3 =

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

Condition2 = "Ok"

Subject:

Anchor Bolt and Baseplate Analysis

Location:

180-ft EEI Monopole
 Colchester, CT

Rev. 0: 9/28/12

Prepared by: T.J.L. Checked by: C.F.C.
 Job No. 12044.CO14

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturing Moment =	OM := 3485-ft-kips	(Input From RisaTower)
Shear Force =	Shear := 28-kips	(Input From RisaTower)
Axial Force =	Axial := 40-kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 16	(User Input)
Diameter of Bolt Circle =	D _{bc} := 70.0-in	(User Input)
Bolt "Column" Distance =	l := 3.0-in	(User Input)
Bolt Ultimate Strenght =	F _u := 100-ksi	(User Input)
Bolt Yeld Strenght =	F _y := 75-ksi	(User Input)
Bolt Modulus =	E := 29000-ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25-in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 Mod 60

Plate Yield Strength =	F _{ybp} := 60-ksi	(User Input)
Base Plate Thickness =	t _{bp} := 2.0-in	(User Input)
Base Plate Diameter =	D _{bp} := 76.0-in	(User Input)
Outer Pole Diameter =	D _{pole} := 60.5-in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 35\text{-in}$$

Distance to Bolts =

$$i := 1..N$$

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

$$d_1 = 13.39\text{-in}$$

$$d_7 = 13.39\text{-in}$$

$$d_2 = 24.75\text{-in}$$

$$d_8 = 0.00\text{-in}$$

$$d_3 = 32.34\text{-in}$$

$$d_9 = -13.39\text{-in}$$

$$d_4 = 35.00\text{-in}$$

$$d_{10} = -24.75\text{-in}$$

$$d_5 = 32.34\text{-in}$$

$$d_{11} = -32.34\text{-in}$$

$$d_6 = 24.75\text{-in}$$

etc.

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 30.3\text{-in}$$

Moment Arms of Bolts about Neutral Axis =

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

$$MA_1 = 0.00\text{-in}$$

$$MA_7 = 0.00\text{-in}$$

$$MA_2 = 0.00\text{-in}$$

$$MA_8 = 0.00\text{-in}$$

$$MA_3 = 2.09\text{-in}$$

$$MA_9 = 0.00\text{-in}$$

$$MA_4 = 4.75\text{-in}$$

$$MA_{10} = 0.00\text{-in}$$

$$MA_5 = 2.09\text{-in}$$

$$MA_{11} = 0.00\text{-in}$$

$$MA_6 = 0.00\text{-in}$$

etc

Effective Width of Baseplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 36.8\text{-in}$$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 9.8 \times 10^3 \cdot \text{in}^2$$

Gross Area of Bolt =

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

Net Area of Bolt =

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

Net Diameter =

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

Radius of Gyration of Bolt =

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

Section Modulus of Bolt =

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force =

$$T_{\text{Max}} := OM \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 146.9 \cdot \text{kips}$$

Allowable Tensile Force =

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

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

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} = 75.4\% \quad \text{Bolts are "upset bolts". Use net area per AISC}$$

Condition1 =

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment =

$$M_x := \left(\frac{\text{Shear}}{N} \right) \cdot l = 0.437 \cdot \text{ft-kips}$$

Maximum Bending Stress =

$$f_{bx} := \frac{M_x}{S_x} = 6.4 \cdot \text{ksi}$$

Allowable Bending Stress =

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

Check Combined Stress Requirement:

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

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{\text{Axial}}{N} = 151.9 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 46.8 \text{ ksi}$$

$$K := 0.65$$

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

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

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 =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = 78 \%$$

Condition 2 =

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

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

Subject:

Anchor Bolt and Baseplate Analysis

Location:

180-ft EEI Monopole
 Colchester, CT

Rev. 0: 9/28/12

Prepared by: T.J.L. Checked by: C.F.C.
 Job No. 12044.CO14

Base Plate Analysis:

Force from Bolts =

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

$$C_1 = 59.7 \cdot \text{kips}$$

$$C_7 = 59.7 \cdot \text{kips}$$

$$C_2 = 108.1 \cdot \text{kips}$$

$$C_8 = 2.5 \cdot \text{kips}$$

$$C_3 = 140.5 \cdot \text{kips}$$

$$C_9 = -54.7 \cdot \text{kips}$$

$$C_4 = 151.9 \cdot \text{kips}$$

$$C_{10} = -103.1 \cdot \text{kips}$$

$$C_5 = 140.5 \cdot \text{kips}$$

$$C_{11} = -135.5 \cdot \text{kips}$$

$$C_6 = 108.1 \cdot \text{kips}$$

etc.

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot M A_i}{(B_{eff} t_{bp})^2} = 53.3 \cdot \text{ksi}$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot F_y = 59.9 \cdot \text{ksi}$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 89.0 \cdot \%$$

Condition3 =

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

Condition3 = "Ok"

Subject:

CAISSON FOUNDATION

Location:

180-ft EEI Monopole
 Colchester, CT

Rev. 0: 9/28/12

Prepared by: TJL Checked by: C.F.C.
 Job No. 12044.CO14

Caisson Foundation:

Input Data:

Shear Force =	$S := 28k$	USER INPUT-FROM RISATower
Overturing Moment =	$M := 3485ft \cdot k$	USER INPUT-FROM RISATower
Applied Axial Load =	$A1 := 40k$	USER INPUT-FROM RISATower
Bending Moment =	$Mu := 3635ft \cdot k$	USER INPUT-FROM LPILE
Moment Capacity =	$Mn := 8986ft \cdot k$	USER INPUT-FROM LPILE
Foundation Diameter =	$d := 8ft$	USER INPUT
Overall Length of Caisson =	$L_c := 28.0ft$	USER INPUT
Depth From Top of Caisson to Grade =	$L_{pag} := 1.0ft$	USER INPUT
Number of Rebar =	$n := 27$	USER INPUT
Area of Rebar =	$Ar := 1.56in^2$	USER INPUT
Rebar Yield Strength =	$fy := 60ksi$	USER INPUT
Concrete Comp Strength =	$fc := 4ksi$	USER INPUT

Check Foundation Depth:

Depth of Caisson Below Ground Level = $LD := L_c - L_{pag} = 27ft$ (TIA/EIA-222-F 7.2.5)

Depth Required = $LD1 := 2.0ft + \left(\frac{S \cdot ft^2}{3k \cdot d} \right) + 2ft^5 \left(\frac{M \cdot ft}{3k \cdot d} + \frac{S \cdot ft}{2k} + \frac{S^2 \cdot ft^3}{18k^2 \cdot d^2} \right)^{.5} = 28.46ft$

DepthCheck := if($LD1 \leq LD$, "OK", "NO GOOD")

DepthCheck = "NO GOOD"

Note: Result not applicable.
 Actual soil is better than normal
 soil as defined in TIA/EIA 222 F.
 Refer to L-Pile analysis.

Check Moment Capacity:

Factor of Safety = $FS := \frac{Mn}{Mu} = 2.5$

Factor of Safety Required = $FS_{reqd} := 1.3$

FOSCheck := if($FS \geq FS_{reqd}$, "OK", "NO GOOD")

FOSCheck = "OK"

Check Axial Capacity:

Concrete Weight = $A2 := .150 \frac{k}{ft^3} \cdot LD \cdot \pi \cdot \frac{d^2}{4} = 203.6 \cdot kips$

Total Axial Load = $AT := A1 + A2 = 243.6 \cdot kips$

Area of Concrete = $Ag := \pi \cdot \frac{d^2}{4} = 50.27ft^2$

Axial Capacity = $Po := n \cdot Ar \cdot fy + (Ag - n \cdot Ar) \cdot 0.85 \cdot fc = 26994 \cdot kips$

AxialCheck := if($AT \leq Po$, "OK", "NO GOOD")

AxialCheck = "OK"

Colchester South Caisson Analysis.lpo

LPILE Plus for windows, Version 5.0 (5.0.39)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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This program is licensed to:

TJL
Centek Engineering Inc

Path to file locations: J:\Jobs\1204400.WI\CO14 - AT&T CT2233\Calcs\MathCad\Foundation\
Name of input data file: Colchester South Caisson Analysis.lpd
Name of output file: Colchester South Caisson Analysis.lpo
Name of plot output file: Colchester South Caisson Analysis.lpp
Name of runtime file: Colchester South Caisson Analysis.lpr

Time and Date of Analysis

Date: September 28, 2012 Time: 11:33:28

Problem Title

12044.CO14 - CT2233

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 3:
- Computation of Nonlinear Bending Stiffness and Ultimate Bending Moment
Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- Analysis includes computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-04 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 8

Pile Structural Properties and Geometry

Pile Length = 336.00 in
Depth of ground surface below top of pile = 12.00 in
Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in ⁴	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
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Colchester South Caisson Analysis.lpo

1	0.0000	96.00000000	4169220.	7238.2300	3605000.
2	336.0000	96.00000000	4169220.	7238.2300	3605000.

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of moment of inertia and modulus of are not used for any computations other than total stress due to combined axial loading and bending.

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 12.000 in
 Distance from top of pile to bottom of layer = 36.000 in
 p-y subgrade modulus k for top of soil layer = .000 lbs/in**3
 p-y subgrade modulus k for bottom of layer = .000 lbs/in**3

NOTE: Internal default values for p-y subgrade modulus will be computed for the above soil layer.

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 36.000 in
 Distance from top of pile to bottom of layer = 156.000 in
 p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
 p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 156.000 in
 Distance from top of pile to bottom of layer = 228.000 in
 p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
 p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 228.000 in
 Distance from top of pile to bottom of layer = 372.000 in
 p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
 p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

(Depth of lowest layer extends 36.00 in below pile tip)

Effective Unit weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	12.00	.05200
2	36.00	.05200
3	36.00	.07200
4	156.00	.07200
5	156.00	.07500
6	228.00	.07500
7	228.00	.08100
8	372.00	.08100

Shear Strength of Soils

Shear strength parameters with depth defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	12.000	.00000	1.00	-----	-----
2	36.000	.00000	1.00	-----	-----
3	36.000	.00000	33.00	-----	-----
4	156.000	.00000	33.00	-----	-----
5	156.000	.00000	35.00	-----	-----
6	228.000	.00000	35.00	-----	-----
7	228.000	.00000	35.00	-----	-----
8	372.000	.00000	35.00	-----	-----

Notes:

- (1) Cohesion = uniaxial compressive strength for rock materials.
- (2) Values of E50 are reported for clay strata.
- (3) Default values will be generated for E50 when input values are 0.
- (4) RQD and k_{rm} are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)

Shear force at pile head = 28000.000 lbs
 Bending moment at pile head = 41820000.000 in-lbs
 Axial load at pile head = 40000.000 lbs

Non-zero moment at pile head for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Number of sections = 1

Pile Section No. 1

The sectional shape is a circular drilled shaft (bored pile).

Outside Diameter = 96.0000 in

Material Properties:

Compressive Strength of Concrete = 4.000 kip/in**2
 Yield Stress of Reinforcement = 60. kip/in**2
 Modulus of Elasticity of Reinforcement = 29000. kip/in**2
 Number of Reinforcing Bars = 27
 Area of Single Bar = 1.56000 in**2
 Number of Rows of Reinforcing Bars = 27
 Area of Steel = 42.120 in**2
 Area of Shaft = 7238.229 in**2
 Percentage of Steel Reinforcement = .582 percent
 Cover Thickness (edge to bar center) = 4.000 in

Unfactored Axial Squash Load Capacity = 26993.97 kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement in**2	Distance to Centroidal Axis in
1	1.560	43.926
2	1.560	43.332
3	1.560	42.152
4	1.560	40.402
5	1.560	38.105
6	1.560	35.293
7	1.560	32.004
8	1.560	28.283
9	1.560	24.178
10	1.560	19.747
11	1.560	15.049
12	1.560	10.147
13	1.560	5.108
14	1.560	0.000
15	1.560	-5.108
16	1.560	-10.147
17	1.560	-15.049
18	1.560	-19.747

Colchester South Caisson Analysis.lpo

19	1.560	-24.178
20	1.560	-28.283
21	1.560	-32.004
22	1.560	-35.293
23	1.560	-38.105
24	1.560	-40.402
25	1.560	-42.152
26	1.560	-43.332
27	1.560	-43.926

Axial Thrust Force = 40000.00 lbs

Bending Moment in-lbs	Bending Stiffness lb-in ²	Bending Curvature rad/in	Maximum Strain in/in	Neutral Axis Position inches	Max. Concrete Stress psi	Max. Steel Stress psi
10187864.	1.630058E+13	6.250000E-07	.00003158	50.52269411	112.07494	841.87459
20272499.	1.621800E+13	.00000125	.00006171	49.36636019	217.18787	1641.83207
30253118.	1.613500E+13	.00000188	.00009182	48.96961355	320.51986	2441.17501
40130099.	1.605204E+13	.00000250	.00012193	48.77111578	422.14562	3240.50892
40130099.	1.284163E+13	.00000313	.00007201	23.04167604	248.06632	6242.60189
40130099.	1.070136E+13	.00000375	.00008507	22.68461752	291.89825	7529.95238
40130099.	9.172594E+12	.00000438	.00009814	22.43291903	335.47377	8816.87869
40130099.	8.026020E+12	.00000500	.00011152	22.30483675	379.78186	10095.00472
40130099.	7.134240E+12	.00000563	.00012460	22.15037584	422.71762	11382.07675
40130099.	6.420816E+12	.00000625	.00013768	22.02937746	465.40027	12668.68290
40130099.	5.837105E+12	.00000688	.00015079	21.93273211	507.82902	13954.81985
40130099.	5.350680E+12	.00000750	.00016391	21.85436583	550.00304	15240.48451
40130099.	4.939089E+12	.00000813	.00017704	21.79007292	591.92146	16525.67390
40130099.	4.586297E+12	.00000875	.00019020	21.73685217	633.58350	17810.38435
40130099.	4.280544E+12	.00000938	.00020337	21.69249773	674.98820	19094.61352
40130099.	4.013010E+12	.00001000	.00021655	21.65536451	716.13489	20378.35639
40130099.	3.776950E+12	.00001063	.00022976	21.62418222	757.02247	21661.61171
40130099.	3.567120E+12	.00001125	.00024298	21.59797525	797.65027	22944.37419
40130099.	3.379377E+12	.00001188	.00025621	21.57596540	838.01730	24226.64128
40130099.	3.210408E+12	.00001250	.00026947	21.55753183	878.12264	25508.40983
40130099.	3.057531E+12	.00001313	.00028274	21.54217100	917.96532	26789.67704
40130099.	2.918553E+12	.00001375	.00029603	21.52947950	957.54469	28070.43668
40130099.	2.791659E+12	.00001438	.00030934	21.51911116	996.85955	29350.68793
40130099.	2.675340E+12	.00001500	.00032266	21.51078844	1035.90917	30630.42518
40854322.	2.614677E+12	.00001563	.00033600	21.50427103	1074.69247	31909.64609
42423499.	2.610677E+12	.00001625	.00034936	21.49935865	1113.20849	33188.34690
43991073.	2.606878E+12	.00001688	.00036274	21.49588251	1151.45638	34466.52291
45557038.	2.603259E+12	.00001750	.00037614	21.49369669	1189.43518	35744.17010
47121376.	2.599800E+12	.00001813	.00038955	21.49267244	1227.14376	37021.28598
48684079.	2.596484E+12	.00001875	.00040299	21.49270105	1264.58116	38297.86649
50245146.	2.593298E+12	.00001938	.00041644	21.49369097	1301.74654	39573.90583
51804560.	2.590228E+12	.00002000	.00042991	21.49555635	1338.63874	40849.40151
53362315.	2.587264E+12	.00002063	.00044340	21.49822569	1375.25682	42124.34872
54918396.	2.584395E+12	.00002125	.00045691	21.50163317	1411.59963	43398.74427
56472800.	2.581614E+12	.00002188	.00047044	21.50572443	1447.66627	44672.58253
58025513.	2.578912E+12	.00002250	.00048399	21.51044798	1483.45562	45945.85992
59576523.	2.576282E+12	.00002313	.00049755	21.51575804	1518.96655	47218.57275
61125819.	2.573719E+12	.00002375	.00051114	21.52161455	1554.19798	48490.71671
62673394.	2.571216E+12	.00002438	.00052474	21.52798319	1589.14890	49762.28638
65763339.	2.566374E+12	.00002500	.00053820	21.54213095	1658.20475	52303.68495
68846265.	2.561722E+12	.00002563	.00055176	21.55797815	1726.12498	54842.73329
71922083.	2.557230E+12	.00002625	.00056534	21.57534456	1792.90038	57379.39362
74990697.	2.552875E+12	.00002688	.00057891	21.59408140	1858.52150	59913.62745
77463992.	2.529436E+12	.00002750	.00059248	21.55594397	1918.70914	60000.00000
79479115.	2.493462E+12	.00002813	.00060605	21.47865343	1974.53682	60000.00000
81192444.	2.451093E+12	.00002875	.00061962	21.37959337	2027.18010	60000.00000
82688109.	2.405472E+12	.00002938	.00063319	21.26787901	2077.28497	60000.00000
84048424.	2.359254E+12	.00003000	.00064676	21.15209627	2125.51405	60000.00000
85263186.	2.312222E+12	.00003063	.00066033	21.03123236	2171.80547	60000.00000
86361702.	2.265225E+12	.00003125	.00067390	20.90778208	2216.38083	60000.00000
87056334.	2.210955E+12	.00003188	.00068747	20.79999876	2260.78127	60000.00000
88376044.	2.175410E+12	.00003250	.00070104	20.74359369	2308.08237	60000.00000
89196013.	2.130054E+12	.00003313	.00071461	20.60448790	2347.09947	60000.00000
90013838.	2.087277E+12	.00003375	.00072818	20.47426558	2385.47692	60000.00000
90747621.	2.045017E+12	.00003438	.00074175	20.34267569	2422.38888	60000.00000
91406853.	2.003438E+12	.00003500	.00075532	20.21081686	2457.96374	60000.00000
92064202.	1.964036E+12	.00003563	.00076889	20.08667707	2492.93972	60000.00000
92710337.	1.926449E+12	.00003625	.00078246	19.96855402	2527.21576	60000.00000
93233238.	1.888268E+12	.00003688	.00079603	19.84298944	2559.63387	60000.00000
93754470.	1.851940E+12	.00003750	.00080960	19.72420835	2591.49079	60000.00000
94274023.	1.817331E+12	.00003813	.00082317	19.61172438	2622.78383	60000.00000
94791867.	1.784317E+12	.00003875	.00083674	19.50509405	2653.50998	60000.00000
95232614.	1.751404E+12	.00003938	.00085031	19.39497900	2682.85497	60000.00000
95639636.	1.719364E+12	.00004000	.00086388	19.28658342	2711.31757	60000.00000
96156989.	1.690672E+12	.00004063	.00087745	19.20000029	2740.75740	60000.00000
96535364.	1.660823E+12	.00004125	.00089102	19.18292856	2775.52803	60000.00000
96927250.	1.632459E+12	.00004188	.00090459	19.07628965	2801.20335	60000.00000
97317084.	1.605230E+12	.00004250	.00091816	18.97440290	2826.37182	60000.00000
97617773.	1.577661E+12	.00004313	.00093173	18.86522341	2849.96783	60000.00000
97917281.	1.551165E+12	.00004375	.00094530	18.76075888	2873.10362	60000.00000
98215603.	1.525679E+12	.00004438	.00095887	18.66073751	2895.77715	60000.00000

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98512730.	1.501146E+12	.00006563	.00121832	18.56490755	2917.98629	60000.00000
98808662.	1.477513E+12	.00006688	.00123538	18.47303724	2939.72899	60000.00000
99103398.	1.454729E+12	.00006813	.00125247	18.38491201	2961.00319	60000.00000
99396929.	1.432749E+12	.00006938	.00126959	18.30033159	2981.80670	60000.00000
99634294.	1.410751E+12	.00007063	.00128619	18.21150255	3001.46863	60000.00000
99856921.	1.389314E+12	.00007188	.00130268	18.12423563	3020.52378	60000.00000
1.000785E+08	1.368594E+12	.00007313	.00131919	18.04027319	3039.13995	60000.00000
1.002989E+08	1.348557E+12	.00007438	.00133573	17.95945501	3057.31559	60000.00000
1.007366E+08	1.310395E+12	.00007688	.00136889	17.80663633	3092.33644	60000.00000
1.011700E+08	1.274582E+12	.00007938	.00140213	17.66466379	3125.57010	60000.00000
1.012966E+08	1.237210E+12	.00008188	.00144100	17.59999895	3162.33870	60000.00000
1.020178E+08	1.209100E+12	.00008438	.00147647	17.49890471	3193.43005	60000.00000
1.023154E+08	1.177732E+12	.00008688	.00150715	17.34849501	3218.33871	60000.00000
1.026096E+08	1.148080E+12	.00008938	.00153792	17.20746946	3241.71561	60000.00000
1.029004E+08	1.120004E+12	.00009188	.00156877	17.07507563	3263.54711	60000.00000
1.031876E+08	1.093379E+12	.00009438	.00159972	16.95063829	3283.81909	60000.00000
1.034713E+08	1.068091E+12	.00009688	.00163075	16.83355379	3302.51727	60000.00000
1.037150E+08	1.043673E+12	.00009938	.00166126	16.71707296	3319.28184	60000.00000
1.039165E+08	1.020040E+12	.00010188	.00169120	16.60072088	3334.17801	60000.00000
1.041149E+08	9.975084E+11	.00010438	.00172122	16.49075747	3347.59442	60000.00000
1.043101E+08	9.760011E+11	.00010688	.00175133	16.38673925	3359.51738	60000.00000
1.045021E+08	9.554474E+11	.00010938	.00178153	16.28827143	3369.93333	60000.00000
1.046907E+08	9.357830E+11	.00011188	.00181181	16.19499063	3378.82825	60000.00000
1.048760E+08	9.169490E+11	.00011438	.00184219	16.10656214	3386.18775	60000.00000
1.050580E+08	8.988920E+11	.00011688	.00187265	16.02268839	3391.99746	60000.00000
1.057681E+08	8.860156E+11	.00011938	.00191000	16.00000048	3397.01895	60000.00000
1.066627E+08	8.751810E+11	.00012188	.00195000	16.00000048	3399.70675	60000.00000
1.066627E+08	8.575894E+11	.00012438	.00198008	15.92021513	3397.17077	60000.00000
1.066627E+08	8.406911E+11	.00012688	.00200799	15.82655954	3390.32244	60000.00000
1.066627E+08	8.244459E+11	.00012938	.00203600	15.73716402	3383.45222	60000.00000
1.066627E+08	8.088166E+11	.00013188	.00206408	15.65179682	3385.45811	60000.00000
1.066627E+08	7.937688E+11	.00013438	.00209225	15.57024050	3390.25296	60000.00000
1.066627E+08	7.792707E+11	.00013688	.00212051	15.49229479	3394.10496	60000.00000
1.066627E+08	7.652928E+11	.00013938	.00214885	15.41777658	3397.00305	60000.00000
1.066627E+08	7.518075E+11	.00014188	.00217729	15.34650850	3398.93581	60000.00000
1.066627E+08	7.387891E+11	.00014438	.00220581	15.27833319	3399.89167	60000.00000
1.066627E+08	7.262140E+11	.00014688	.00223451	15.21371126	3396.79105	60000.00000
1.066627E+08	7.140598E+11	.00014938	.00226337	15.15225935	3390.75208	60000.00000
1.066627E+08	7.023057E+11	.00015188	.00229229	15.09326792	3384.69556	60000.00000
1.067262E+08	6.913439E+11	.00015438	.00232128	15.03661966	3378.62140	60000.00000
1.068002E+08	6.807982E+11	.00015688	.00234996	14.97983408	3378.87038	60000.00000
1.068517E+08	6.704423E+11	.00015938	.00237788	14.92001009	3383.69428	60000.00000
1.069028E+08	6.604034E+11	.00016188	.00240585	14.86242056	3387.90756	60000.00000
1.069533E+08	6.506665E+11	.00016438	.00243389	14.80696249	3391.50361	60000.00000
1.070033E+08	6.412182E+11	.00016688	.00246200	14.75354433	3394.47597	60000.00000
1.070528E+08	6.320458E+11	.00016938	.00249017	14.70208311	3396.81811	60000.00000
1.071017E+08	6.231371E+11	.00017188	.00251840	14.65249586	3398.52324	60000.00000
1.071501E+08	6.144808E+11	.00017438	.00254670	14.60470819	3399.58452	60000.00000
1.072433E+08	5.978719E+11	.00017938	.00260366	14.51515245	3395.69670	60000.00000
1.073326E+08	5.821430E+11	.00018438	.00266102	14.43267488	3385.82267	60000.00000
1.073326E+08	5.667729E+11	.00018938	.00272700	14.39999914	3373.67456	60000.00000
1.073326E+08	5.521935E+11	.00019438	.00279900	14.39999914	3375.30202	60000.00000
1.074675E+08	5.390220E+11	.00019938	.00287100	14.39999914	3387.05715	60000.00000
1.077648E+08	5.272897E+11	.00020438	.00293341	14.35306120	3393.62604	60000.00000
1.078264E+08	5.149916E+11	.00020938	.00299025	14.28178453	3397.35851	60000.00000
1.078868E+08	5.032619E+11	.00021438	.00304731	14.21487093	3399.48319	60000.00000
1.079130E+08	4.919113E+11	.00021938	.00310262	14.14298201	3398.87772	60000.00000
1.079236E+08	4.809967E+11	.00022438	.00315925	14.08021116	3391.31261	60000.00000
1.079338E+08	4.705563E+11	.00022938	.00321600	14.02069044	3383.71637	60000.00000
1.079437E+08	4.605596E+11	.00023438	.00327286	13.96421957	3376.08854	60000.00000
1.079531E+08	4.509789E+11	.00023938	.00332985	13.91061831	3368.42841	60000.00000
1.079621E+08	4.417885E+11	.00024438	.00338697	13.85972071	3360.73534	60000.00000
1.079706E+08	4.329649E+11	.00024938	.00344421	13.81137514	3353.00859	60000.00000
1.079787E+08	4.244865E+11	.00025438	.00350158	13.76544142	3361.18685	60000.00000
1.079864E+08	4.163332E+11	.00025938	.00355909	13.72179079	3369.09304	60000.00000
1.079932E+08	4.084848E+11	.00026438	.00361682	13.68065786	3376.16959	60000.00000
1.079932E+08	4.009028E+11	.00026938	.00367630	13.64750147	3382.77999	60000.00000
1.079932E+08	3.935970E+11	.00027438	.00373595	13.61622477	3388.35815	60000.00000
1.079932E+08	3.865528E+11	.00027938	.00379580	13.58674192	3392.87934	60000.00000
1.079932E+08	3.797562E+11	.00028438	.00385584	13.55898428	3396.31826	60000.00000

Unfactored (Nominal) Moment Capacity at Concrete Strain of 0.003 = 107836.68681 in-kip

Computed values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 28000.000 lbs
Specified moment at pile head = 41820000.000 in-lbs
Specified axial load at pile head = 40000.000 lbs

Non-zero moment for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

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Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res. p lbs/in	Es*h F/L
0.000	.762254	4.18E+07	28000.	-.004820	486.998	2.61E+12	0.000	0.000
26.880	.638504	4.26E+07	27934.	-.004386	495.716	2.61E+12	-8.601	45.262
53.760	.526539	4.33E+07	22918.	-.003943	504.062	2.61E+12	-564.854	3604.504
80.640	.426558	4.36E+07	-5130.907	-.003495	507.550	2.61E+12	-1525.556	12017.
107.520	.338633	4.28E+07	-57144.	-.003049	498.437	2.61E+12	-2190.858	21738.
134.400	.262449	4.05E+07	-1.19E+05	-.002659	471.384	8.80E+12	-2332.885	29867.
161.280	.191940	3.64E+07	-1.79E+05	-.002591	425.155	1.61E+13	-1997.485	34967.
188.160	.123064	3.10E+07	-2.28E+05	-.002535	361.977	1.61E+13	-1578.418	43095.
215.040	.055571	2.44E+07	-2.61E+05	-.002489	285.881	1.62E+13	-847.186	51224.
241.920	-.010837	1.71E+07	-2.70E+05	-.002454	202.950	1.62E+13	188.804	58539.
268.800	-.076481	1.01E+07	-2.48E+05	-.002432	121.793	1.63E+13	1517.487	66667.
295.680	-.141672	4.16E+06	-1.86E+05	-.002420	53.467	1.63E+13	3153.716	74796.
322.560	-.206671	5.27E+05	-75801.	-.002417	11.588	1.63E+13	5100.608	82924.

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection = .76225372 in
 Computed slope at pile head = -.00482030
 Maximum bending moment = 43613323. lbs-in
 Maximum shear force = -270798.26680 lbs
 Depth of maximum bending moment = 77.28000000 in
 Depth of maximum shear force = 238.56000 in
 Number of iterations = 72
 Number of zero deflection points = 1

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacement in
 Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
 Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
 Type 4 = Deflection and Moment, S = Pile-head Slope, radians
 Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs		
1	v=	M=	28000.	4.18E+07	40000.0000	.7622537	4.3613E+07	-270798.

Computed Pile-head Stiffness Matrix Members
 K22, K23, K32, K33 for Superstructure

Top y in	Shear React. lbs	Mom. React. in-lbs	K22 lbs/in	K32 in-lbs/in
.00136420	2800.00004	580754.21008	2052479.	4.257091E+08
.00410666	8428.83988	1748244.	2052479.	4.257091E+08
.00650891	13359.39513	2770902.	2052479.	4.257091E+08
.00821622	16857.67976	3497565.	2051757.	4.256904E+08
.00954160	19571.16012	4061618.	2051141.	4.256749E+08
.01062458	21788.23501	4522510.	2050738.	4.256648E+08
.01154027	23662.74512	4912204.	2050450.	4.256575E+08
.01233351	25286.51964	5249781.	2050230.	4.256520E+08
.01303321	26718.79026	5547553.	2050055.	4.256476E+08
.01365912	28000.00000	5813923.	2049912.	4.256440E+08
Top Rota. rad	Shear React. lbs	Mom. React. in-lbs	K23 lbs/rad	K33 in-lbs/rad
.00003992	16993.34204	4182000.	4.257091E+08	1.047655E+11
.00012020	51155.23434	12589074.	4.255927E+08	1.047365E+11

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.00019077	81083.50600	19953211.	4.250414E+08	1.045951E+11
.00024096	102320.27946	25178149.	4.246420E+08	1.044925E+11
.00027997	118792.88191	29230926.	4.243103E+08	1.044085E+11
.00031188	132252.21692	32542285.	4.240466E+08	1.043419E+11
.00033891	143632.42563	35342000.	4.238077E+08	1.042815E+11
.00036235	153490.82094	37767223.	4.236014E+08	1.042293E+11
.00038304	162186.96618	39906422.	4.234250E+08	1.041846E+11
.00040389	169969.14251	41820000.	4.208319E+08	1.035434E+11

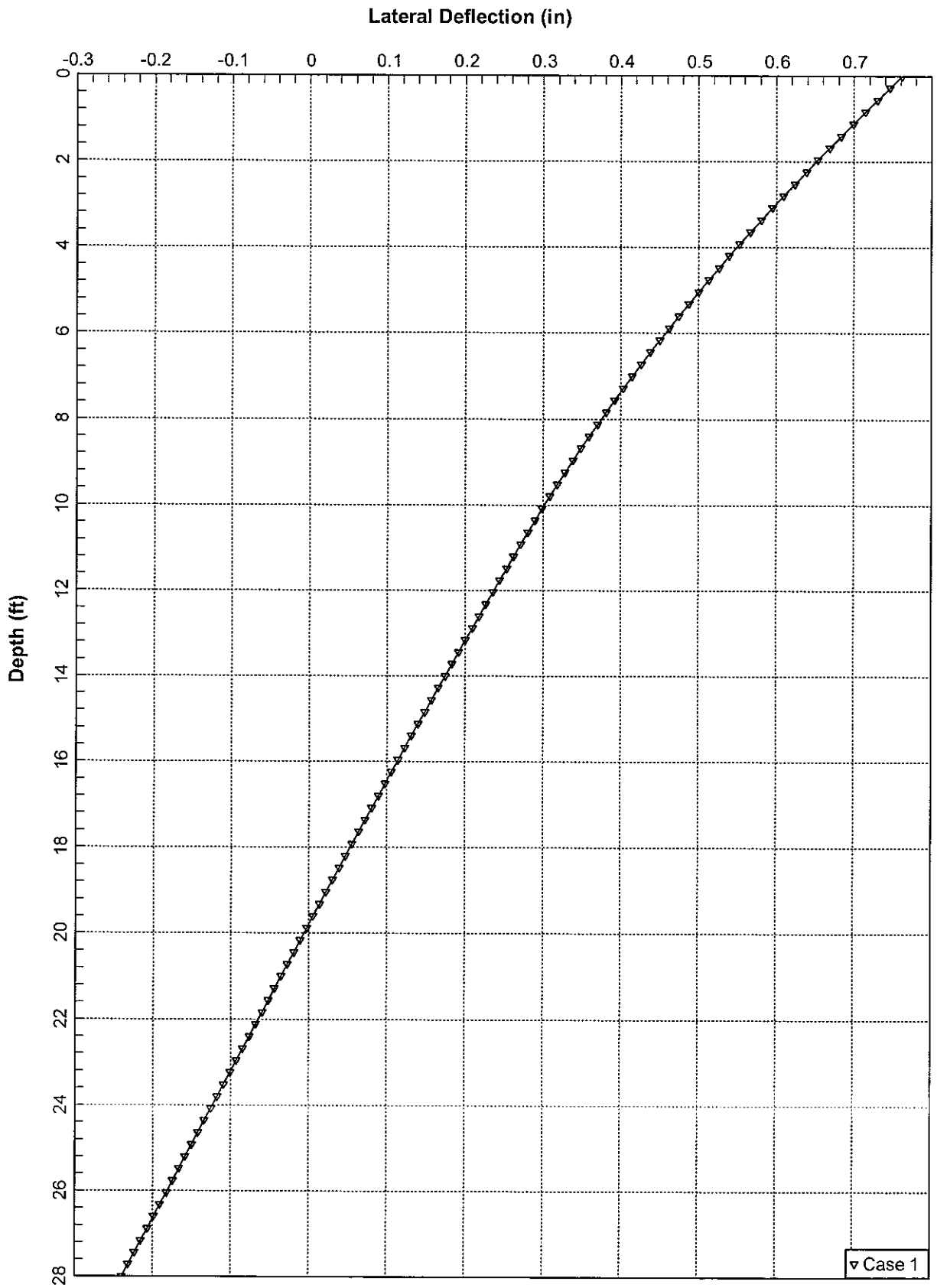
K22 = abs(Shear Reaction/Top y)
 K23 = abs(Shear Reaction/Top Rotation)
 K32 = abs(Moment Reaction/Top y)
 K33 = abs(Moment Reaction/Top Rotation)

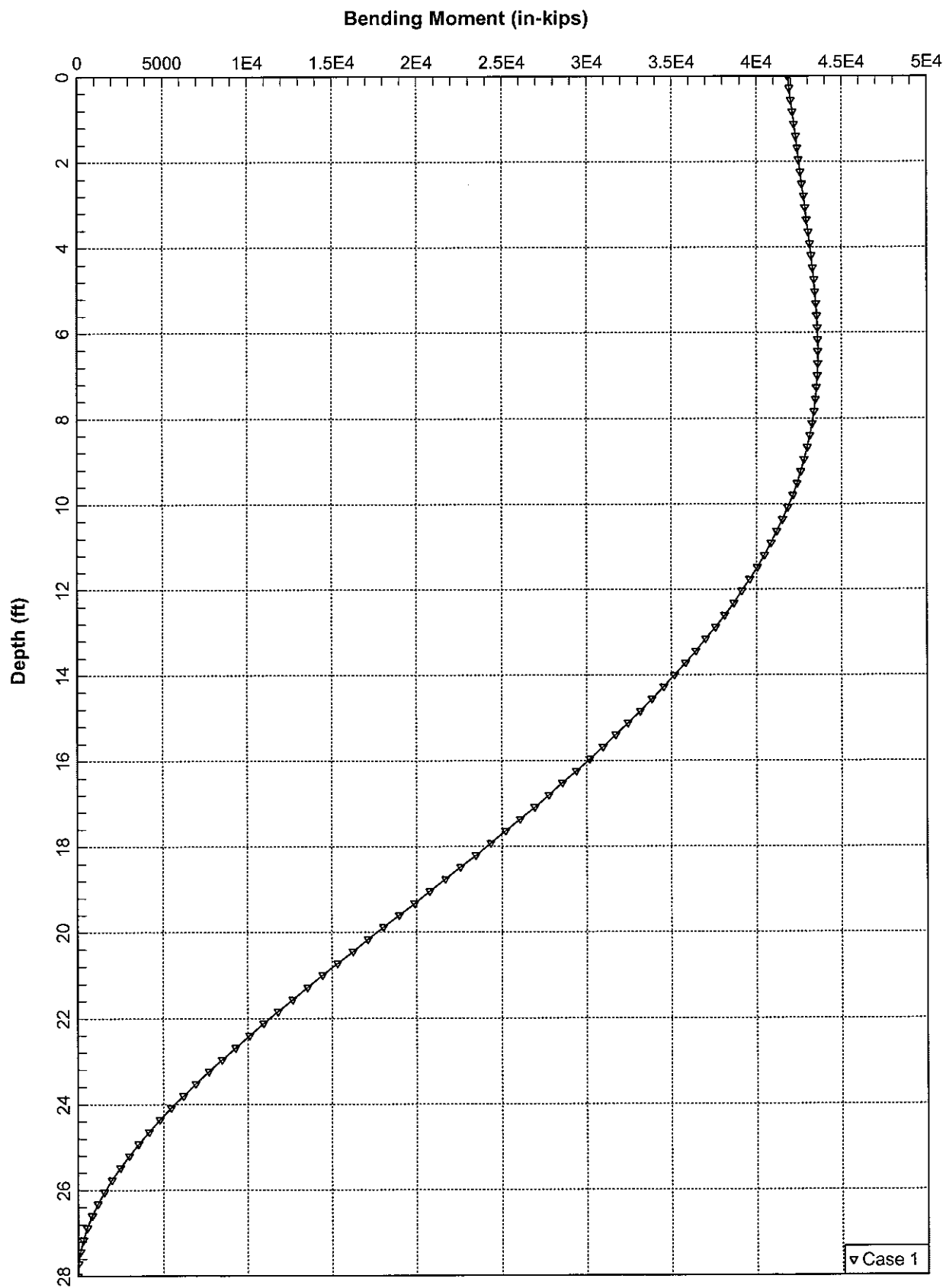
The analysis ended normally.

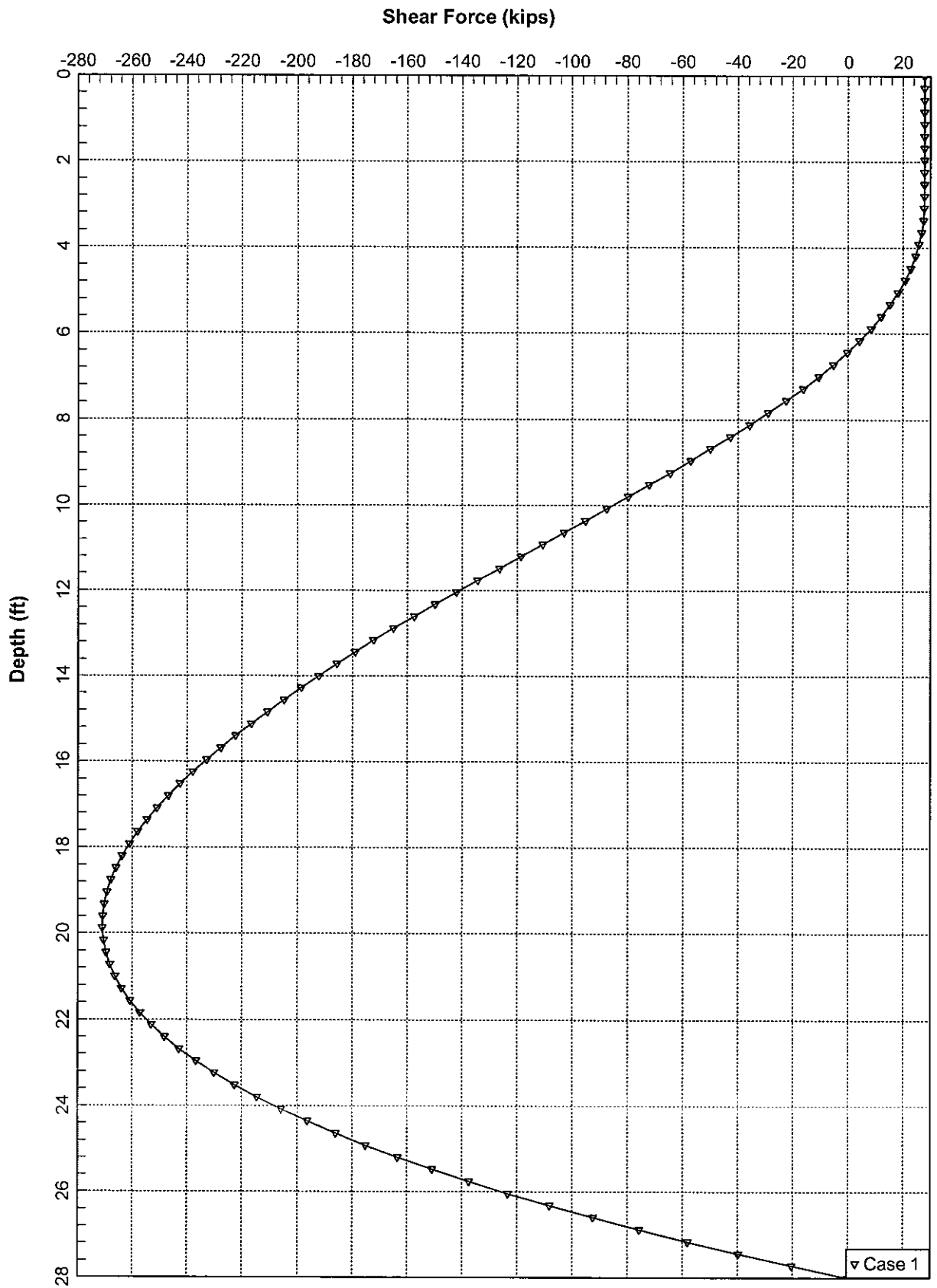
 Summary of Warning Messages

**** WARNING ****

An unreasonable value was input for friction angle has been specified for a soil layer defined using the sand criteria. The input value is either smaller than 20 degrees or higher than 48 degrees. The input data should be checked for correctness.







AM-X-CD-14-65-00T-RET (4' 65° Dual Broadband Antenna)

Dual Band Electrical DownTilt Antenna

698 ~ 894MHz, X-pol., H65° / V17.0°

1710 ~ 2170MHz, X-pol., H65° / V8.5°

Electrical Specification

Frequency Range	698~894MHz	1710~2170MHz
Impedance	50Ω	
Polarization	Dual, Slant ±45°	
Gain	14.0dBi / 11.85dBd @ 698-806MHz 14.8dBi / 12.65dBd @ 824-894MHz	16.1dBi / 13.95dBd @ 1710-1755MHz 16.3dBi / 14.15dBd @ 1850-1900MHz 16.0dBi / 13.85dBd @ 2110-2155MHz
Beamwidth	Horizontal 67° @ 698-806MHz 65° @ 824-894MHz	60° @ 1710-1755MHz 61° @ 1850-1900MHz 64° @ 2110-2155MHz
	Vertical 17.5° @ 698-806MHz 16.5° @ 824-894MHz	8.8° @ 1710-1755MHz 8.5° @ 1850-1900MHz 8.0° @ 2110-2155MHz
VSWR	≤1.5:1	
Front-to-Back Ratio	≥28 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 15° from Boresight)	> 16 dB @ 0-6° Tilt > 18 dB @ 7-10° Tilt (Up to 15° 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)	11.8×5.9×48 inches (300×150×1219mm)
Weight (Without clamp)	36.4 lbs (16.5 kg)
Connector	4 x 7/16 DIN(F), Long Neck
Max Wind Speed	150 mph
Wind Load (@150 mph)	1260 N

P65-17-XLH-RR

Dual Broadband Antennas

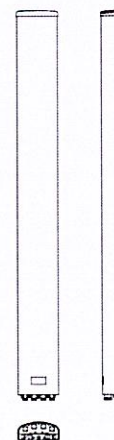
POLARIZATION: Dual linear $\pm 45^\circ$
 FREQUENCY (MHz): 698-894, 1710-2170
 HORIZONTAL BEAM WIDTH ($^\circ$): 65, 65
 GAIN (dBi dBd): 17.2/15.1 17.5/15.4
 TILT: 0-7, 0-8
 LENGTH: 96"

ELECTRICAL SPECIFICATIONS*

	698-894		1710-2170		
Frequency range (MHz)	698-806	806-894	1710-1880	1850-1990	1900-2170
Frequency band (MHz)	16.4/14.3	17.2/15.1	16.9/14.8	17.2/15.1	17.5/15.4
Gain (dBi/dBd)	Dual Linear +/- 45		Dual Linear +/- 45		
Polarization	50		50		
Nominal Impedance (Ω)	< 1.5:1		< 1.5:1		
VSWR	70	63	60	63	60
Horizontal beam width, -3 dB ($^\circ$)	8.4		6.5		
Vertical beam width, -3 dB ($^\circ$)	0 to 7		0 to 8		
Electrical down tilt ($^\circ$)	> 16		> 16		
Side lobe suppression, vertical 1st upper (dB)	> 30		> 30		
Isolation between inputs (dB)	> 40		> 40		
Inter band Isolation (dB)	< 2		< 2		
Tracking, horizontal plane $\pm 60^\circ$ (dB)	< 0.5		< 0.5		
Vertical beam squint ($^\circ$)	> 25		> 30		
Front to back ratio (dB) $180^\circ \pm 30^\circ$ copolar	> 22		> 25		
Front to back ratio (dB) $180^\circ \pm 30^\circ$ total power	> 15		> 15		
Cross polar discrimination (XPD) 0° (dB)	10		10		
Cross polar discrimination (XPD) $\pm 60^\circ$ (dB)	< -153		< -153		
IM3, 2xTx&43dBm (dBc)	500		300		
Power handling, average per input (W)	1000		600		
Power handling, average total (W)					

MECHANICAL SPECIFICATIONS*

Connector	4 x 7/16 DIN Female, IP67, 4 x AISG [2 x i-RET 8510.40]
Connector position	Bottom
Dimensions, HxWxD, mm(ft)	2445x312x148(96"x12"x6")
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, kg (lbs)	28.2 (62)
Weight, without brackets, kg (lbs)	22.7 (50)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.6 (N)	1006 / 147 / 1273
Maximum operational wind speed, m/s (mph)	45 (100)
Survival wind speed, m/s (mph)	67 (150)
Lightning protection	DC Ground
Operating Temperature	-40°C to +60°C
Radome Material	PVC, IP55
Radome colour	Light Grey
Packing size, HxWxD, mm (ft)	2610 x 427 x 275 (102.8" x 17" x 11")
Shipping weight, kg (lbs)	37 (81)
RET	IRET AISGv1.1, MET and AISGv2.0 Available
Brackets	7256.00, 7454.00A



*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

ANTENNA PATTERNS*

For detailed patterns visit <http://www.powerwave.com/rpa/>.

RRUS 11

Frequency (AT&T)

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

RF Characteristics

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

RET/TMA Support

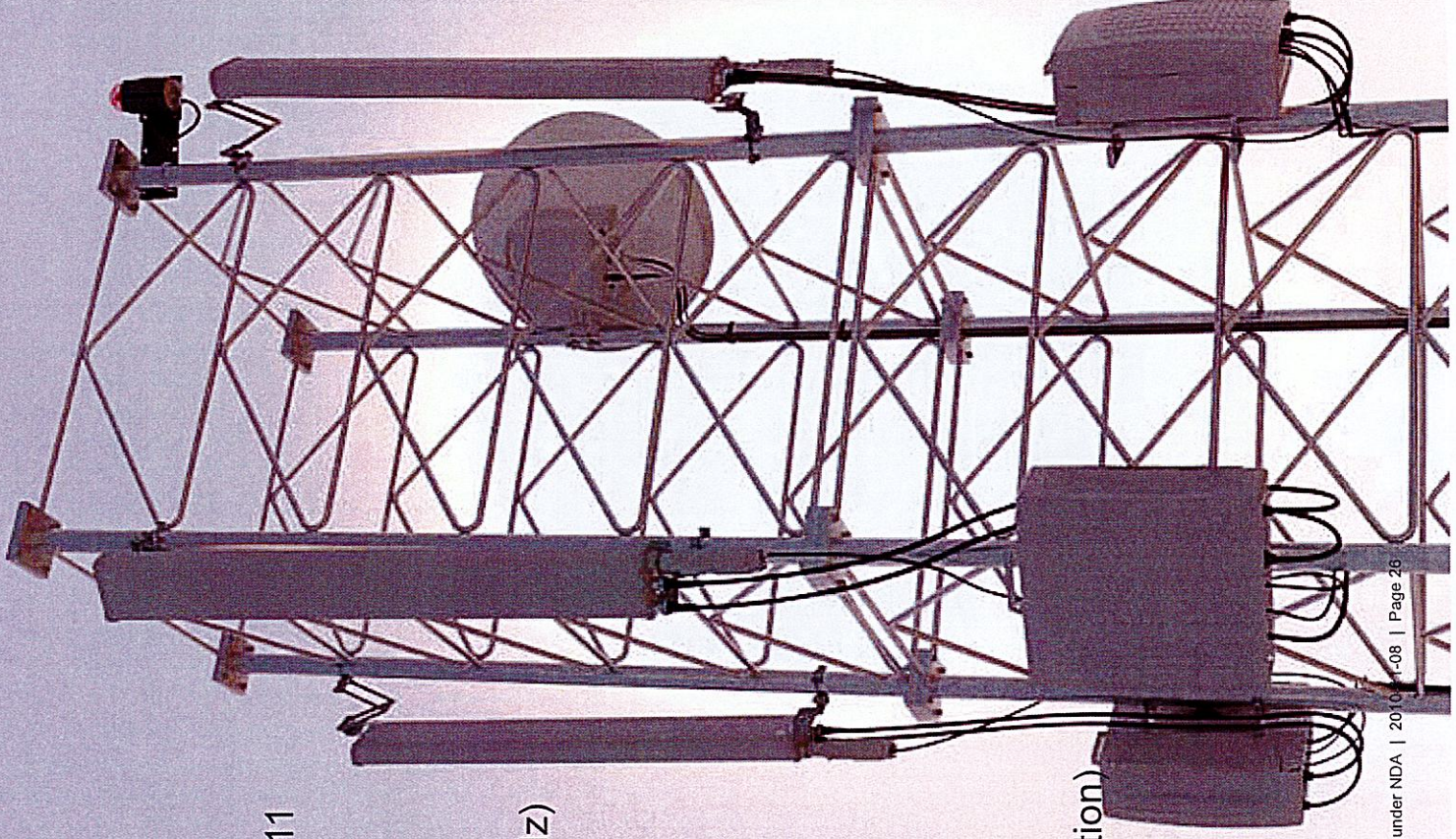
- ✓ AISG 2.0 Compatible
- ✓ Via RET Port and Centre Conductor
- ✓ Cascading
- ✓ 30 VDC Bias

Environmental

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

Power

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



RRUS 11 Mechanics

Wall and pole mounting brackets

- Reused from RRUW and RRU22
- Vertical Mount Only

Clearing distances:

- Above ≥ 16 in.
- Below ≥ 12 in.
- Side ≥ 0 mm

DC connector

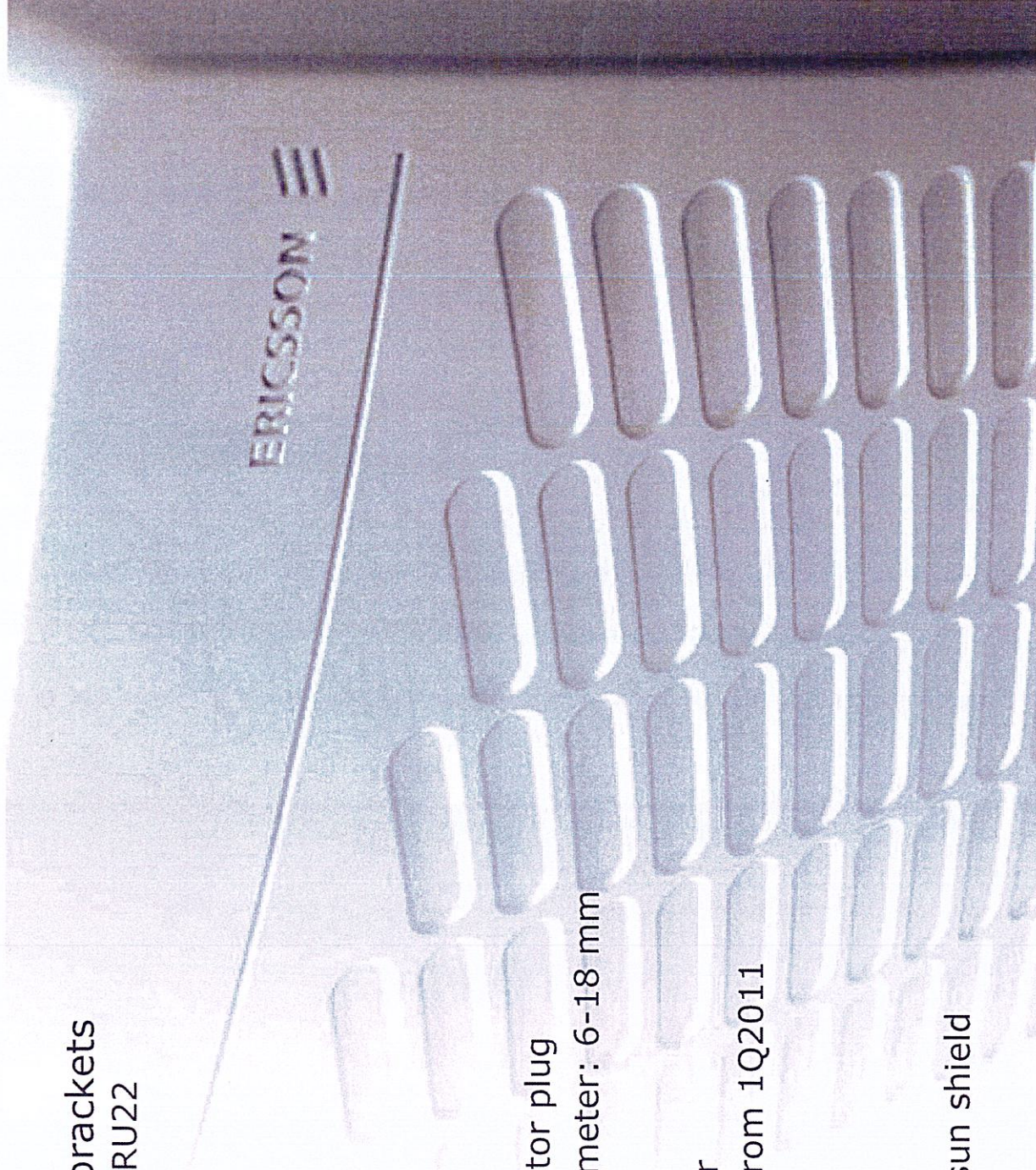
- Bayonet
- Screw terminals in connector plug
- Supported outer cable diameter: 6-18 mm

CPRI connector

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

Size & Weight

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



POWER

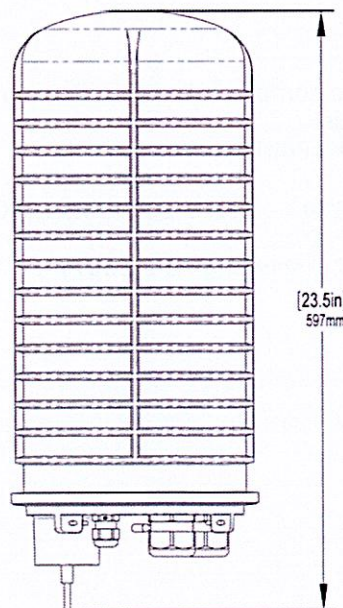
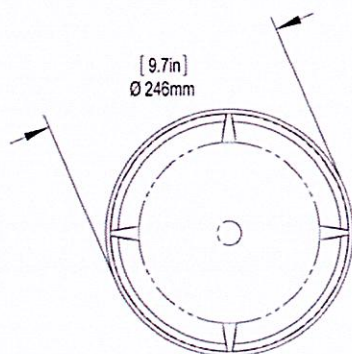
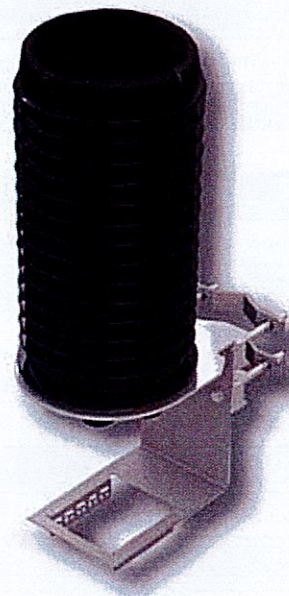
DC6-48-60-18-8F

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 μ s
Maximum Discharge Current (I_{max}) per NEMA LS-1	60 kA 8/20 μ 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 psi
Resistance to Aggressive Materials	CEI IEC 61073-2 including acids and bases
UV Protection	ISO 4892-2 Method A Xenon-Arc 2160 hrs
Weight	20 lbs without Mounting Bracket

STANDARDS

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

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



Raycap

G02-00-068 REV 050610



GS-07F-0435V

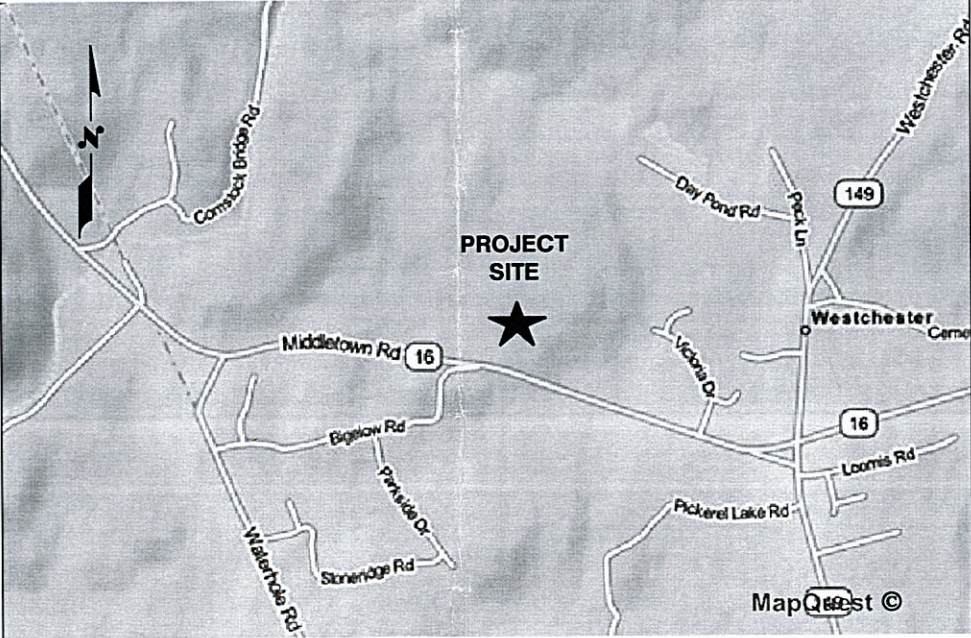
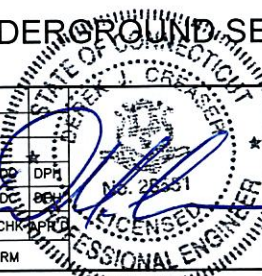


Certified to
ISO 9001:2000



TUV Rheinland
of North America

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

PROJECT INFORMATION SCOPE OF WORK: TELECOMMUNICATIONS FACILITY UPGRADE (LTE): 1. INSTALL (3) NEW LTE ANTENNAS, (6) RRH'S, (1) SURGE ARRESTOR, (1) FIBER LINE, (2) DC POWER LINES & (1) GPS ANTENNA 2. INSTALL (1) LTE 6601 CABINET SITE ADDRESS: 856 MIDDLETOWN ROAD COLCHESTER, CT 06415 LATITUDE: 41.55163 N 41° 33' 05.9" N LONGITUDE: 72.42580 W 72° 25' 32.9" W CURRENT USE: TELECOMMUNICATIONS FACILITY PROPOSED USE: TELECOMMUNICATIONS FACILITY		 SITE NUMBER: CT2233 SITE NAME: COLCHESTER CT																																	
DRAWING INDEX T-1 TITLE SHEET GN-1 GENERAL NOTES A-1 COMPOUND AND EQUIPMENT PLAN A-2 ELEVATION AND ANTENNA PLAN A-3 DETAILS G-1 PLUMBING DIAGRAM & GROUNDING DETAILS		REV 1 1 1 1 1 1	VICINITY MAP DIRECTIONS TO SITE: START OUT GOING NORTHEAST ON ENTERPRISE DR TOWARD CAPITOL BLVD. TURN LEFT ONTO CAPITOL BLVD. TURN LEFT ONTO WEST ST. MERGE ONTO I-91 N VIA THE RAMP ON THE LEFT TOWARD HARTFORD 4.5 MILES. MERGE ONTO CT-3 N VIA EXIT 25 TOWARD GLASTONBURY. MERGE ONTO CT-2 E TOWARD NORWICH 15.8 MILES. TAKE THE CT-149 EXIT, EXIT 16, TOWARD WESTCHESTER/MOODUS. TURN RIGHT ONTO WESTCHESTER RD/CT-149. TURN RIGHT ONTO MIDDLETOWN RD/CT-16. 856 MIDDLETOWN RD IS ON THE RIGHT. 	GENERAL NOTES 1. THIS DOCUMENT IS THE CREATION, DESIGN, PROPERTY AND COPYRIGHTED WORK OF AT&T. ANY DUPLICATION OR USE WITHOUT EXPRESS WRITTEN CONSENT IS STRICTLY PROHIBITED. DUPLICATION AND USE BY GOVERNMENT AGENCIES FOR THE PURPOSES OF CONDUCTING THEIR LAWFULLY AUTHORIZED REGULATORY AND ADMINISTRATIVE FUNCTIONS IS SPECIFICALLY ALLOWED. 2. THE FACILITY IS AN UNMANNED PRIVATE AND SECURED EQUIPMENT INSTALLATION. IT IS ONLY ACCESSED BY TRAINED TECHNICIANS FOR PERIODIC ROUTINE MAINTENANCE AND THEREFORE DOES NOT REQUIRE ANY WATER OR SANITARY SEWER SERVICE. THE FACILITY IS NOT GOVERNED BY REGULATIONS REQUIRING PUBLIC ACCESS PER ADA REQUIREMENTS. 3. CONTRACTOR SHALL VERIFY ALL PLANS AND EXISTING DIMENSIONS AND CONDITIONS ON THE JOB SITE AND SHALL IMMEDIATELY NOTIFY THE AT&T REPRESENTATIVE IN WRITING OF DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.																															
			CALL BEFORE YOU DIG CALL TOLL FREE 1-800-922-4455 OR DIAL 811 UNDERGROUND SERVICE ALERT																																
 1600 OSGOOD STREET BUILDING 20 NORTH, SUITE 3090 N. ANDOVER, MA 01845 TEL: (978) 557-5553 FAX: (978) 336-5586	 a UniTek GLOBAL SERVICES company 800 MARSHALL PHELPS ROAD UNIT#: 2A WINDSOR, CT 06095	SITE NUMBER: CT2233 SITE NAME: COLCHESTER CT 856 MIDDLETOWN ROAD COLCHESTER, CT 06415 NEW LONDON COUNTY	 500 ENTERPRISE DRIVE, SUITE 3A ROCKY HILL, CT 06067	<table><tr><td>1</td><td>10/09/12</td><td>ISSUED FOR CONSTRUCTION</td><td>NB</td><td>DPH</td><td>10-25531</td></tr><tr><td>0</td><td>08/24/12</td><td>ISSUED FOR REVIEW</td><td>RM</td><td>DC</td><td></td></tr><tr><td>NO.</td><td>DATE</td><td>REVISIONS</td><td>BY</td><td>CHKD</td><td>PROG</td></tr><tr><td colspan="2">SCALE: AS SHOWN</td><td>DESIGNED BY: DC</td><td colspan="2">DRAWN BY: RM</td><td></td></tr></table> 	1	10/09/12	ISSUED FOR CONSTRUCTION	NB	DPH	10-25531	0	08/24/12	ISSUED FOR REVIEW	RM	DC		NO.	DATE	REVISIONS	BY	CHKD	PROG	SCALE: AS SHOWN		DESIGNED BY: DC	DRAWN BY: RM			AT&T TITLE SHEET (LTE) <table><tr><td>JOB NUMBER</td><td>DRAWING NUMBER</td><td>REV</td></tr><tr><td>2233.01</td><td>T-1</td><td>0</td></tr></table>	JOB NUMBER	DRAWING NUMBER	REV	2233.01	T-1	0
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GENERAL NOTES

1. THE SUBCONTRACTOR SHALL REVIEW AND INSPECT THE EXISTING FACILITY GROUNDING SYSTEM AND LIGHTNING PROTECTION SYSTEM (AS DESIGNED AND INSTALLED) FOR STRICT COMPLIANCE WITH THE NEC (AS ADOPTED BY THE AHJ), THE SITE-SPECIFIC (UL, LPI, OR NFPA) LIGHTING PROTECTION CODE, AND GENERAL COMPLIANCE WITH TELCORDIA AND TIA GROUNDING STANDARDS. THE SUBCONTRACTOR SHALL REPORT ANY VIOLATIONS OR ADVERSE FINDINGS TO THE CONTRACTOR FOR RESOLUTION.
2. ALL GROUND ELECTRODE SYSTEMS (INCLUDING TELECOMMUNICATION, RADIO, LIGHTNING PROTECTION, AND AC POWER GES'S) SHALL BE BONDED TOGETHER, AT OR BELOW GRADE, BY TWO OR MORE COPPER BONDING CONDUCTORS IN ACCORDANCE WITH THE NEC.
3. THE SUBCONTRACTOR SHALL PERFORM IEEE FALL-OF-POTENTIAL RESISTANCE TO EARTH TESTING (PER IEEE 1100 AND 81) FOR NEW GROUND ELECTRODE SYSTEMS. THE SUBCONTRACTOR SHALL FURNISH AND INSTALL SUPPLEMENTAL GROUND ELECTRODES AS NEEDED TO ACHIEVE A TEST RESULT OF 5 OHMS OR LESS.
4. METAL RACEWAY SHALL NOT BE USED AS THE NEC REQUIRED EQUIPMENT GROUND CONDUCTOR. STRANDED COPPER CONDUCTORS WITH GREEN INSULATION, SIZED IN ACCORDANCE WITH THE NEC, SHALL BE FURNISHED AND INSTALLED WITH THE POWER CIRCUITS TO BTS EQUIPMENT.
5. EACH BTS CABINET FRAME SHALL BE DIRECTLY CONNECTED TO THE MASTER GROUND BAR WITH GREEN INSULATED SUPPLEMENTAL EQUIPMENT GROUND WIRES, 6 AWG STRANDED COPPER OR LARGER FOR INDOOR BTS 2 AWG STRANDED COPPER FOR OUTDOOR BTS.
6. EXOTHERMIC WELDS SHALL BE USED FOR ALL GROUNDING CONNECTIONS BELOW GRADE.
7. APPROVED ANTIOXIDANT COATINGS (I.E., CONDUCTIVE GEL OR PASTE) SHALL BE USED ON ALL COMPRESSION AND BOLTED GROUND CONNECTIONS.
8. ICE BRIDGE BONDING CONDUCTORS SHALL BE EXOTHERMICALLY BONDED OR BOLTED TO THE BRIDGE AND THE TOWER GROUND BAR.
9. ALUMINUM CONDUCTOR OR COPPER CLAD STEEL CONDUCTOR SHALL NOT BE USED FOR GROUNDING CONNECTIONS.
10. MISCELLANEOUS ELECTRICAL AND NON-ELECTRICAL METAL BOXES, FRAMES AND SUPPORTS SHALL BE BONDED TO THE GROUND RING, IN ACCORDANCE WITH THE NEC.
11. METAL CONDUIT SHALL BE MADE ELECTRICALLY CONTINUOUS WITH LISTED BONDING FITTINGS OR BY BONDING ACROSS THE DISCONTINUITY WITH 6 AWS COPPER WIRE UL APPROVED GROUNDING TYPE CONDUIT CLAMPS.
12. ALL NEW STRUCTURES WITH A FOUNDATION AND/OR FOOTING HAVING 20 FT. OR MORE 1/2" OR GREATER ELECTRICALLY CONDUCTIVE REINFORCING STEEL MUST HAVE IT BONDED TO THE GROUND RING USING AN EXOTHERMIC WELD CONNECTION USING #2 AWG SOLID TINNED COPPER GROUND WIRE, PER NEC 250.50

1. FOR THE PURPOSE OF THE CONSTRUCTION DRAWING, THE FOLLOWING DEFINITIONS SHALL APPLY:
CONTRACTOR - NEXLINK
SUBCONTRACTOR - GENERAL CONTRACTOR (CONSTRUCTION)
OWNER - AT&T MOBILITY
2. PRIOR TO THE SUBMISSION OF BIDS, THE BIDDING SUBCONTRACTOR SHALL VISIT THE CELL SITE TO FAMILIARIZE WITH THE EXISTING CONDITIONS AND TO CONFIRM THAT THE WORK CAN BE ACCOMPLISHED AS SHOWN ON THE CONSTRUCTION DRAWINGS. ANY DISCREPANCY FOUND SHALL BE BROUGHT TO THE ATTENTION OF CONTRACTOR.
3. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES. SUBCONTRACTOR SHALL ISSUE ALL APPROPRIATE NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS, AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK. ALL WORK CARRIED OUT SHALL COMPLY WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.
4. DRAWINGS PROVIDED HERE ARE NOT TO BE SCALED AND ARE INTENDED TO SHOW OUTLINE ONLY.
5. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
6. "KITTING LIST" SUPPLIED WITH THE BID PACKAGE IDENTIFIES ITEMS THAT WILL BE SUPPLIED BY CONTRACTOR. ITEMS NOT INCLUDED IN THE BILL OF MATERIALS AND KITTING LIST SHALL BE SUPPLIED BY THE SUBCONTRACTOR.
7. THE SUBCONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
8. IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE SUBCONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION SPACE FOR APPROVAL BY THE CONTRACTOR.
9. SUBCONTRACTOR SHALL DETERMINE ACTUAL ROUTING OF CONDUIT, POWER AND T1 CABLES, GROUNDING CABLES AS SHOWN ON THE POWER, GROUNDING AND TELCO PLAN DRAWING. SUBCONTRACTOR SHALL UTILIZE EXISTING TRAYS AND/OR SHALL ADD NEW TRAYS AS NECESSARY. SUBCONTRACTOR SHALL CONFIRM THE ACTUAL ROUTING WITH THE CONTRACTOR.
10. THE SUBCONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, LANDSCAPING AND STRUCTURES. ANY DAMAGED PART SHALL BE REPAIRED AT SUBCONTRACTOR'S EXPENSE TO THE SATISFACTION OF OWNER.
11. SUBCONTRACTOR SHALL LEGALLY AND PROPERLY DISPOSE OF ALL SCRAP MATERIALS SUCH AS COAXIAL CABLES AND OTHER ITEMS REMOVED FROM THE EXISTING FACILITY. ANTENNAS REMOVED SHALL BE RETURNED TO THE OWNER'S DESIGNATED LOCATION.
12. SUBCONTRACTOR SHALL LEAVE PREMISES IN CLEAN CONDITION.
13. ALL CONCRETE REPAIR WORK SHALL BE DONE IN ACCORDANCE WITH AMERICAN CONCRETE INSTITUTE (ACI) 301.
14. ANY NEW CONCRETE NEEDED FOR THE CONSTRUCTION SHALL BE AIR-ENTRAINED AND SHALL HAVE 4000 PSI STRENGTH AT 28 DAYS. ALL CONCRETE WORK SHALL BE DONE IN ACCORDANCE WITH ACI 318 CODE REQUIREMENTS.

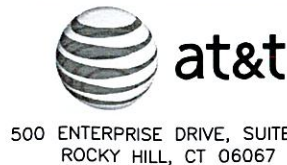
15. ALL STRUCTURAL STEEL WORK SHALL BE DETAILLED, FABRICATED AND ERECTED IN ACCORDANCE WITH AISC SPECIFICATIONS. ALL STRUCTURAL STEEL SHALL BE ASTM A36 ($F_y = 36$ ksi) UNLESS OTHERWISE NOTED. PIPES SHALL BE ASTM A53 TYPE E ($F_y = 36$ ksi). ALL STEEL EXPOSED TO WEATHER SHALL BE HOT DIPPED GALVANIZED. TOUCHUP ALL SCRATCHES AND OTHER MARKS IN THE FIELD AFTER STEEL IS ERECTED USING A COMPATIBLE ZINC RICH PAINT.
16. CONSTRUCTION SHALL COMPLY WITH UMTS SPECIFICATIONS AND "GENERAL CONSTRUCTION SERVICES FOR CONSTRUCTION OF AT&T MOBILITY SITES."
17. SUBCONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS PRIOR TO COMMENCING ANY WORK. ALL DIMENSIONS OF EXISTING CONSTRUCTION SHOWN ON THE DRAWINGS MUST BE VERIFIED. SUBCONTRACTOR SHALL NOTIFY THE CONTRACTOR OF ANY DISCREPANCIES PRIOR TO ORDERING MATERIAL OR PROCEEDING WITH CONSTRUCTION.
18. THE EXISTING CELL SITE IS IN FULL COMMERCIAL OPERATION. ANY CONSTRUCTION WORK BY SUBCONTRACTOR SHALL NOT DISRUPT THE EXISTING NORMAL OPERATION. ANY WORK ON EXISTING EQUIPMENT MUST BE COORDINATED WITH CONTRACTOR. ALSO, WORK SHOULD BE SCHEDULED FOR AN APPROPRIATE MAINTENANCE WINDOW USUALLY IN LOW TRAFFIC PERIODS AFTER MIDNIGHT.
19. SINCE THE CELL SITE IS ACTIVE, ALL SAFETY PRECAUTIONS MUST BE TAKEN WHEN WORKING AROUND HIGH LEVELS OF ELECTROMAGNETIC RADIATION. EQUIPMENT SHOULD BE SHUTDOWN PRIOR TO PERFORMING ANY WORK THAT COULD EXPOSE THE WORKERS TO DANGER. PERSONAL RF EXPOSURE MONITORS ARE ADVISED TO BE WORN TO ALERT OF ANY DANGEROUS EXPOSURE LEVELS.
20. APPLICABLE BUILDING CODES:
SUBCONTRACTOR'S WORK SHALL COMPLY WITH ALL APPLICABLE NATIONAL, STATE, AND LOCAL CODES AS ADOPTED BY THE LOCAL AUTHORITY HAVING JURISDICTION (AHJ) FOR THE LOCATION. THE EDITION OF THE AHJ ADOPTED CODES AND STANDARDS IN EFFECT ON THE DATE OF CONTRACT AWARD SHALL GOVERN THE DESIGN.
BUILDING CODE: 2003 IBC WITH 2005 CT SUPPLEMENT & 2009 CT AMENDMENTS
ELECTRICAL CODE: REFER TO ELECTRICAL DRAWINGS
LIGHTENING CODE: REFER TO ELECTRICAL DRAWINGS
- SUBCONTRACTOR'S WORK SHALL COMPLY WITH THE LATEST EDITION OF THE FOLLOWING STANDARDS:
- AMERICAN CONCRETE INSTITUTE (ACI) 318; BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE;
 - AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
 - MANUAL OF STEEL CONSTRUCTION, ASD, NINTH EDITION;
 - TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA) 222-F, STRUCTURAL STANDARDS FOR STEEL
 - ANTENNA TOWER AND ANTENNA SUPPORTING STRUCTURES; REFER TO ELECTRICAL DRAWINGS FOR SPECIFIC ELECTRICAL STANDARDS.

FOR ANY CONFLICTS BETWEEN SECTIONS OF LISTED CODES AND STANDARDS REGARDING MATERIAL, METHODS OF CONSTRUCTION, OR OTHER REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENT SHALL GOVERN. WHERE THERE IS CONFLICT BETWEEN A GENERAL REQUIREMENT AND A SPECIFIC REQUIREMENT, THE SPECIFIC REQUIREMENT SHALL GOVERN.

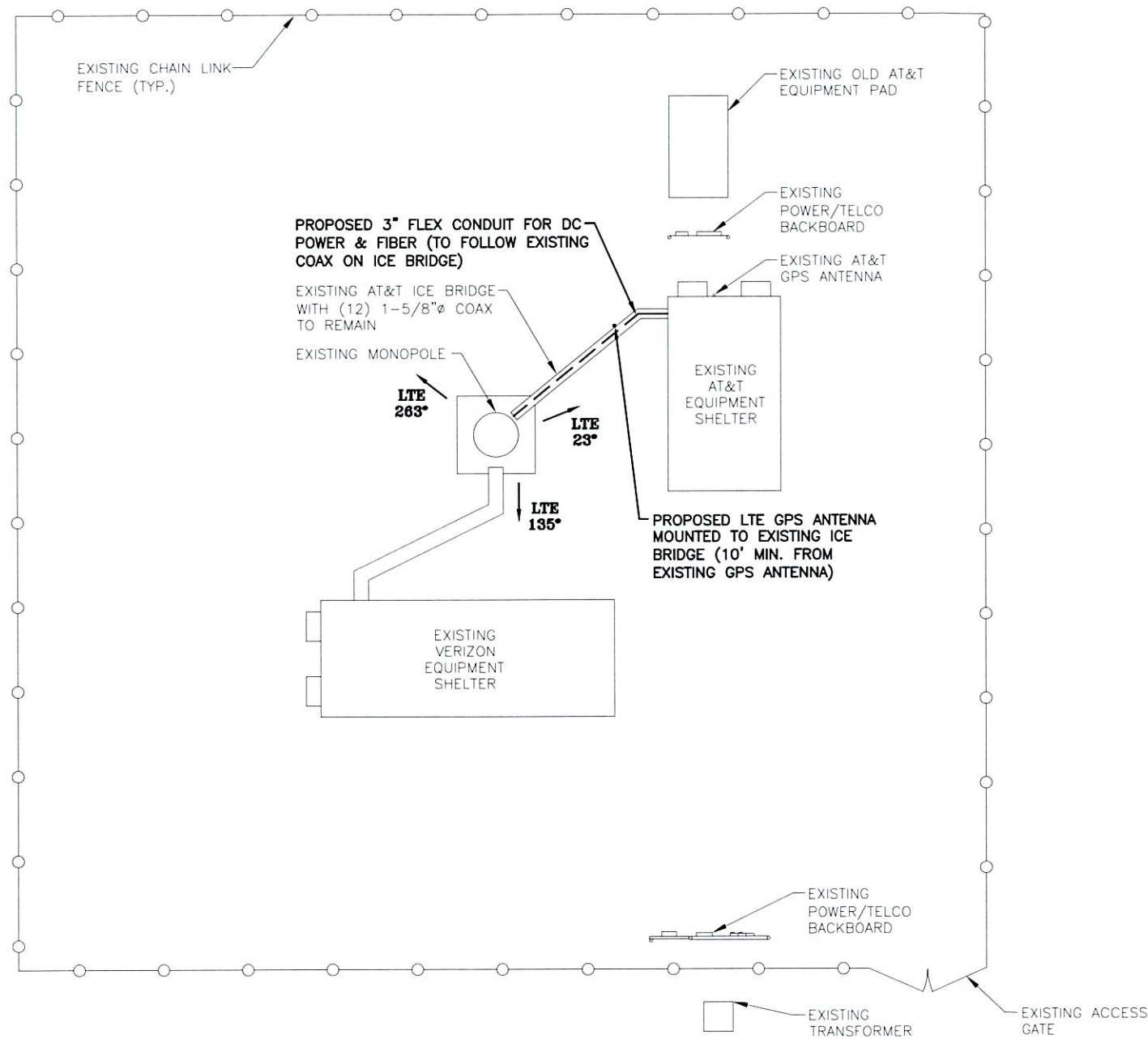
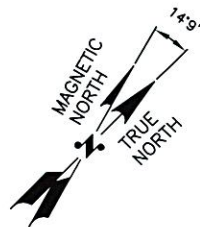
AGL	ABOVE GRADE LEVEL	G.C.	GENERAL CONTRACTOR	RF	RADIO FREQUENCY
AWG	AMERICAN WIRE GAUGE	MGB	MASTER GROUND BUS		
BCW	BARE COPPER WIRE	MIN	MINIMUM	TBD	TO BE DETERMINED
BTS	BASE TRANSCEIVER STATION	PROPOSED	NEW	TBR	TO BE REMOVED
EXISTING	EXISTING	N.T.S.	NOT TO SCALE	TBRR	TO BE REMOVED AND REPLACED
EG	EQUIPMENT GROUND	REF	REFERENCE		
EGR	EQUIPMENT GROUND RING	REQ	REQUIRED	TYP	TYPICAL



856 MIDDLETOWN ROAD
COLCHESTER, CT 06415
NEW LONDON COUNTY



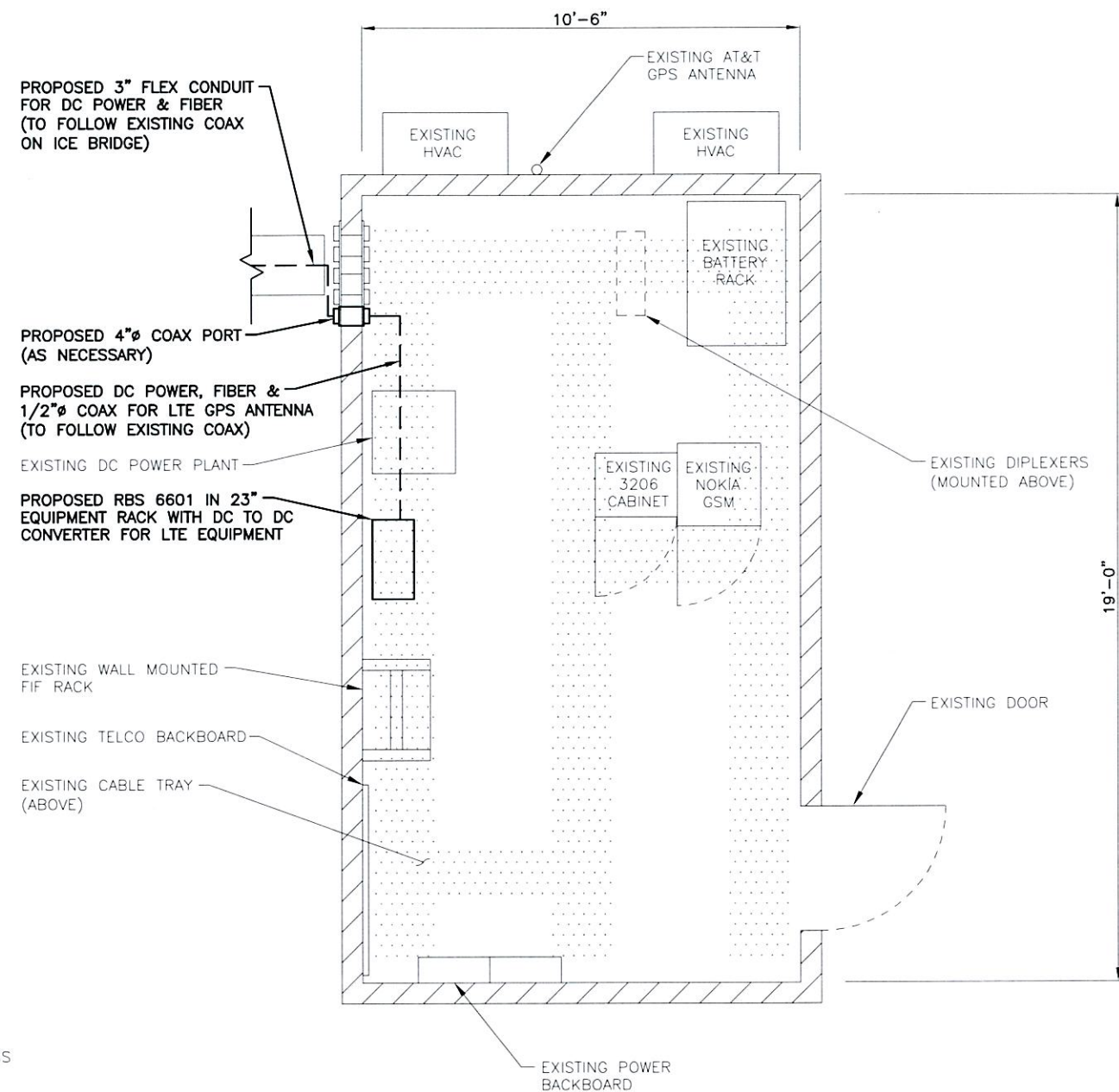
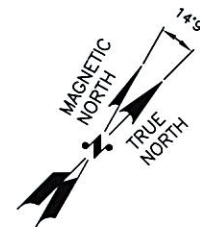
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COMPOUND PLAN

SCALE: 1/8"=1'-0"

0 4'-0" 8'-0" 16'-0" 24'-0"



EQUIPMENT PLAN

SCALE: 1/2"= 1'-0"

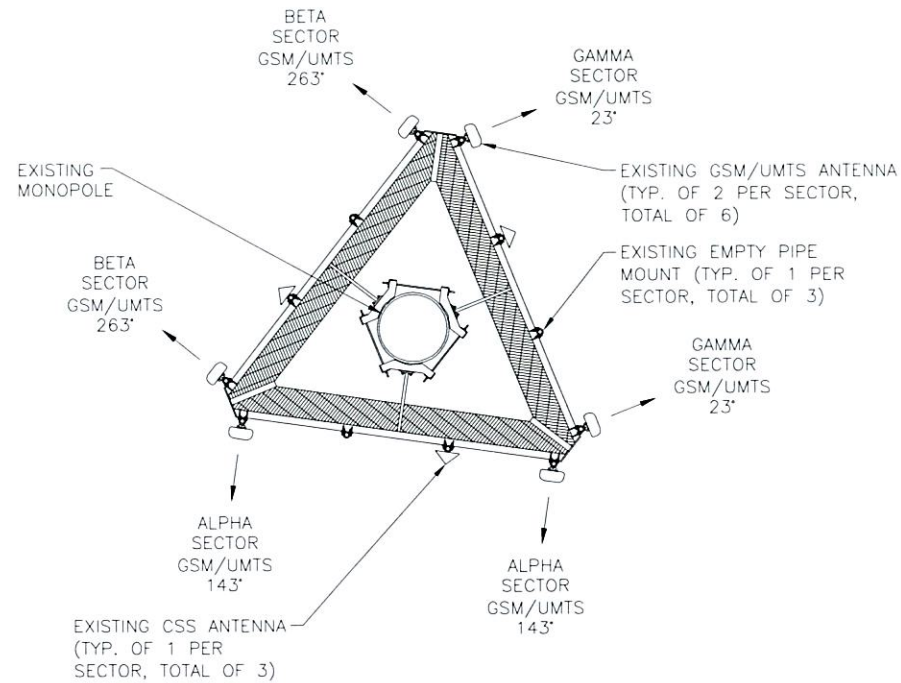
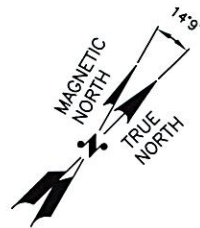
0 1'-0" 2'-0" 4'-0" 6'-0"

NOTE:

AN ANALYSIS FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT SHALL BE DETERMINED PRIOR TO CONSTRUCTION. REFER TO STRUCTURAL ANALYSIS BY: CENTEK ENGINEERING, DATED: SEPTEMBER 28, 2012.

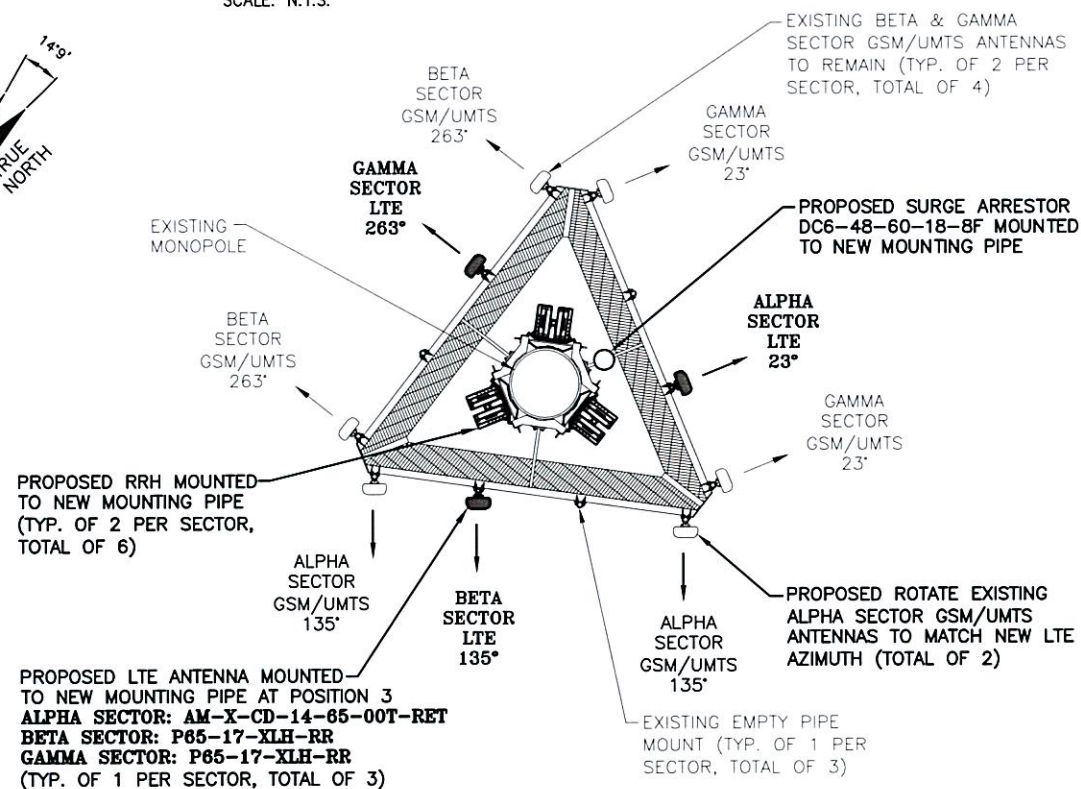
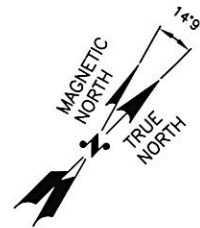
NOTE:

REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.



EXISTING GSM/UMTS ANTENNA PLAN

SCALE: N.T.S.



PROPOSED LTE ANTENNA PLAN

SCALE: N.T.S.

NOTE:

REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

NOTE:

AN ANALYSIS FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT SHALL BE DETERMINED PRIOR TO CONSTRUCTION. REFER TO STRUCTURAL ANALYSIS BY: CENTEK ENGINEERING, DATED: SEPTEMBER 28, 2012.

TOP OF EXISTING TOWER
ELEV. 180'-0"± (AGL)

CENTER OF PROPOSED AT&T LTE ANTENNAS
ELEV. 160'-0"± (AGL)

CENTER OF PROPOSED AT&T
RRHS & SURGE ARRESTOR
ELEV. 159'-0"± (AGL)

PROPOSED LTE ANTENNA MOUNTED TO NEW MOUNTING PIPE AT POSITION 3
ALPHA SECTOR:
AM-X-CD-14-65-00T-RET
BETA SECTOR: P65-17-XLH-RR
GAMMA SECTOR: P65-17-XLH-RR
(TYP. OF 1 PER SECTOR, TOTAL OF 3)

EXISTING ANTENNA BY OTHERS (TYP.)

PROPOSED RRH MOUNTED TO NEW MOUNTING PIPE (TYP. OF 2 PER SECTOR, TOTAL OF 6)

EXISTING GSM/UMTS ANTENNAS (TYP. OF 2 PER SECTOR, TOTAL OF 6)

PROPOSED SURGE ARRESTOR DC6-48-60-18-8F MOUNTED TO NEW MOUNTING PIPE

EXISTING MONOPOLE

PROPOSED DC POWER & FIBER (TO FOLLOW EXISTING COAX)

EXISTING AT&T ICE BRIDGE WITH (12) 1-5/8"Ø COAX TO REMAIN

PROPOSED LTE GPS ANTENNA MOUNTED TO EXISTING ICE BRIDGE (10' MIN. FROM EXISTING GPS ANTENNA)

PROPOSED 3" FLEX CONDUIT FOR DC POWER & FIBER (TO FOLLOW EXISTING COAX ON ICE BRIDGE)

EXISTING AT&T GPS ANTENNA

EXISTING AT&T EQUIPMENT SHELTER

EXISTING POWER/TELCO BACKBORAD

EXISTING CHAIN LINK FENCE (TYP.)

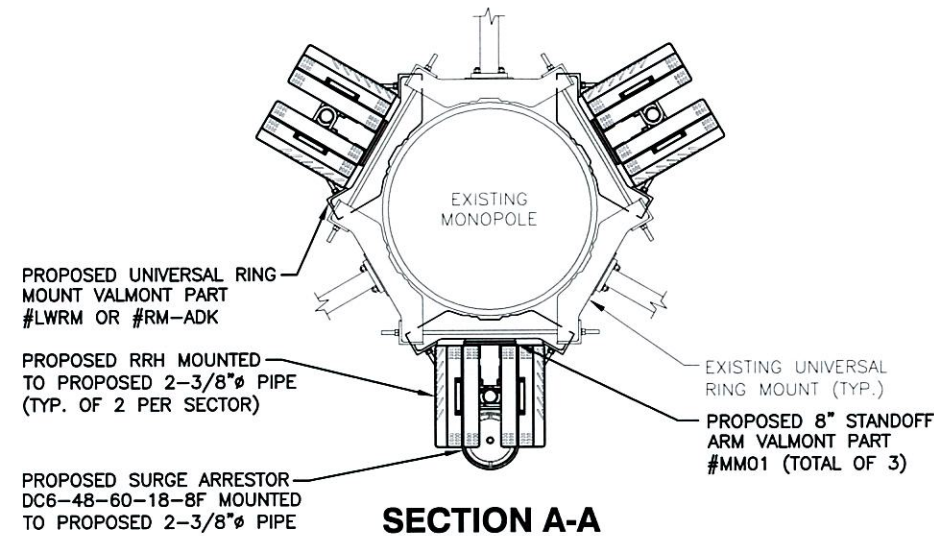
EXISTING VERIZON EQUIPMENT SHELTER

GROUND LEVEL
ELEV. 0'-0"± (AGL)

NORTHWEST ELEVATION

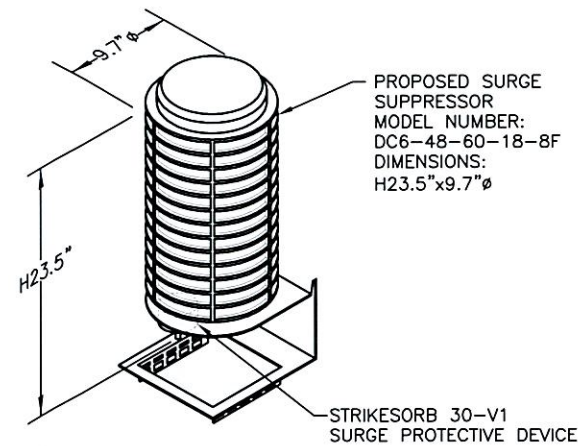
SCALE: 3/32"=1'-0"

4'-10'-8" 21'-4" 32'-0"



NOTE:
REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

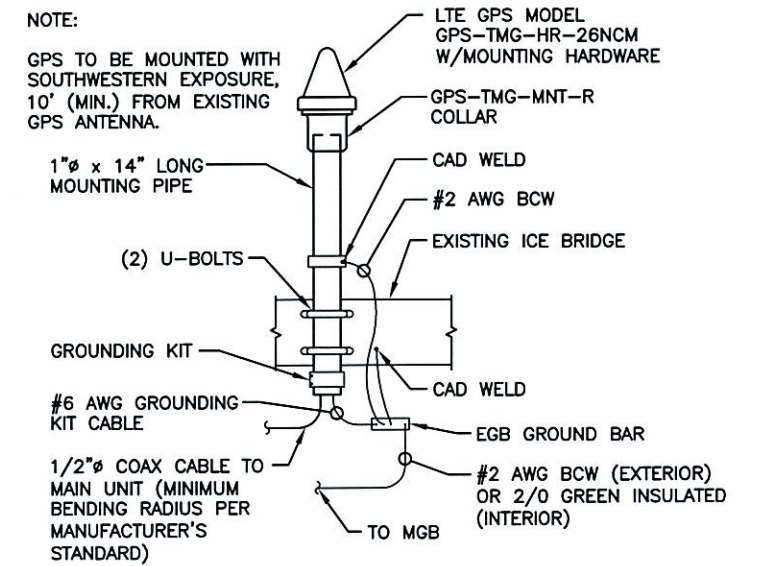
NOTE:
AN ANALYSIS FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT SHALL BE DETERMINED PRIOR TO CONSTRUCTION. REFER TO STRUCTURAL ANALYSIS BY: CENTEK ENGINEERING, DATED: SEPTEMBER 28, 2012.



NOTE:
MOUNT PER MANUFACTURER'S SPECIFICATIONS.

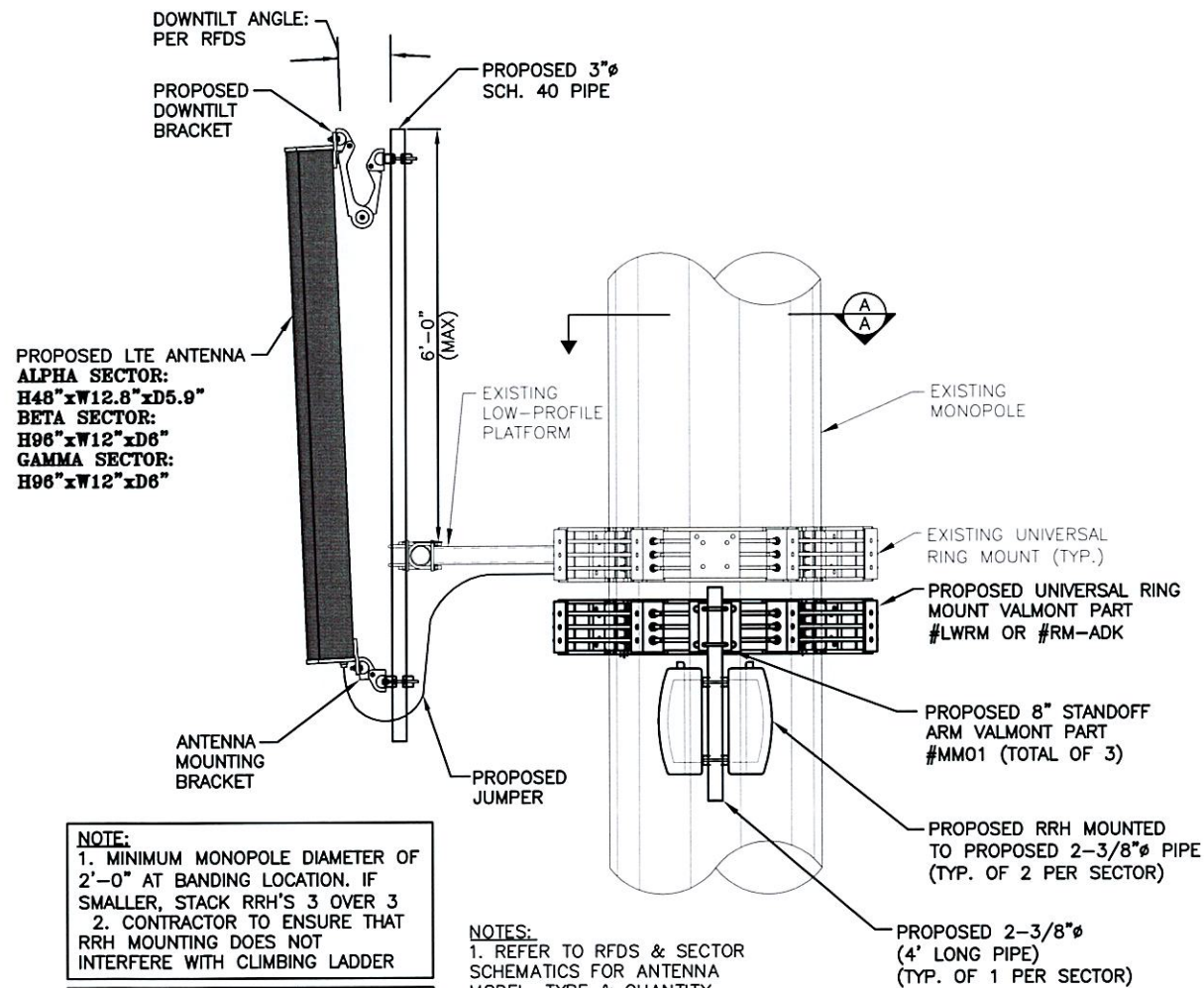
DC SURGE SUPPRESSOR DETAIL

SCALE: N.T.S.



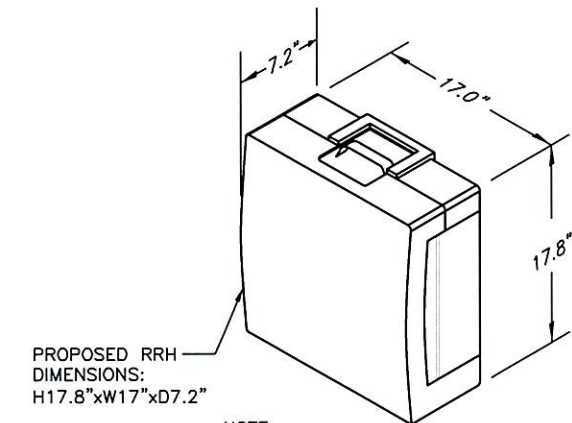
GPS MOUNTING DETAIL

SCALE: N.T.S.



PROPOSED RRH & SURGE ARRESTOR MOUNTING DETAIL

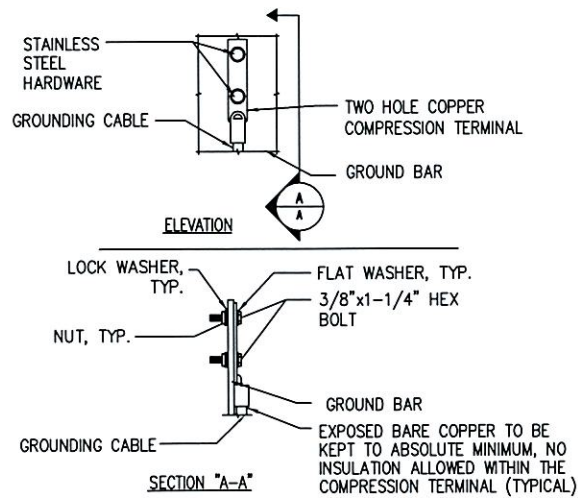
SCALE: N.T.S.



NOTE:
MOUNT PER MANUFACTURER'S SPECIFICATIONS.

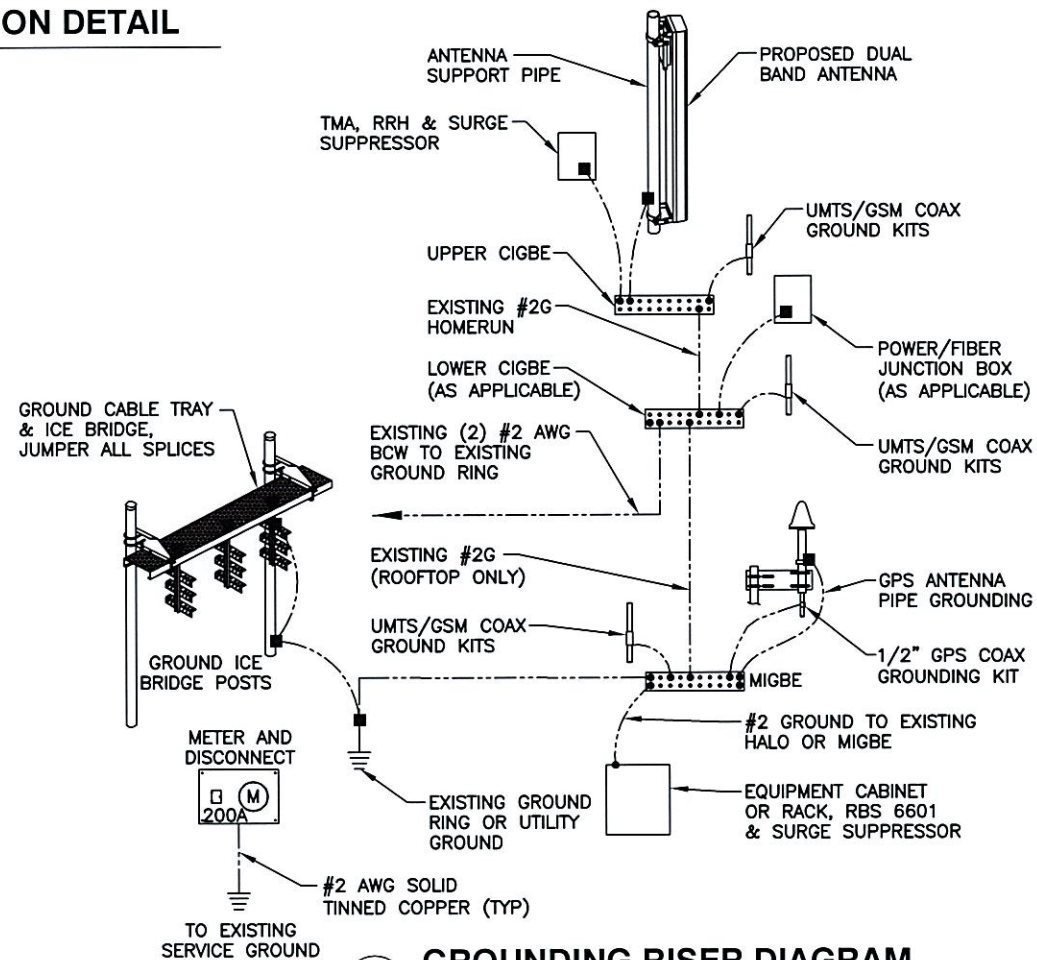
RRH DETAIL

SCALE: N.T.S.

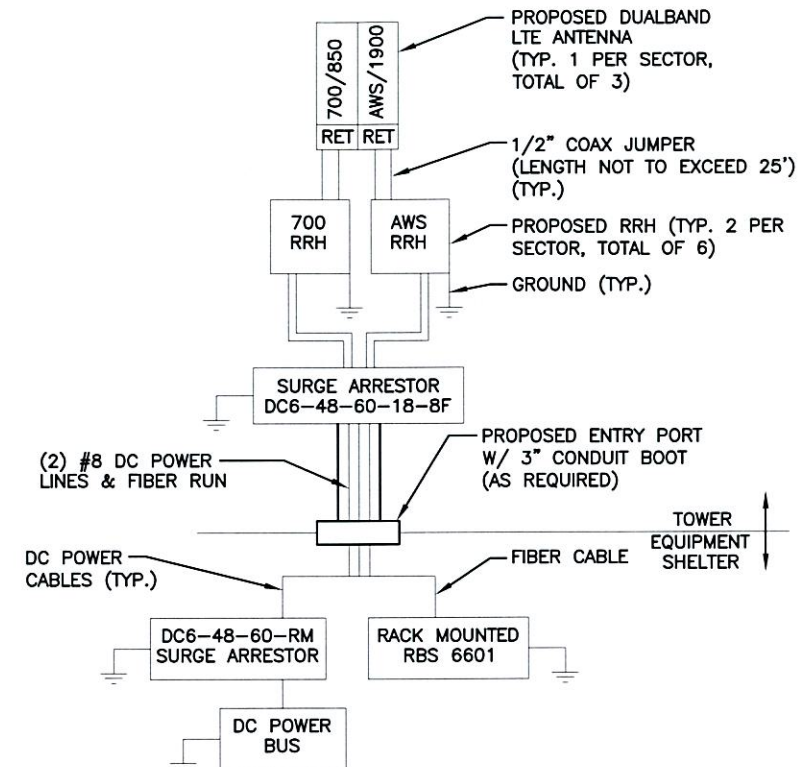


TYPICAL GROUND BAR CONNECTION DETAIL

1
—
N.T.S.



3
—
N.T.S.

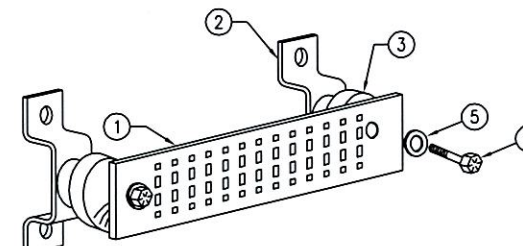


NOTE:

CONTRACTOR TO CONFIRM ALL PARTS & INSTALL ALL EQUIPMENT TO MANUFACTURER'S RECOMMENDATIONS.

2
—
N.T.S.

WIRELESS SOLUTIONS INC.			
NO.	REQ.	PART NO.	DESCRIPTION
①	1	HLGB-0420-IS	SOLID GND. BAR (20"x4"x1/4")
②	2	—	WALL MTG. BRKT.
③	2	—	INSULATORS
④	4	—	5/8"-11x1" H.H.C.S.
⑤	4	—	5/8 LOCKWASHER



4
—
N.T.S.

EACH GROUND CONDUCTOR TERMINATING ON ANY GROUND BAR SHALL HAVE AN IDENTIFICATION TAG ATTACHED AT EACH END THAT WILL IDENTIFY ITS ORIGIN AND DESTINATION.

SECTION "P" - SURGE PRODUCERS

CABLE ENTRY PORTS (HATCH PLATES) (#2)
GENERATOR FRAMEWORK (IF AVAILABLE) (#2)
TELCO GROUND BAR
COMMERCIAL POWER COMMON NEUTRAL/GROUND BOND (#2)
+24V POWER SUPPLY RETURN BAR (#2)
-48V POWER SUPPLY RETURN BAR (#2)
RECTIFIER FRAMES.

SECTION "A" - SURGE ABSORBERS

INTERIOR GROUND RING (#2)
EXTERNAL EARTH GROUND FIELD (BURIED GROUND RING) (#2)
METALLIC COLD WATER PIPE (IF AVAILABLE) (#2)
BUILDING STEEL (IF AVAILABLE) (#2)

Structural Analysis Report

180-ft Existing EEL Monopole

*Proposed AT&T Mobility
Antenna Upgrade*

AT&T Site Ref: CT2233

Verizon Site Ref: Colchester South

*856 Middletown Road
Colchester, CT*

Centek Project No. 12044.CO14

Date: September 28, 2012



Prepared for:

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

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Introduction

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

The host tower is a 180-ft tall, five-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI job no; 11294-E01), dated November 16, 2002. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned EEI design documents.

Antenna and appurtenance information were obtained from a previous structural analysis report prepared by Centek job no. 11074.CO23 dated November 30, 2011 and an AT&T tower site leasing form.

The tower is made up of five (5) tapered vertical sections consisting of A572-65 pole sections. The bottom four (4) vertical tower sections are slip joint connected and the top vertical tower section is flange connected. The diameter of the pole (flat-flat) is 14.5-in at the top and 60.5-in at the base.

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

Antenna and Appurtenance Summary

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

- VERIZON (RESERVED):
Antennas: Six (6) Antel LPA-80063-6CF panel antennas, six (6) Antel BXA-70063-6CF panel antennas, six (6) LPA-171063-12CF panel antennas and three (3) RRH's mounted to a 13-ft low profile platform with a RAD center elevation of 181-ft above grade.
Coax Cables: Twelve (12) 1-5/8" $\varnothing$ coax cables running on the inside of the existing tower. Six (6) 1-5/8" $\varnothing$ coax cables and one (1) 1-1/4" $\varnothing$ fiber cable banded to the exterior of the existing tower.
- AT&T (EXISTING TO REMAIN):
Antennas: Six (6) Powerwave 7770 panel antennas, six (6) Powerwave LGP21401 TMA's, six (6) Powerwave LGP21901 diplexers and three (3) Bias-T mounted on a 13-ft low profile platform with a RAD center elevation of 160-ft above existing grade.
Coax Cables: Twelve (12) 1-5/8" $\varnothing$ coax cables running on the inside of the existing tower.
- AT&T (EXISTING TO REMOVE):
Antennas: Three (3) CSS DUO1417-8686 panel antennas on a 13-ft low profile platform with a RAD center elevation of 160-ft above existing grade.

- **AT&T (RESERVED):**
Antennas: Three (3) Powerwave 7770 panel antennas on a 13-ft low profile platform with a RAD center elevation of 160-ft above existing grade.
- **AT&T (PROPOSED):**
Antennas: One (1) KMW AM-X-CD-14-65-00T-RET and two (2) Powerwave P65-17-XLH-RR panel antennas mounted on a 13-ft low profile platform with a RAD center elevation of 160-ft above grade level.
- **AT&T (PROPOSED):**
Antennas: Six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrester mounted to one (1) universal ring mount with a RAD center elevation of 159-ft above grade level.
Coax Cables: One (1) fiber cable and two (2) dc control cables running inside of the existing tower.

Primary Assumptions Used in the Analysis

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

Analysis

The existing tower was analyzed using a comprehensive computer program entitled 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 CSBC¹ 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:	New London; v = 85 mph (fastest mile)	[Section 16 of TIA/EIA-222-F-96]
	Colchester; v = 105 mph (3 second gust) equivalent to v = 85 mph (fastest mile)	[Appendix K of the 2005 CT Building Code Supplement]
	TIA/EIA-222-F and Appendix K wind speeds are equal.	
Load Cases:	<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

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

Tower Capacity

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

- Calculated stresses were found to be within allowable limits. In Load Case 1, per RISATower "Section Capacity Table", this tower was found to be at **97.7%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L1)	151.00'-179.00'	97.7%	PASS

Foundation and Anchors

The existing foundation consists of a 8.0-ft Ø x 28.0-ft long reinforced concrete caisson. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; project no. 11294-E01 dated November 16, 2002. The base of the tower is connected to the foundation by means of (16) 2.25"Ø, ASTM A615-75 anchor bolts embedded approximately 7-ft into the concrete foundation structure.

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

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

Location	Vector	Proposed Reactions
Base	Shear	28 kips
	Compression	40 kips
	Moment	3485 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	Proposed Loading	Result
Reinforced Concrete Caisson	Moment Capacity	52.0%	PASS
	Lateral Deflection	0.76 in ⁽¹⁾	

Note 1: Lateral deflection typically limited to 1.0" for monopole tower structures.

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Colchester, CT
September 28, 2012

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Flange Bolts	Tension	54.3%	PASS
Flange Plate	Bending	73.7%	PASS
Anchor Bolts	Compression	78.0%	PASS
Base Plate	Bending	89.0%	PASS

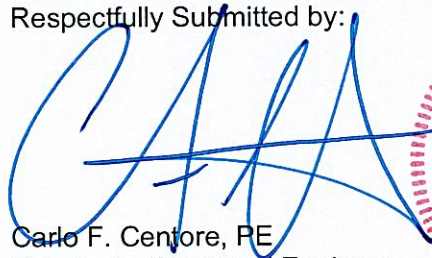
Conclusion

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

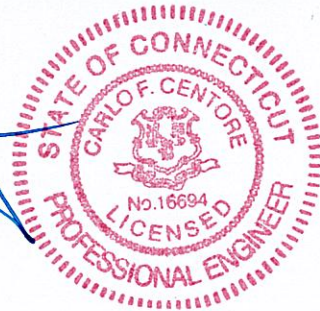
The analysis is based, in part, on the information provided to this office by AT&T Mobility. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

Respectfully Submitted by:



Carlo F. Centore, PE
Principal ~ Structural Engineer



Prepared by:



Timothy J. Lynn, EIT
Structural Engineer

CEN TEK Engineering, Inc.
Structural Analysis - 180-ft EEI Monopole
AT&T Antenna Upgrade – CT2233
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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:

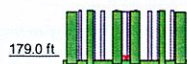
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or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

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

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

RISATower Features:

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



179.0 ft

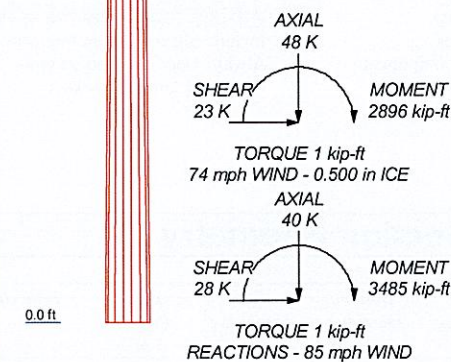
151.0 ft

125.9 ft

85.8 ft

42.1 ft

0.0 ft



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
LPA-80063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Existing)	160
LPA-171063-12CF (Verizon - Reserved)	181	7770.00 (ATI - Existing)	160
BXA-70063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Existing)	160
BXA-70063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Existing)	160
LPA-171063-12CF (Verizon - Reserved)	181	(2) LGP21401 TMA (ATI - Existing)	160
LPA-80063/6CF (Verizon - Reserved)	181	(2) LGP21401 TMA (ATI - Existing)	160
LPA-80063/6CF (Verizon - Reserved)	181	(2) LGP21401 TMA (ATI - Existing)	160
LPA-171063-12CF (Verizon - Reserved)	181	(2) LGP21901 Diplexer (ATI - Existing)	160
BXA-70063/6CF (Verizon - Reserved)	181	(2) LGP21901 Diplexer (ATI - Existing)	160
BXA-70063/6CF (Verizon - Reserved)	181	(2) LGP21901 Diplexer (ATI - Existing)	160
LPA-171063-12CF (Verizon - Reserved)	181	Smart Bias T (ATI - Existing)	160
LPA-80063/6CF (Verizon - Reserved)	181	Smart Bias T (ATI - Existing)	160
LPA-80063/6CF (Verizon - Reserved)	181	Smart Bias T (ATI - Existing)	160
LPA-171063-12CF (Verizon - Reserved)	181	7770.00 (ATI - Reserved)	160
BXA-70063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Reserved)	160
BXA-70063/6CF (Verizon - Reserved)	181	7770.00 (ATI - Reserved)	160
LPA-171063-12CF (Verizon - Reserved)	181	AM-X-CD-14-65-00T-RET (ATI - Proposed)	160
BXA-70063/6CF (Verizon - Reserved)	181	P65-17-XLH-RR (ATI - Proposed)	160
BXA-70063/6CF (Verizon - Reserved)	181	P65-17-XLH-RR (ATI - Proposed)	160
LPA-171063-12CF (Verizon - Reserved)	181	(2) RRUS-11 (ATI - Proposed)	159
LPA-80063/6CF (Verizon - Reserved)	181	(2) RRUS-11 (ATI - Proposed)	159
RRH (Verizon - Reserved)	181	(2) RRUS-11 (ATI - Proposed)	159
RRH (Verizon - Reserved)	181	DC6-48-60-18-8F Surge Arrestor (ATI - Proposed)	159
RRH (Verizon - Reserved)	181	13' Low Profile Platform (ATI - Existing)	158
EE1 14-ft Low Profile Platform (Verizon - Existing)	178.5	Valmont Uni-Tri Bracket (ATI - Proposed)	156
7770.00 (ATI - Existing)	160		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 97.7%

Centek Engineering Inc.

63-2 North Branford Rd.

Branford, CT 06405

Phone: (203) 488-0580

FAX: (203) 488-8587

Job: 12044.CO14 - CT2233

Project: 150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT

Client: AT&T Mobility

Drawn by: T.J.L.

App'd:

Code: TIA/EIA-222-F

Date: 09/28/12

Scale: NTS

Path: J:\Users\12044\00\WC\014 - AT&T CT2233\Draws\FRI Files\150' EEI Monopole Colchester CT.dwg

Dwg No. E-1

<i>RISATower</i> Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page	1 of 22
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	Client	AT&T Mobility	Designed by	TJL

Tower Input Data

There is a pole section.

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

The following design criteria apply:

Basic wind speed of 85 mph.

Nominal ice thickness of 0.500 in.

Ice density of 56 pcf.

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

Temperature drop of 50 °F.

Deflections calculated using a wind speed of 50 mph.

Weld together tower sections have flange connections..

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

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

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

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

Pressures are calculated at each section.

Stress ratio used in pole design is 1.333.

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

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	179.000-151.000	28.000	0.000	18	14.500	22.070	0.188	0.750	A572-65 (65 ksi)
L2	151.000-125.920	25.080	4.166	18	22.070	28.850	0.250	1.000	A572-65 (65 ksi)
L3	125.920-85.796	44.290	5.416	18	27.224	39.060	0.375	1.500	A572-65 (65 ksi)

<i>RISA</i>Tower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page	2 of 22
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	Client	AT&T Mobility	Designed by	TJL

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L4	85.796-42.132	49.080	6.750	18	36.863	49.990	0.375	1.500	A572-65 (65 ksi)
L5	42.132-0.000	48.882		18	47.435	60.500	0.438	1.750	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in ²	I in ⁴	r in	C in	I/C in ³	J in ⁴	Iu/Q in ³	w in	w/t
L1	14.724	8.518	220.441	5.081	7.366	29.927	441.172	4.260	2.222	11.851
	22.410	13.023	787.837	7.768	11.212	70.270	1576.711	6.513	3.554	18.956
L2	22.410	17.314	1041.474	7.746	11.212	92.893	2084.319	8.659	3.444	13.777
	29.295	22.694	2345.214	10.153	14.656	160.020	4693.514	11.349	4.638	18.55
L3	28.774	31.957	2910.379	9.531	13.830	210.444	5824.588	15.981	4.131	11.017
	39.663	46.045	8705.695	13.733	19.842	438.740	17422.845	23.027	6.215	16.572
L4	38.902	43.429	7304.859	12.953	18.726	390.088	14619.331	21.719	5.828	15.541
	50.761	59.054	18366.002	17.613	25.395	723.216	36756.170	29.533	8.138	21.702
L5	49.998	65.261	18211.055	16.684	24.097	755.747	36446.073	32.637	7.578	17.322
	61.433	83.404	38013.044	21.322	30.734	1236.840	76076.106	41.710	9.878	22.578

Tower Elevation ft	Gusset Area (per face) ft ²	Gusset Thickness in	Gusset Grade	Adjust. Factor A _f	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 179.000-151.000				1	1	1		
L2 151.000-125.920				1	1	1		
L3 125.920-85.796				1	1	1		
L4 85.796-42.132				1	1	1		
L5 42.132-0.000				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C _A A _A ft ² /ft	Weight klf
1 5/8 (Verizon - Existing)	C	No	Inside Pole	178.000 - 3.000	12	No Ice	0.000	0.001
1 5/8 (AT&T - Existing)	C	No	Inside Pole	160.000 - 3.000	12	1/2" Ice	0.000	0.001
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	178.000 - 3.000	1	No Ice	0.198	0.001
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	178.000 - 3.000	5	1/2" Ice	0.298	0.003
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	178.000 - 3.000	5	No Ice	0.000	0.001
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	178.000 - 3.000	5	1/2" Ice	0.000	0.003

<i>RISATower</i> <i>Centek Engineering Inc.</i> 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page 3 of 22
	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date 11:27:29 09/28/12
	Client	AT&T Mobility	Designed by TJL

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C _A A _A ft ² /ft	Weight klf
HYBRIFLEX 1-1/4" (Verizon - Reserved)	C	No	CaAa (Out Of Face)	178.000 - 3.000	1	No Ice	0.000	0.001
RG6-Fiber	C	No	Inside Pole	160.000 - 3.000	1	1/2" Ice	0.000	0.003
(AT&T - Proposed)						No Ice	0.000	0.001
#8 AWG Copper Wire	C	No	Inside Pole	160.000 - 3.000	2	1/2" Ice	0.000	0.001
(AT&T - Proposed)						No Ice	0.000	0.000
						1/2" Ice	0.000	0.000

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
L1	179.000-151.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	5.346	0.663
L2	151.000-125.920	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	4.966	0.843
L3	125.920-85.796	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	7.945	1.348
L4	85.796-42.132	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	8.645	1.467
L5	42.132-0.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	7.748	1.315

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
L1	179.000-151.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	8.046	0.941
L2	151.000-125.920	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	7.474	1.101
L3	125.920-85.796	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	11.957	1.762
L4	85.796-42.132	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	13.012	1.917
L5	42.132-0.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	11.661	1.718

Discrete Tower Loads

<i>RISATower</i> Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page	4 of 22
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	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K
LPA-80063/6CF (Verizon - Reserved)	A	From Face	3.000 6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-171063-12CF (Verizon - Reserved)	A	From Face	3.000 4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
BXA-70063/6CF (Verizon - Reserved)	A	From Face	3.000 1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
BXA-70063/6CF (Verizon - Reserved)	A	From Face	3.000 -1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
LPA-171063-12CF (Verizon - Reserved)	A	From Face	3.000 -4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
LPA-80063/6CF (Verizon - Reserved)	A	From Face	3.000 -6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-80063/6CF (Verizon - Reserved)	B	From Face	3.000 6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-171063-12CF (Verizon - Reserved)	B	From Face	3.000 4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
BXA-70063/6CF (Verizon - Reserved)	B	From Face	3.000 1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
BXA-70063/6CF (Verizon - Reserved)	B	From Face	3.000 -1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
LPA-171063-12CF (Verizon - Reserved)	B	From Face	3.000 -4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
LPA-80063/6CF (Verizon - Reserved)	B	From Face	3.000 -6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-80063/6CF (Verizon - Reserved)	C	From Face	3.000 6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-171063-12CF (Verizon - Reserved)	C	From Face	3.000 4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
BXA-70063/6CF (Verizon - Reserved)	C	From Face	3.000 1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
BXA-70063/6CF (Verizon - Reserved)	C	From Face	3.000 -1.000 0.000	0.000	181.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
LPA-171063-12CF (Verizon - Reserved)	C	From Face	3.000 -4.000 0.000	0.000	181.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
LPA-80063/6CF (Verizon - Reserved)	C	From Face	3.000 -6.000 0.000	0.000	181.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
RRH (Verizon - Reserved)	A	From Face	3.000 0.000 0.000	0.000	181.000	No Ice 1/2" Ice	0.000 0.000	0.000 0.000	0.050 0.072

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	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date	11:27:29 09/28/12
	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
RRH (Verizon - Reserved)	B	From Face	3.000 0.000 0.000	0.000	181.000	No Ice 1/2" Ice	0.000 0.000	0.000 0.000	0.050 0.072
RRH (Verizon - Reserved)	C	From Face	3.000 0.000 0.000	0.000	181.000	No Ice 1/2" Ice	0.000 0.000	0.000 0.000	0.050 0.072
EEI 14-ft Low Profile Platform (Verizon - Existing)	C	None		0.000	178.500	No Ice 1/2" Ice	16.500 20.000	16.500 20.000	1.550 1.800
7770.00 (AT&T - Existing)	A	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	A	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	B	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	B	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	C	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Existing)	C	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
(2) LGP21401 TMA (AT&T - Existing)	A	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21401 TMA (AT&T - Existing)	B	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21401 TMA (AT&T - Existing)	C	From Face	3.000 -6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21901 Diplexer (AT&T - Existing)	A	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
(2) LGP21901 Diplexer (AT&T - Existing)	B	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
(2) LGP21901 Diplexer (AT&T - Existing)	C	From Face	3.000 6.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
Smart Bias T (AT&T - Existing)	A	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.156 0.212	0.078 0.121	0.002 0.003
Smart Bias T (AT&T - Existing)	B	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.156 0.212	0.078 0.121	0.002 0.003
Smart Bias T (AT&T - Existing)	C	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	0.156 0.212	0.078 0.121	0.002 0.003
13' Low Profile Platform (AT&T - Existing)	C	None		0.000	158.000	No Ice 1/2" Ice	15.700 20.100	15.700 20.100	1.300 1.765
7770.00	A	From Face	3.000	0.000	160.000	No Ice	5.882	2.928	0.035

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	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date	11:27:29 09/28/12
	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
(AT&T - Reserved)			-2.000 0.000			1/2" Ice	6.314	3.273	0.068
7770.00 (AT&T - Reserved)	B	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
7770.00 (AT&T - Reserved)	C	From Face	3.000 -2.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
AM-X-CD-14-65-00T-RET (AT&T - Proposed)	A	From Face	3.000 2.000 0.000	0.000	160.000	No Ice 1/2" Ice	5.507 5.899	2.828 3.137	0.037 0.069
P65-17-XLH-RR (AT&T - Proposed)	B	From Face	3.000 2.000 0.000	0.000	160.000	No Ice 1/2" Ice	11.467 12.083	6.800 7.384	0.062 0.124
P65-17-XLH-RR (AT&T - Proposed)	C	From Face	3.000 2.000 0.000	0.000	160.000	No Ice 1/2" Ice	11.467 12.083	6.800 7.384	0.062 0.124
(2) RRUS-11 (AT&T - Proposed)	A	From Face	1.000 2.000 0.000	0.000	159.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
(2) RRUS-11 (AT&T - Proposed)	B	From Face	1.000 2.000 0.000	0.000	159.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
(2) RRUS-11 (AT&T - Proposed)	C	From Face	1.000 2.000 0.000	0.000	159.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
DC6-48-60-18-8F Surge Arrestor (AT&T - Proposed)	C	From Face	0.500 0.000 0.000	0.000	159.000	No Ice 1/2" Ice	2.228 2.447	2.228 2.447	0.020 0.039
Valmont Uni-Tri Bracket (AT&T - Proposed)	C	None		0.000	156.000	No Ice 1/2" Ice	1.750 1.940	1.750 1.940	0.290 0.306

Tower Pressures - No Ice

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _{AA} In Face ft ²	C _{AA} Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²			
L1 179.000-151.0 00	164.034	1.581	0.029	42.665	A	0.000	42.665	42.665	100.00	0.000	0.000
					B	0.000	42.665		100.00	0.000	0.000
					C	0.000	42.665		100.00	0.000	5.346
L2 151.000-125.9 20	137.903	1.505	0.028	53.211	A	0.000	53.211	53.211	100.00	0.000	0.000
					B	0.000	53.211		100.00	0.000	0.000
					C	0.000	53.211		100.00	0.000	4.966
L3 125.920-85.79 6	105.065	1.392	0.026	112.677	A	0.000	112.677	112.677	100.00	0.000	0.000
					B	0.000	112.677		100.00	0.000	0.000
					C	0.000	112.677		100.00	0.000	7.945
L4	63.538	1.206	0.022	160.649	A	0.000	160.649	160.649	100.00	0.000	0.000

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	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date	11:27:29 09/28/12
	Client	AT&T Mobility	Designed by	TJL

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²			
85.796-42.132					B	0.000	160.649		100.00	0.000	0.000
					C	0.000	160.649		100.00	0.000	8.645
L5	20.345	1	0.018	192.646	A	0.000	192.646	192.646	100.00	0.000	0.000
42.132-0.000					B	0.000	192.646		100.00	0.000	0.000
					C	0.000	192.646		100.00	0.000	7.748

Tower Pressure - With Ice

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	t _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	in	ft ²		ft ²	ft ²	ft ²			
L1	164.034	1.581	0.022	0.500	44.998	A	0.000	44.998	44.998	100.00	0.000	0.000
179.000-151.000						B	0.000	44.998		100.00	0.000	0.000
						C	0.000	44.998		100.00	0.000	8.046
L2	137.903	1.505	0.021	0.500	55.301	A	0.000	55.301	55.301	100.00	0.000	0.000
151.000-125.920						B	0.000	55.301		100.00	0.000	0.000
						C	0.000	55.301		100.00	0.000	7.474
L3	105.065	1.392	0.019	0.500	116.020	A	0.000	116.020	116.020	100.00	0.000	0.000
125.920-85.796						B	0.000	116.020		100.00	0.000	0.000
						C	0.000	116.020		100.00	0.000	11.957
L4	63.538	1.206	0.017	0.500	164.288	A	0.000	164.288	164.288	100.00	0.000	0.000
85.796-42.132						B	0.000	164.288		100.00	0.000	0.000
						C	0.000	164.288		100.00	0.000	13.012
L5	20.345	1	0.014	0.500	196.157	A	0.000	196.157	196.157	100.00	0.000	0.000
42.132-0.000						B	0.000	196.157		100.00	0.000	0.000
						C	0.000	196.157		100.00	0.000	11.661

Tower Pressure - Service

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²			
L1	164.034	1.581	0.010	42.665	A	0.000	42.665	42.665	100.00	0.000	0.000
179.000-151.000					B	0.000	42.665		100.00	0.000	0.000
					C	0.000	42.665		100.00	0.000	5.346
L2	137.903	1.505	0.010	53.211	A	0.000	53.211	53.211	100.00	0.000	0.000
151.000-125.920					B	0.000	53.211		100.00	0.000	0.000
					C	0.000	53.211		100.00	0.000	4.966
L3	105.065	1.392	0.009	112.677	A	0.000	112.677	112.677	100.00	0.000	0.000
125.920-85.796					B	0.000	112.677		100.00	0.000	0.000
					C	0.000	112.677		100.00	0.000	7.945
L4	63.538	1.206	0.008	160.649	A	0.000	160.649	160.649	100.00	0.000	0.000
85.796-42.132					B	0.000	160.649		100.00	0.000	0.000
					C	0.000	160.649		100.00	0.000	8.645
L5	20.345	1	0.006	192.646	A	0.000	192.646	192.646	100.00	0.000	0.000
42.132-0.000					B	0.000	192.646		100.00	0.000	0.000

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	Project 150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT Client AT&T Mobility	Date 11:27:29 09/28/12 Designed by TJL

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²			
					C	0.000	192.646		100.00	0.000	7.748

Tower Forces - No Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.663	1.026	A	1	0.65	1	1	1	42.665	1.635	0.058	C
179.000-151.0			B	1	0.65	1	1	1	42.665			
00			C	1	0.65	1	1	1	42.665			
L2	0.843	1.707	A	1	0.65	1	1	1	53.211	1.860	0.074	C
151.000-125.9			B	1	0.65	1	1	1	53.211			
20			C	1	0.65	1	1	1	53.211			
L3	1.348	5.878	A	1	0.65	1	1	1	112.677	3.527	0.088	C
125.920-85.79			B	1	0.65	1	1	1	112.677			
6			C	1	0.65	1	1	1	112.677			
L4	1.467	8.558	A	1	0.65	1	1	1	160.649	4.239	0.097	C
85.796-42.132			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5	1.315	12.364	A	1	0.65	1	1	1	192.646	4.156	0.099	C
42.132-0.000			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	1249.170 kip-ft	15.417		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.663	1.026	A	1	0.65	1	1	1	42.665	1.635	0.058	C
179.000-151.0			B	1	0.65	1	1	1	42.665			
00			C	1	0.65	1	1	1	42.665			
L2	0.843	1.707	A	1	0.65	1	1	1	53.211	1.860	0.074	C
151.000-125.9			B	1	0.65	1	1	1	53.211			
20			C	1	0.65	1	1	1	53.211			
L3	1.348	5.878	A	1	0.65	1	1	1	112.677	3.527	0.088	C
125.920-85.79			B	1	0.65	1	1	1	112.677			
6			C	1	0.65	1	1	1	112.677			
L4	1.467	8.558	A	1	0.65	1	1	1	160.649	4.239	0.097	C
85.796-42.132			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5	1.315	12.364	A	1	0.65	1	1	1	192.646	4.156	0.099	C
42.132-0.000			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	1249.170 kip-ft	15.417		

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	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date	11:27:29 09/28/12
	Client	AT&T Mobility	Designed by	TJL

Tower Forces - No Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.663	1.026	A	1	0.65	1	1	1	42.665	1.635	0.058	C
179.000-151.0			B	1	0.65	1	1	1	42.665			
00			C	1	0.65	1	1	1	42.665			
L2	0.843	1.707	A	1	0.65	1	1	1	53.211	1.860	0.074	C
151.000-125.9			B	1	0.65	1	1	1	53.211			
20			C	1	0.65	1	1	1	53.211			
L3	1.348	5.878	A	1	0.65	1	1	1	112.677	3.527	0.088	C
125.920-85.79			B	1	0.65	1	1	1	112.677			
6			C	1	0.65	1	1	1	112.677			
L4	1.467	8.558	A	1	0.65	1	1	1	160.649	4.239	0.097	C
85.796-42.132			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5	1.315	12.364	A	1	0.65	1	1	1	192.646	4.156	0.099	C
42.132-0.000			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	1249.170 kip-ft	15.417		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.663	1.026	A	1	0.65	1	1	1	42.665	1.635	0.058	C
179.000-151.0			B	1	0.65	1	1	1	42.665			
00			C	1	0.65	1	1	1	42.665			
L2	0.843	1.707	A	1	0.65	1	1	1	53.211	1.860	0.074	C
151.000-125.9			B	1	0.65	1	1	1	53.211			
20			C	1	0.65	1	1	1	53.211			
L3	1.348	5.878	A	1	0.65	1	1	1	112.677	3.527	0.088	C
125.920-85.79			B	1	0.65	1	1	1	112.677			
6			C	1	0.65	1	1	1	112.677			
L4	1.467	8.558	A	1	0.65	1	1	1	160.649	4.239	0.097	C
85.796-42.132			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5	1.315	12.364	A	1	0.65	1	1	1	192.646	4.156	0.099	C
42.132-0.000			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	1249.170 kip-ft	15.417		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	

RISATower

Centek Engineering Inc.
 63-2 North Branford Rd.
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Project

150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT

Date

11:27:29 09/28/12

Client

AT&T Mobility

Designed by

TJL

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.941	1.351	A	1	0.65	1	1	1	44.998	1.382	0.049	C
179.000-151.0			B	1	0.65	1	1	1	44.998			
00			C	1	0.65	1	1	1	44.998			
L2	1.101	2.109	A	1	0.65	1	1	1	55.301	1.532	0.061	C
151.000-125.9			B	1	0.65	1	1	1	55.301			
20			C	1	0.65	1	1	1	55.301			
L3	1.762	6.725	A	1	0.65	1	1	1	116.020	2.847	0.071	C
125.920-85.79			B	1	0.65	1	1	1	116.020			
6			C	1	0.65	1	1	1	116.020			
L4	1.917	9.761	A	1	0.65	1	1	1	164.288	3.368	0.077	C
85.796-42.132			B	1	0.65	1	1	1	164.288			
			C	1	0.65	1	1	1	164.288			
L5	1.718	13.804	A	1	0.65	1	1	1	196.157	3.263	0.077	C
42.132-0.000			B	1	0.65	1	1	1	196.157			
			C	1	0.65	1	1	1	196.157			
Sum Weight:	7.439	33.749						OTM	1017.484 kip-ft	12.392		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.941	1.351	A	1	0.65	1	1	1	44.998	1.382	0.049	C
179.000-151.0			B	1	0.65	1	1	1	44.998			
00			C	1	0.65	1	1	1	44.998			
L2	1.101	2.109	A	1	0.65	1	1	1	55.301	1.532	0.061	C
151.000-125.9			B	1	0.65	1	1	1	55.301			
20			C	1	0.65	1	1	1	55.301			
L3	1.762	6.725	A	1	0.65	1	1	1	116.020	2.847	0.071	C
125.920-85.79			B	1	0.65	1	1	1	116.020			
6			C	1	0.65	1	1	1	116.020			
L4	1.917	9.761	A	1	0.65	1	1	1	164.288	3.368	0.077	C
85.796-42.132			B	1	0.65	1	1	1	164.288			
			C	1	0.65	1	1	1	164.288			
L5	1.718	13.804	A	1	0.65	1	1	1	196.157	3.263	0.077	C
42.132-0.000			B	1	0.65	1	1	1	196.157			
			C	1	0.65	1	1	1	196.157			
Sum Weight:	7.439	33.749						OTM	1017.484 kip-ft	12.392		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.941	1.351	A	1	0.65	1	1	1	44.998	1.382	0.049	C
179.000-151.0			B	1	0.65	1	1	1	44.998			
00			C	1	0.65	1	1	1	44.998			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L2	1.101	2.109	A	1	0.65	1	1	1	55.301	1.532	0.061	C
151.000-125.9			B	1	0.65	1	1	1	55.301			
20			C	1	0.65	1	1	1	55.301			
L3	1.762	6.725	A	1	0.65	1	1	1	116.020	2.847	0.071	C
125.920-85.79			B	1	0.65	1	1	1	116.020			
6			C	1	0.65	1	1	1	116.020			
L4	1.917	9.761	A	1	0.65	1	1	1	164.288	3.368	0.077	C
85.796-42.132			B	1	0.65	1	1	1	164.288			
			C	1	0.65	1	1	1	164.288			
L5	1.718	13.804	A	1	0.65	1	1	1	196.157	3.263	0.077	C
42.132-0.000			B	1	0.65	1	1	1	196.157			
			C	1	0.65	1	1	1	196.157			
Sum Weight:	7.439	33.749						OTM	1017.484 kip-ft	12.392		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.941	1.351	A	1	0.65	1	1	1	44.998	1.382	0.049	C
179.000-151.0			B	1	0.65	1	1	1	44.998			
00			C	1	0.65	1	1	1	44.998			
L2	1.101	2.109	A	1	0.65	1	1	1	55.301	1.532	0.061	C
151.000-125.9			B	1	0.65	1	1	1	55.301			
20			C	1	0.65	1	1	1	55.301			
L3	1.762	6.725	A	1	0.65	1	1	1	116.020	2.847	0.071	C
125.920-85.79			B	1	0.65	1	1	1	116.020			
6			C	1	0.65	1	1	1	116.020			
L4	1.917	9.761	A	1	0.65	1	1	1	164.288	3.368	0.077	C
85.796-42.132			B	1	0.65	1	1	1	164.288			
			C	1	0.65	1	1	1	164.288			
L5	1.718	13.804	A	1	0.65	1	1	1	196.157	3.263	0.077	C
42.132-0.000			B	1	0.65	1	1	1	196.157			
			C	1	0.65	1	1	1	196.157			
Sum Weight:	7.439	33.749						OTM	1017.484 kip-ft	12.392		

Tower Forces - Service - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1	0.663	1.026	A	1	0.65	1	1	1	42.665	0.566	0.020	C
179.000-151.0			B	1	0.65	1	1	1	42.665			
00			C	1	0.65	1	1	1	42.665			
L2	0.843	1.707	A	1	0.65	1	1	1	53.211	0.644	0.026	C
151.000-125.9			B	1	0.65	1	1	1	53.211			
20			C	1	0.65	1	1	1	53.211			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L3 125.920-85.79	1.348	5.878	A	1	0.65	1	1	1	112.677	1.220	0.030	C
6			B	1	0.65	1	1	1	112.677			
L4 85.796-42.132	1.467	8.558	C	1	0.65	1	1	1	112.677			
			A	1	0.65	1	1	1	160.649	1.467	0.034	C
			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5 42.132-0.000	1.315	12.364	A	1	0.65	1	1	1	192.646	1.438	0.034	C
			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	432.239 kip-ft	5.335		

Tower Forces - Service - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1 179.000-151.0	0.663	1.026	A	1	0.65	1	1	1	42.665	0.566	0.020	C
00			B	1	0.65	1	1	1	42.665			
			C	1	0.65	1	1	1	42.665			
L2 151.000-125.9	0.843	1.707	A	1	0.65	1	1	1	53.211	0.644	0.026	C
20			B	1	0.65	1	1	1	53.211			
			C	1	0.65	1	1	1	53.211			
L3 125.920-85.79	1.348	5.878	A	1	0.65	1	1	1	112.677	1.220	0.030	C
6			B	1	0.65	1	1	1	112.677			
			C	1	0.65	1	1	1	112.677			
L4 85.796-42.132	1.467	8.558	A	1	0.65	1	1	1	160.649	1.467	0.034	C
			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5 42.132-0.000	1.315	12.364	A	1	0.65	1	1	1	192.646	1.438	0.034	C
			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	432.239 kip-ft	5.335		

Tower Forces - Service - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1 179.000-151.0	0.663	1.026	A	1	0.65	1	1	1	42.665	0.566	0.020	C
00			B	1	0.65	1	1	1	42.665			
			C	1	0.65	1	1	1	42.665			
L2 151.000-125.9	0.843	1.707	A	1	0.65	1	1	1	53.211	0.644	0.026	C
20			B	1	0.65	1	1	1	53.211			
			C	1	0.65	1	1	1	53.211			
L3 125.920-85.79	1.348	5.878	A	1	0.65	1	1	1	112.677	1.220	0.030	C
6			B	1	0.65	1	1	1	112.677			
			C	1	0.65	1	1	1	112.677			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L4 85.796-42.132	1.467	8.558	A	1	0.65	1	1	1	160.649	1.467	0.034	C
			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5 42.132-0.000	1.315	12.364	A	1	0.65	1	1	1	192.646	1.438	0.034	C
			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	432.239 kip-ft	5.335		

Tower Forces - Service - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	klf	
L1 179.000-151.000	0.663	1.026	A	1	0.65	1	1	1	42.665	0.566	0.020	C
			B	1	0.65	1	1	1	42.665			
			C	1	0.65	1	1	1	42.665			
L2 151.000-125.920	0.843	1.707	A	1	0.65	1	1	1	53.211	0.644	0.026	C
			B	1	0.65	1	1	1	53.211			
			C	1	0.65	1	1	1	53.211			
L3 125.920-85.796	1.348	5.878	A	1	0.65	1	1	1	112.677	1.220	0.030	C
			B	1	0.65	1	1	1	112.677			
			C	1	0.65	1	1	1	112.677			
L4 85.796-42.132	1.467	8.558	A	1	0.65	1	1	1	160.649	1.467	0.034	C
			B	1	0.65	1	1	1	160.649			
			C	1	0.65	1	1	1	160.649			
L5 42.132-0.000	1.315	12.364	A	1	0.65	1	1	1	192.646	1.438	0.034	C
			B	1	0.65	1	1	1	192.646			
			C	1	0.65	1	1	1	192.646			
Sum Weight:	5.636	29.533						OTM	432.239 kip-ft	5.335		

Force Totals

Load Case	Vertical Forces	Sum of Forces X	Sum of Forces Z	Sum of Overturning Moments, M _x	Sum of Overturning Moments, M _z	Sum of Torques
	K	K	K	kip-ft	kip-ft	kip-ft
Leg Weight	29.533					
Bracing Weight	0.000					
Total Member Self-Weight	29.533			0.118	-0.058	
Total Weight	39.741			0.118	-0.058	
Wind 0 deg - No Ice		0.042	-27.768	-3376.465	-6.816	0.352
Wind 30 deg - No Ice		13.896	-24.069	-2927.468	-1690.300	0.817
Wind 45 deg - No Ice		19.630	-19.665	-2392.266	-2386.923	0.973
Wind 60 deg - No Ice		24.026	-13.920	-1694.026	-2920.885	1.063
Wind 90 deg - No Ice		27.719	-0.042	-6.641	-3368.836	1.024
Wind 120 deg - No Ice		23.984	13.847	1682.556	-2914.126	0.711
Wind 135 deg - No Ice		19.570	19.605	2382.943	-2377.365	0.475
Wind 150 deg - No Ice		13.823	24.026	2920.945	-1678.594	0.207

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Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 180 deg - No Ice		-0.042	27.768	3376.700	6.701	-0.352
Wind 210 deg - No Ice		-13.896	24.069	2927.703	1690.185	-0.817
Wind 225 deg - No Ice		-19.630	19.665	2392.501	2386.807	-0.973
Wind 240 deg - No Ice		-24.026	13.920	1694.262	2920.769	-1.063
Wind 270 deg - No Ice		-27.719	0.042	6.876	3368.721	-1.024
Wind 300 deg - No Ice		-23.984	-13.847	-1682.321	2914.011	-0.711
Wind 315 deg - No Ice		-19.570	-19.605	-2382.708	2377.250	-0.475
Wind 330 deg - No Ice		-13.823	-24.026	-2920.709	1678.479	-0.207
Member Ice	4.216					
Total Weight Ice	48.151			0.253	-0.127	
Wind 0 deg - Ice		0.031	-22.585	-2770.985	-5.069	0.289
Wind 30 deg - Ice		11.301	-19.575	-2402.181	-1387.173	0.657
Wind 45 deg - Ice		15.967	-15.992	-1962.803	-1959.148	0.779
Wind 60 deg - Ice		19.544	-11.319	-1389.646	-2397.619	0.848
Wind 90 deg - Ice		22.549	-0.031	-4.689	-2765.659	0.812
Wind 120 deg - Ice		19.513	11.266	1381.593	-2392.678	0.559
Wind 135 deg - Ice		15.923	15.948	1956.320	-1952.160	0.370
Wind 150 deg - Ice		11.248	19.544	2397.745	-1378.614	0.156
Wind 180 deg - Ice		-0.031	22.585	2771.491	4.815	-0.289
Wind 210 deg - Ice		-11.301	19.575	2402.687	1386.919	-0.657
Wind 225 deg - Ice		-15.967	15.992	1963.309	1958.894	-0.779
Wind 240 deg - Ice		-19.544	11.319	1390.152	2397.365	-0.848
Wind 270 deg - Ice		-22.549	0.031	5.195	2765.405	-0.812
Wind 300 deg - Ice		-19.513	-11.266	-1381.087	2392.423	-0.559
Wind 315 deg - Ice		-15.923	-15.948	-1955.814	1951.905	-0.370
Wind 330 deg - Ice		-11.248	-19.544	-2397.239	1378.359	-0.156
Total Weight	39.741			0.118	-0.058	
Wind 0 deg - Service		0.015	-9.608	-1168.250	-2.396	0.122
Wind 30 deg - Service		4.808	-8.328	-1012.888	-584.917	0.283
Wind 45 deg - Service		6.792	-6.804	-827.697	-825.963	0.337
Wind 60 deg - Service		8.314	-4.817	-586.091	-1010.724	0.368
Wind 90 deg - Service		9.591	-0.015	-2.221	-1165.725	0.354
Wind 120 deg - Service		8.299	4.791	582.276	-1008.386	0.246
Wind 135 deg - Service		6.772	6.784	824.625	-822.655	0.164
Wind 150 deg - Service		4.783	8.314	1010.784	-580.866	0.072
Wind 180 deg - Service		-0.015	9.608	1168.485	2.281	-0.122
Wind 210 deg - Service		-4.808	8.328	1013.123	584.801	-0.283
Wind 225 deg - Service		-6.792	6.804	827.932	825.847	-0.337
Wind 240 deg - Service		-8.314	4.817	586.327	1010.609	-0.368
Wind 270 deg - Service		-9.591	0.015	2.456	1165.610	-0.354
Wind 300 deg - Service		-8.299	-4.791	-582.041	1008.271	-0.246
Wind 315 deg - Service		-6.772	-6.784	-824.389	822.540	-0.164
Wind 330 deg - Service		-4.783	-8.314	-1010.549	580.751	-0.072

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	179 - 151	Pole	Max Tension	18	0.000	0.000	0.000
			Max. Compression	18	-9.254	-0.127	-0.253
			Max. Mx	6	-4.532	-294.135	0.356
			Max. My	10	-4.522	0.369	-294.649
			Max. Vy	6	14.591	-294.135	0.356
			Max. Vx	10	14.640	0.369	-294.649
			Max. Torque	5			-1.048
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-11.892	-0.127	-0.253
			Max. Mx	6	-6.936	-614.958	1.240
L2	151 - 125.92	Pole	Max. My	10	-6.928	1.272	-616.517

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Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L3	125.92 - 85.796	Pole	Max. Vy	6	16.141	-614.958	1.240
			Max. Vx	10	16.191	1.272	-616.517
			Max. Torque	5			-1.046
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-19.750	-0.127	-0.253
			Max. Mx	6	-13.970	-1308.660	2.921
			Max. My	10	-13.965	2.971	-1312.184
			Max. Vy	6	19.594	-1308.660	2.921
			Max. Vx	10	19.644	2.971	-1312.184
			Max. Torque	5			-1.041
L4	85.796 - 42.132	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-30.794	-0.127	-0.253
			Max. Mx	6	-23.938	-2221.032	4.766
			Max. My	10	-23.936	4.822	-2226.695
			Max. Vy	6	23.466	-2221.032	4.766
			Max. Vx	10	23.516	4.822	-2226.695
			Max. Torque	5			-1.036
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-48.151	-0.127	-0.253
			Max. Mx	6	-39.727	-3472.604	6.867
L5	42.132 - 0	Pole	Max. My	10	-39.727	6.924	-3480.692
			Max. Vy	6	27.739	-3472.604	6.867
			Max. Vx	10	27.788	6.924	-3480.692
			Max. Torque	5			-1.034

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	19	48.151	-0.031	22.585
	Max. H _x	14	39.741	27.719	-0.042
	Max. H _z	2	39.741	-0.042	27.768
	Max. M _x	2	3480.446	-0.042	27.768
	Max. M _z	6	3472.604	-27.719	0.042
	Max. Torsion	13	1.027	24.026	-13.920
	Min. Vert	1	39.741	0.000	0.000
	Min. H _x	6	39.741	-27.719	0.042
	Min. H _z	10	39.741	0.042	-27.768
	Min. M _x	10	-3480.692	0.042	-27.768
	Min. M _z	14	-3472.487	27.719	-0.042
	Min. Torsion	5	-1.034	-24.026	13.920

Tower Mast Reaction Summary

Load Combination	Vertical K	Shear _x K	Shear _z K	Overturning Moment, M _x kip-ft	Overturning Moment, M _z kip-ft	Torque kip-ft
Dead Only	39.741	0.000	0.000	0.118	-0.058	0.000
Dead+Wind 0 deg - No Ice	39.741	0.042	-27.768	-3480.446	-7.038	0.337
Dead+Wind 30 deg - No Ice	39.741	13.896	-24.069	-3017.621	-1742.347	0.791

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Load Combination	Vertical K	Shear _x K	Shear _z K	Overturning Moment, M _x kip-ft	Overturning Moment, M _z kip-ft	Torque kip-ft
Dead+Wind 45 deg - No Ice	39.741	19.630	-19.665	-2465.948	-2460.419	0.945
Dead+Wind 60 deg - No Ice	39.741	24.026	-13.920	-1746.218	-3010.830	1.034
Dead+Wind 90 deg - No Ice	39.741	27.719	-0.042	-6.867	-3472.604	0.997
Dead+Wind 120 deg - No Ice	39.741	23.984	13.847	1734.385	-3003.903	0.690
Dead+Wind 135 deg - No Ice	39.741	19.570	19.605	2456.355	-2450.598	0.460
Dead+Wind 150 deg - No Ice	39.741	13.823	24.026	3010.927	-1730.290	0.199
Dead+Wind 180 deg - No Ice	39.741	-0.042	27.768	3480.692	6.924	-0.343
Dead+Wind 210 deg - No Ice	39.741	-13.896	24.069	3017.860	1742.239	-0.791
Dead+Wind 225 deg - No Ice	39.741	-19.630	19.665	2466.181	2460.311	-0.941
Dead+Wind 240 deg - No Ice	39.741	-24.026	13.920	1746.447	3010.719	-1.027
Dead+Wind 270 deg - No Ice	39.741	-27.719	0.042	7.095	3472.487	-0.990
Dead+Wind 300 deg - No Ice	39.741	-23.984	-13.847	-1734.150	3003.776	-0.690
Dead+Wind 315 deg - No Ice	39.741	-19.570	-19.605	-2456.115	2450.471	-0.464
Dead+Wind 330 deg - No Ice	39.741	-13.823	-24.026	-3010.683	1730.166	-0.205
Dead+Ice+Temp	48.151	0.000	0.000	0.253	-0.127	0.000
Dead+Wind 0 deg+Ice+Temp	48.151	0.031	-22.585	-2892.364	-5.307	0.275
Dead+Wind 30 deg+Ice+Temp	48.151	11.301	-19.575	-2507.406	-1447.940	0.633
Dead+Wind 45 deg+Ice+Temp	48.151	15.967	-15.992	-2048.788	-2044.967	0.753
Dead+Wind 60 deg+Ice+Temp	48.151	19.544	-11.319	-1450.531	-2502.647	0.822
Dead+Wind 90 deg+Ice+Temp	48.151	22.549	-0.031	-4.906	-2886.823	0.788
Dead+Wind 120 deg+Ice+Temp	48.151	19.513	11.266	1442.124	-2497.507	0.542
Dead+Wind 135 deg+Ice+Temp	48.151	15.923	15.948	2042.038	-2037.684	0.359
Dead+Wind 150 deg+Ice+Temp	48.151	11.248	19.544	2502.803	-1439.004	0.151
Dead+Wind 180 deg+Ice+Temp	48.151	-0.031	22.585	2892.913	5.036	-0.279
Dead+Wind 210 deg+Ice+Temp	48.151	-11.301	19.575	2507.948	1447.676	-0.633
Dead+Wind 225 deg+Ice+Temp	48.151	-15.967	15.992	2049.326	2044.702	-0.751
Dead+Wind 240 deg+Ice+Temp	48.151	-19.544	11.319	1451.066	2502.380	-0.818
Dead+Wind 270 deg+Ice+Temp	48.151	-22.549	0.031	5.438	2886.547	-0.784
Dead+Wind 300 deg+Ice+Temp	48.151	-19.513	-11.266	-1441.585	2497.225	-0.542
Dead+Wind 315 deg+Ice+Temp	48.151	-15.923	-15.948	-2041.494	2037.402	-0.361
Dead+Wind 330 deg+Ice+Temp	48.151	-11.248	-19.544	-2502.256	1438.724	-0.155
Dead+Wind 0 deg - Service	39.741	0.015	-9.608	-1206.466	-2.482	0.120
Dead+Wind 30 deg - Service	39.741	4.808	-8.328	-1046.026	-604.057	0.279
Dead+Wind 45 deg - Service	39.741	6.792	-6.804	-854.777	-852.987	0.333
Dead+Wind 60 deg - Service	39.741	8.314	-4.817	-605.268	-1043.793	0.364
Dead+Wind 90 deg - Service	39.741	9.591	-0.015	-2.295	-1203.861	0.351
Dead+Wind 120 deg - Service	39.741	8.299	4.791	601.328	-1041.376	0.244
Dead+Wind 135 deg - Service	39.741	6.772	6.784	851.607	-849.568	0.163
Dead+Wind 150 deg - Service	39.741	4.783	8.314	1043.859	-599.867	0.071
Dead+Wind 180 deg - Service	39.741	-0.015	9.608	1206.718	2.359	-0.121
Dead+Wind 210 deg - Service	39.741	-4.808	8.328	1046.277	603.935	-0.279
Dead+Wind 225 deg - Service	39.741	-6.792	6.804	855.027	852.865	-0.333
Dead+Wind 240 deg - Service	39.741	-8.314	4.817	605.518	1043.670	-0.364
Dead+Wind 270 deg - Service	39.741	-9.591	0.015	2.545	1203.737	-0.350
Dead+Wind 300 deg - Service	39.741	-8.299	-4.791	-601.077	1041.251	-0.244
Dead+Wind 315 deg - Service	39.741	-6.772	-6.784	-851.356	849.443	-0.163
Dead+Wind 330 deg - Service	39.741	-4.783	-8.314	-1043.607	599.743	-0.072

Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.000	-39.741	0.000	0.000	39.741	0.000	0.000%
2	0.042	-39.741	-27.768	-0.042	39.741	27.768	0.000%
3	13.896	-39.741	-24.069	-13.896	39.741	24.069	0.000%
4	19.630	-39.741	-19.665	-19.630	39.741	19.665	0.000%
5	24.026	-39.741	-13.920	-24.026	39.741	13.920	0.000%

RISATower

Centek Engineering Inc.
63-2 North Branford Rd.
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Project

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Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
6	27.719	-39.741	-0.042	-27.719	39.741	0.042	0.000%
7	23.984	-39.741	13.847	-23.984	39.741	-13.847	0.000%
8	19.570	-39.741	19.605	-19.570	39.741	-19.605	0.000%
9	13.823	-39.741	24.026	-13.823	39.741	-24.026	0.000%
10	-0.042	-39.741	27.768	0.042	39.741	-27.768	0.000%
11	-13.896	-39.741	24.069	13.896	39.741	-24.069	0.000%
12	-19.630	-39.741	19.665	19.630	39.741	-19.665	0.000%
13	-24.026	-39.741	13.920	24.026	39.741	-13.920	0.000%
14	-27.719	-39.741	0.042	27.719	39.741	-0.042	0.000%
15	-23.984	-39.741	-13.847	23.984	39.741	13.847	0.000%
16	-19.570	-39.741	-19.605	19.570	39.741	19.605	0.000%
17	-13.823	-39.741	-24.026	13.823	39.741	24.026	0.000%
18	0.000	-48.151	0.000	0.000	48.151	0.000	0.000%
19	0.031	-48.151	-22.585	-0.031	48.151	22.585	0.000%
20	11.301	-48.151	-19.575	-11.301	48.151	19.575	0.000%
21	15.967	-48.151	-15.992	-15.967	48.151	15.992	0.000%
22	19.544	-48.151	-11.319	-19.544	48.151	11.319	0.000%
23	22.549	-48.151	-0.031	-22.549	48.151	0.031	0.000%
24	19.513	-48.151	11.266	-19.513	48.151	-11.266	0.000%
25	15.923	-48.151	15.948	-15.923	48.151	-15.948	0.000%
26	11.248	-48.151	19.544	-11.248	48.151	-19.544	0.000%
27	-0.031	-48.151	22.585	0.031	48.151	-22.585	0.000%
28	-11.301	-48.151	19.575	11.301	48.151	-19.575	0.000%
29	-15.967	-48.151	15.992	15.967	48.151	-15.992	0.000%
30	-19.544	-48.151	11.319	-19.544	48.151	11.319	0.000%
31	-22.549	-48.151	0.031	22.549	48.151	-0.031	0.000%
32	-19.513	-48.151	-11.266	19.513	48.151	11.266	0.000%
33	-15.923	-48.151	-15.948	15.923	48.151	15.948	0.000%
34	-11.248	-48.151	-19.544	11.248	48.151	19.544	0.000%
35	0.015	-39.741	-9.608	-0.015	39.741	9.608	0.000%
36	4.808	-39.741	-8.328	-4.808	39.741	8.328	0.000%
37	6.792	-39.741	-6.804	-6.792	39.741	6.804	0.000%
38	8.314	-39.741	-4.817	-8.314	39.741	4.817	0.000%
39	9.591	-39.741	-0.015	-9.591	39.741	0.015	0.000%
40	8.299	-39.741	4.791	-8.299	39.741	-4.791	0.000%
41	6.772	-39.741	6.784	-6.772	39.741	-6.784	0.000%
42	4.783	-39.741	8.314	-4.783	39.741	-8.314	0.000%
43	-0.015	-39.741	9.608	0.015	39.741	-9.608	0.000%
44	-4.808	-39.741	8.328	4.808	39.741	-8.328	0.000%
45	-6.792	-39.741	6.804	6.792	39.741	-6.804	0.000%
46	-8.314	-39.741	4.817	8.314	39.741	-4.817	0.000%
47	-9.591	-39.741	0.015	9.591	39.741	-0.015	0.000%
48	-8.299	-39.741	-4.791	8.299	39.741	4.791	0.000%
49	-6.772	-39.741	-6.784	6.772	39.741	6.784	0.000%
50	-4.783	-39.741	-8.314	4.783	39.741	8.314	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00055781
3	Yes	6	0.00000001	0.00003453
4	Yes	6	0.00000001	0.00003326
5	Yes	6	0.00000001	0.00003294
6	Yes	4	0.00000001	0.00084268

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7	Yes	6	0.00000001	0.00003433
8	Yes	6	0.00000001	0.00003321
9	Yes	6	0.00000001	0.00003355
10	Yes	4	0.00000001	0.00021858
11	Yes	6	0.00000001	0.00003314
12	Yes	6	0.00000001	0.00003325
13	Yes	6	0.00000001	0.00003473
14	Yes	5	0.00000001	0.00004093
15	Yes	6	0.00000001	0.00003313
16	Yes	6	0.00000001	0.00003322
17	Yes	6	0.00000001	0.00003391
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00033520
20	Yes	6	0.00000001	0.00013413
21	Yes	6	0.00000001	0.00014461
22	Yes	6	0.00000001	0.00013007
23	Yes	5	0.00000001	0.00033938
24	Yes	6	0.00000001	0.00013301
25	Yes	6	0.00000001	0.00014381
26	Yes	6	0.00000001	0.00013106
27	Yes	5	0.00000001	0.00033337
28	Yes	6	0.00000001	0.00013060
29	Yes	6	0.00000001	0.00014461
30	Yes	6	0.00000001	0.00013467
31	Yes	5	0.00000001	0.00034442
32	Yes	6	0.00000001	0.00012989
33	Yes	6	0.00000001	0.00014374
34	Yes	6	0.00000001	0.00013183
35	Yes	4	0.00000001	0.00010870
36	Yes	5	0.00000001	0.00011625
37	Yes	5	0.00000001	0.00012907
38	Yes	5	0.00000001	0.00010825
39	Yes	4	0.00000001	0.00020722
40	Yes	5	0.00000001	0.00011440
41	Yes	5	0.00000001	0.00012750
42	Yes	5	0.00000001	0.00011045
43	Yes	4	0.00000001	0.00008935
44	Yes	5	0.00000001	0.00010933
45	Yes	5	0.00000001	0.00012911
46	Yes	5	0.00000001	0.00011735
47	Yes	4	0.00000001	0.00023242
48	Yes	5	0.00000001	0.00010811
49	Yes	5	0.00000001	0.00012729
50	Yes	5	0.00000001	0.00011204

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	179 - 151	46.708	44	3.124	0.005
L2	151 - 125.92	30.168	44	2.395	0.004
L3	130.086 - 85.796	21.023	44	1.778	0.002
L4	91.212 - 42.132	9.384	44	1.077	0.001
L5	48.882 - 0	2.461	44	0.473	0.000

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Critical Deflections and Radius of Curvature - Service Wind

Elevation	Appurtenance	Gov. Load	Deflection	Tilt	Twist	Radius of Curvature
ft		Comb.	in	°	°	ft
181.000	LPA-80063/6CF	44	46.708	3.124	0.005	7960
178.500	EEI 14-ft Low Profile Platform	44	46.393	3.111	0.005	7960
160.000	7770.00	44	35.079	2.646	0.004	2093
159.000	(2) RRUS-11	44	34.506	2.620	0.004	1989
158.000	13' Low Profile Platform	44	33.940	2.593	0.004	1894
156.000	Valmont Uni-Tri Bracket	44	32.826	2.538	0.004	1729

Maximum Tower Deflections - Design Wind

Section No.	Elevation	Horz. Deflection	Gov. Load	Tilt	Twist
	ft	in	Comb.	°	°
L1	179 - 151	134.065	10	8.975	0.015
L2	151 - 125.92	86.745	11	6.888	0.010
L3	130.086 - 85.796	60.510	11	5.118	0.005
L4	91.212 - 42.132	27.040	11	3.104	0.002
L5	48.882 - 0	7.096	11	1.363	0.001

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load	Deflection	Tilt	Twist	Radius of Curvature
ft		Comb.	in	°	°	ft
181.000	LPA-80063/6CF	10	134.065	8.975	0.016	2882
178.500	EEI 14-ft Low Profile Platform	10	133.163	8.940	0.016	2882
160.000	7770.00	11	100.799	7.608	0.012	755
159.000	(2) RRUS-11	11	99.161	7.531	0.012	716
158.000	13' Low Profile Platform	11	97.540	7.454	0.012	682
156.000	Valmont Uni-Tri Bracket	11	94.353	7.297	0.012	622

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L _u	Kl/r	F _a	A	Actual P	Allow. P _a	Ratio P
	ft		ft	ft		ksi	in ²	K	K	P _a
L1	179 - 151 (1)	TP22.07x14.5x0.188	28.000	0.000	0.0	39.000	13.023	-4.516	507.890	0.009
L2	151 - 125.92 (2)	TP28.85x22.07x0.25	25.080	0.000	0.0	39.000	21.800	-6.924	850.218	0.008
L3	125.92 - 85.796 (3)	TP39.06x27.224x0.375	44.290	0.000	0.0	39.000	44.322	-13.962	1728.560	0.008
L4	85.796 - 42.132 (4)	TP49.99x36.863x0.375	49.080	0.000	0.0	39.000	45.806	-16.254	1786.450	0.009

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Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	F _a ksi	A in ²	Actual P K	Allow. P _a K	Ratio P P _a
L5	42.132 - 0 (5)	TP60.5x47.435x0.438	48.882	0.000	0.0	39.000	67.767	-27.086	2642.900	0.010

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M _x kip-ft	Actual f _{bx} ksi	Allow. F _{bx} ksi	Ratio f _{bx} F _{bx}	Actual M _y kip-ft	Actual f _{by} ksi	Allow. F _{by} ksi	Ratio f _{by} F _{by}
L1	179 - 151 (1)	TP22.07x14.5x0.188	294.832	50.348	39.000	1.291	0.000	0.000	39.000	0.000
L2	151 - 125.92 (2)	TP28.85x22.07x0.25	617.222	50.176	39.000	1.287	0.000	0.000	39.000	0.000
L3	125.92 - 85.796 (3)	TP39.06x27.224x0.375	1313.875	38.798	39.000	0.995	0.000	0.000	39.000	0.000
L4	85.796 - 42.132 (4)	TP49.99x36.863x0.375	1463.625	40.452	39.000	1.037	0.000	0.000	39.000	0.000
L5	42.132 - 0 (5)	TP60.5x47.435x0.438	2390.617	35.192	39.000	0.902	0.000	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f _v ksi	Allow. F _v ksi	Ratio f _v F _v	Actual T kip-ft	Actual f _{vt} ksi	Allow. F _{vt} ksi	Ratio f _{vt} F _{vt}
L1	179 - 151 (1)	TP22.07x14.5x0.188	14.665	1.126	26.000	0.087	0.801	0.067	26.000	0.003
L2	151 - 125.92 (2)	TP28.85x22.07x0.25	16.216	0.744	26.000	0.057	0.797	0.032	26.000	0.001
L3	125.92 - 85.796 (3)	TP39.06x27.224x0.375	19.669	0.444	26.000	0.034	0.794	0.011	26.000	0.000
L4	85.796 - 42.132 (4)	TP49.99x36.863x0.375	20.618	0.450	26.000	0.034	0.793	0.011	26.000	0.000
L5	42.132 - 0 (5)	TP60.5x47.435x0.438	24.420	0.360	26.000	0.027	0.792	0.006	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P P _a	Ratio f _{bx} F _{bx}	Ratio f _{by} F _{by}	Ratio f _v F _v	Ratio f _{vt} F _{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	179 - 151 (1)	0.009	1.291	0.000	0.087	0.003	1.302	1.333	H1-3+VT ✓
L2	151 - 125.92 (2)	0.008	1.287	0.000	0.057	0.001	1.296	1.333	H1-3+VT ✓
L3	125.92 - 85.796 (3)	0.008	0.995	0.000	0.034	0.000	1.003	1.333	H1-3+VT ✓
L4	85.796 - 42.132 (4)	0.009	1.037	0.000	0.034	0.000	1.047	1.333	H1-3+VT ✓
L5	42.132 - 0 (5)	0.010	0.902	0.000	0.027	0.000	0.913	1.333	H1-3+VT ✓

<i>RISATower</i> Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO14 - CT2233	Page	22 of 22
	Project	150-ft EEI Monopole - 856 Middletown Rd., Colchester, CT	Date	11:27:29 09/28/12
	Client	AT&T Mobility	Designed by	TJL

Section No.	Elevation ft	Ratio P P_a	Ratio f_{bx} F_{bx}	Ratio f_{by} F_{by}	Ratio f_v F_v	Ratio f_{vt} F_{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
							✓		

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	SF* P_{allow} K	% Capacity	Pass Fail
L1	179 - 151	Pole	TP22.07x14.5x0.188	1	-4.516	677.017	97.7	Pass
L2	151 - 125.92	Pole	TP28.85x22.07x0.25	2	-6.924	1133.341	97.2	Pass
L3	125.92 - 85.796	Pole	TP39.06x27.224x0.375	3	-13.962	2304.170	75.3	Pass
L4	85.796 - 42.132	Pole	TP49.99x36.863x0.375	4	-16.254	2381.338	78.5	Pass
L5	42.132 - 0	Pole	TP60.5x47.435x0.438	5	-27.086	3522.986	68.5	Pass
							Summary	
							Pole (L1)	97.7 Pass
							RATING =	97.7 Pass

Flange Bolt and Flange Plate Analysis:

Input Data:

Tower Reactions:

Overturing Moment =	OM := 295-ft-kips	(Input From RisaTower)
Shear Force =	Shear := 15-kips	(Input From RisaTower)
Axial Force =	Axial := 9.5-kips	(Input From RisaTower)

Flange Bolt Data:

Use ASTM A325

Number of Flange Bolts =	N := 24	(User Input)
Diameter of Bolt Circle =	D _{bc} := 25.75-in	(User Input)
Bolt Ultimate Strength =	F _u := 120-ksi	(User Input)
Bolt Yield Strength =	F _y := 92-ksi	(User Input)
Bolt Modulus =	E := 29000-ksi	(User Input)
Diameter of Flange Bolts =	D := 1.0-in	(User Input)
Threads per Inch =	n := 8	(User Input)

Flange Plate Data:

Use ASTM A572 GR. 60

Plate Yield Strength =	F _{ybp} := 60-ksi	(User Input)
Flange Plate Thickness =	t _{bp} := 1.0-in	(User Input)
Flange Plate Diameter =	D _{bp} := 29.0-in	(User Input)
Outer Pole Diameter =	D _{pole} := 22.07-in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 12.875 \text{ in}$$

Distance to Bolts =

$$i := 1..N$$

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

$$d_1 = 3.33 \text{ in} \quad d_7 = 12.44 \text{ in}$$

$$d_2 = 6.44 \text{ in} \quad d_8 = 11.15 \text{ in}$$

$$d_3 = 9.10 \text{ in} \quad d_9 = 9.10 \text{ in}$$

$$d_4 = 11.15 \text{ in} \quad d_{10} = 6.44 \text{ in}$$

$$d_5 = 12.44 \text{ in} \quad d_{11} = 3.33 \text{ in}$$

$$d_6 = 12.88 \text{ in} \quad d_{12} = 0.00 \text{ in}$$

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 11 \text{ in}$$

Moment Arms of Bolts about Neutral Axis =

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

$$MA_1 = 0.00 \text{ in} \quad MA_7 = 1.40 \text{ in}$$

$$MA_2 = 0.00 \text{ in} \quad MA_8 = 0.12 \text{ in}$$

$$MA_3 = 0.00 \text{ in} \quad MA_9 = 0.00 \text{ in}$$

$$MA_4 = 0.12 \text{ in} \quad MA_{10} = 0.00 \text{ in}$$

$$MA_5 = 1.40 \text{ in} \quad MA_{11} = 0.00 \text{ in}$$

$$MA_6 = 1.84 \text{ in} \quad MA_{12} = 0.00 \text{ in}$$

Effective Width of Flangeplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 15.1 \text{ in}$$

Flange Bolt Analysis:

Calculated Flange Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 1.989 \times 10^3 \cdot \text{in}^2$$

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 =

$$T_{\text{Max}} := \text{OM} \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 22.5 \cdot \text{kips}$$

Allowable Tensile Force =

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

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Gross}}} = 54.3 \cdot \%$$

Condition1 =

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

Condition1 = "OK"

Flange Plate Analysis:

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

$C_1 = 6.3\text{-kips}$	$C_7 = 22.5\text{-kips}$
$C_2 = 11.9\text{-kips}$	$C_8 = 20.2\text{-kips}$
$C_3 = 16.6\text{-kips}$	$C_9 = 16.6\text{-kips}$
$C_4 = 20.2\text{-kips}$	$C_{10} = 11.9\text{-kips}$
$C_5 = 22.5\text{-kips}$	$C_{11} = 6.3\text{-kips}$
$C_6 = 23.3\text{-kips}$	$C_{12} = 0.4\text{-kips}$

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{(B_{eff} t_{bp})^2} = 44.1\text{-ksi}$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot F_{ybp} = 59.9\text{-ksi}$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 73.7\%$$

Condition3 =

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

Condition2 = "Ok"

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturing Moment =	OM := 3485-ft-kips	(Input From RisaTower)
Shear Force =	Shear := 28-kips	(Input From RisaTower)
Axial Force =	Axial := 40-kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 16	(User Input)
Diameter of Bolt Circle =	D _{bc} := 70.0-in	(User Input)
Bolt "Column" Distance =	l := 3.0-in	(User Input)
Bolt Ultimate Strenght =	F _u := 100-ksi	(User Input)
Bolt Yeild Strenght =	F _y := 75-ksi	(User Input)
Bolt Modulus =	E := 29000-ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25-in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 Mod 60

Plate Yield Strength =	F _{ybp} := 60-ksi	(User Input)
Base Plate Thickness =	t _{bp} := 2.0-in	(User Input)
Base Plate Diameter =	D _{bp} := 76.0-in	(User Input)
Outer Pole Diameter =	D _{pole} := 60.5-in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 35\text{-in}$

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

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

$d_1 = 13.39\text{-in}$	$d_7 = 13.39\text{-in}$
$d_2 = 24.75\text{-in}$	$d_8 = 0.00\text{-in}$
$d_3 = 32.34\text{-in}$	$d_9 = -13.39\text{-in}$
$d_4 = 35.00\text{-in}$	$d_{10} = -24.75\text{-in}$
$d_5 = 32.34\text{-in}$	$d_{11} = -32.34\text{-in}$
$d_6 = 24.75\text{-in}$	etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 30.3\text{-in}$

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

$MA_1 = 0.00\text{-in}$	$MA_7 = 0.00\text{-in}$
$MA_2 = 0.00\text{-in}$	$MA_8 = 0.00\text{-in}$
$MA_3 = 2.09\text{-in}$	$MA_9 = 0.00\text{-in}$
$MA_4 = 4.75\text{-in}$	$MA_{10} = 0.00\text{-in}$
$MA_5 = 2.09\text{-in}$	$MA_{11} = 0.00\text{-in}$
$MA_6 = 0.00\text{-in}$	etc

Effective Width of Baseplate for Bending = $B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2} \right)^2 - \left(\frac{D_{pole}}{2} \right)^2} = 36.8\text{-in}$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 9.8 \times 10^3 \cdot \text{in}^2$$

Gross Area of Bolt =

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

Net Area of Bolt =

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

Net Diameter =

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

Radius of Gyration of Bolt =

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

Section Modulus of Bolt =

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force =

$$T_{\text{Max}} := \text{OM} \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 146.9 \cdot \text{kips}$$

Allowable Tensile Force =

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

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

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} = 75.4\% \quad \text{Bolts are "upset bolts". Use net area per AISC}$$

Condition1 =

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment =

$$M_x := \left(\frac{\text{Shear}}{N} \right) \cdot l = 0.437 \cdot \text{ft-kips}$$

Maximum Bending Stress =

$$f_{bx} := \frac{M_x}{S_x} = 6.4 \cdot \text{ksi}$$

Allowable Bending Stress =

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

Check Combined Stress Requirement:

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

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{l_p} + \frac{Axial}{N} = 151.9 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 46.8 \text{ ksi}$$

$$K := 0.65$$

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

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

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 =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = 78. \%$$

Condition 2 =

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

Condition2 = "OK"

Base Plate Analysis:

Force from Bolts =

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

$$C_1 = 59.7 \cdot \text{kips}$$

$$C_7 = 59.7 \cdot \text{kips}$$

$$C_2 = 108.1 \cdot \text{kips}$$

$$C_8 = 2.5 \cdot \text{kips}$$

$$C_3 = 140.5 \cdot \text{kips}$$

$$C_9 = -54.7 \cdot \text{kips}$$

$$C_4 = 151.9 \cdot \text{kips}$$

$$C_{10} = -103.1 \cdot \text{kips}$$

$$C_5 = 140.5 \cdot \text{kips}$$

$$C_{11} = -135.5 \cdot \text{kips}$$

$$C_6 = 108.1 \cdot \text{kips}$$

etc.

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{(B_{eff} t_{bp})^2} = 53.3 \cdot \text{ksi}$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot F_{ybp} = 59.9 \cdot \text{ksi}$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 89.0\%$$

Condition3 =

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

Condition3 = "Ok"

Caisson Foundation:

Input Data:

Shear Force =	$S := 28k$	USER INPUT-FROM RISATower
Overturing Moment =	$M := 3485ft \cdot k$	USER INPUT-FROM RISATower
Applied Axial Load =	$A1 := 40k$	USER INPUT-FROM RISATower
Bending Moment =	$Mu := 3635ft \cdot k$	USER INPUT-FROM LPILE
Moment Capacity =	$Mn := 8986ft \cdot k$	USER INPUT-FROM LPILE
Foundation Diameter =	$d := 8ft$	USER INPUT
Overall Length of Caisson =	$L_c := 28.0ft$	USER INPUT
Depth From Top of Caisson to Grade =	$L_{pag} := 1.0ft$	USER INPUT
Number of Rebar =	$n := 27$	USER INPUT
Area of Rebar =	$Ar := 1.56in^2$	USER INPUT
Rebar Yield Strength =	$fy := 60ksi$	USER INPUT
Concrete Comp Strength =	$f'c := 4ksi$	USER INPUT

Check Foundation Depth:

Depth of Caisson Below Ground Level = $LD := L_c - L_{pag} = 27ft$ (TIA/EIA-222-F 7.2.5)

Depth Required = $LD1 := 2.0ft + \left(\frac{S \cdot ft^2}{3k \cdot d} \right) + 2ft \cdot \left(\frac{M \cdot ft}{3k \cdot d} + \frac{S \cdot ft}{2k} + \frac{S^2 \cdot ft^3}{18k^2 \cdot d^2} \right)^{.5} = 28.46ft$

DepthCheck := if($LD1 \leq LD$, "OK", "NO GOOD")

DepthCheck = "NO GOOD"

Note: Result not applicable.
 Actual soil is better than normal
 soil as defined in TIA/EIA 222 F.
 Refer to L-Pile analysis.

Check Moment Capacity:

Factor of Safety = $FS := \frac{Mn}{Mu} = 2.5$

Factor of Safety Required = $FS_{reqd} := 1.3$

FOSCheck := if($FS \geq FS_{reqd}$, "OK", "NO GOOD")

FOSCheck = "OK"

Check Axial Capacity:

Concrete Weight = $A2 := .150 \frac{k}{ft^3} \cdot LD \cdot \pi \frac{d^2}{4} = 203.6 \cdot kips$

Total Axial Load = $AT := A1 + A2 = 243.6 \cdot kips$

Area of Concrete = $Ag := \pi \cdot \frac{d^2}{4} = 50.27ft^2$

Axial Capacity = $Po := n \cdot Ar \cdot fy + (Ag - n \cdot Ar) \cdot 0.85 \cdot f'c = 26994 \cdot kips$

AxialCheck := if($AT \leq Po$, "OK", "NO GOOD")

AxialCheck = "OK"

Colchester South Caisson Analysis.lpo

LPILE Plus for windows, version 5.0 (5.0.39)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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This program is licensed to:

TJL
Centek Engineering Inc

Path to file locations: J:\Jobs\1204400.WI\CO14 - AT&T CT2233\Calcs\MathCad\Foundation\
Name of input data file: Colchester South Caisson Analysis.lpd
Name of output file: Colchester South Caisson Analysis.lpo
Name of plot output file: Colchester South Caisson Analysis.lpp
Name of runtime file: Colchester South Caisson Analysis.lpr

Time and Date of Analysis

Date: September 28, 2012 Time: 11:33:28

Problem Title

12044.CO14 - CT2233

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 3:

- Computation of Nonlinear Bending Stiffness and Ultimate Bending Moment Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:

- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- Analysis includes computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-04 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 8

Pile Structural Properties and Geometry

Pile Length = 336.00 in

Depth of ground surface below top of pile = 12.00 in

Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth	Pile	Moment of	Pile	Modulus of
	X	Diameter	Inertia	Area	Elasticity
	in	in	in**4	Sq.in	lbs/Sq.in

Colchester South Caisson Analysis.lpo

1	0.0000	96.00000000	4169220.	7238.2300	3605000.
2	336.0000	96.00000000	4169220.	7238.2300	3605000.

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of moment of inertia and modulus of are not used for any computations other than total stress due to combined axial loading and bending.

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 12.000 in
 Distance from top of pile to bottom of layer = 36.000 in
 p-y subgrade modulus k for top of soil layer = .000 lbs/in**3
 p-y subgrade modulus k for bottom of layer = .000 lbs/in**3

NOTE: Internal default values for p-y subgrade modulus will be computed for the above soil layer.

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 36.000 in
 Distance from top of pile to bottom of layer = 156.000 in
 p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
 p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 156.000 in
 Distance from top of pile to bottom of layer = 228.000 in
 p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
 p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 228.000 in
 Distance from top of pile to bottom of layer = 372.000 in
 p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
 p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

(Depth of lowest layer extends 36.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	12.00	.05200
2	36.00	.05200
3	36.00	.07200
4	156.00	.07200
5	156.00	.07500
6	228.00	.07500
7	228.00	.08100
8	372.00	.08100

Shear Strength of Soils

Shear strength parameters with depth defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k _{rm}	RQD %
1	12.000	.00000	1.00	-----	-----
2	36.000	.00000	1.00	-----	-----
3	36.000	.00000	33.00	-----	-----
4	156.000	.00000	33.00	-----	-----
5	156.000	.00000	35.00	-----	-----
6	228.000	.00000	35.00	-----	-----
7	228.000	.00000	35.00	-----	-----
8	372.000	.00000	35.00	-----	-----

Notes:

- (1) Cohesion = uniaxial compressive strength for rock materials.
- (2) Values of E50 are reported for clay strata.
- (3) Default values will be generated for E50 when input values are 0.
- (4) RQD and k_{rm} are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)

Shear force at pile head = 28000.000 lbs
Bending moment at pile head = 41820000.000 in-lbs
Axial load at pile head = 40000.000 lbs

Non-zero moment at pile head for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Number of sections = 1

Pile Section No. 1

The sectional shape is a circular drilled shaft (bored pile).

Outside Diameter = 96.0000 in

Material Properties:

Compressive Strength of Concrete = 4.000 kip/in**2
Yield Stress of Reinforcement = 60. kip/in**2
Modulus of Elasticity of Reinforcement = 29000. kip/in**2
Number of Reinforcing Bars = 27
Area of Single Bar = 1.56000 in**2
Number of Rows of Reinforcing Bars = 27
Area of Steel = 42.120 in**2
Area of Shaft = 7238.229 in**2
Percentage of Steel Reinforcement = .582 percent
Cover Thickness (edge to bar center) = 4.000 in

Unfactored Axial Squash Load Capacity = 26993.97 kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement in**2	Distance to Centroidal Axis in
1	1.560	43.926
2	1.560	43.332
3	1.560	42.152
4	1.560	40.402
5	1.560	38.105
6	1.560	35.293
7	1.560	32.004
8	1.560	28.283
9	1.560	24.178
10	1.560	19.747
11	1.560	15.049
12	1.560	10.147
13	1.560	5.108
14	1.560	0.000
15	1.560	-5.108
16	1.560	-10.147
17	1.560	-15.049
18	1.560	-19.747

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19	1.560	-24.178
20	1.560	-28.283
21	1.560	-32.004
22	1.560	-35.293
23	1.560	-38.105
24	1.560	-40.402
25	1.560	-42.152
26	1.560	-43.332
27	1.560	-43.926

Axial Thrust Force = 40000.00 lbs

Bending Moment in-lbs	Bending Stiffness lb-in ²	Bending Curvature rad/in	Maximum Strain in/in	Neutral Axis Position inches	Max. Concrete Stress psi	Max. Steel Stress psi
10187864.	1.630058E+13	6.250000E-07	.00003158	50.52269411	112.07494	841.87459
20272499.	1.621800E+13	.00000125	.00006171	49.36636019	217.18787	1641.83207
30253118.	1.613500E+13	.00000188	.00009182	48.96961355	320.51986	2441.17501
40130099.	1.605204E+13	.00000250	.00012193	48.77111578	422.14562	3240.50892
40130099.	1.284163E+13	.00000313	.00007201	23.04167604	248.06632	6242.60189
40130099.	1.070136E+13	.00000375	.00008507	22.68461752	291.89825	7529.95238
40130099.	9.172594E+12	.00000438	.00009814	22.43291903	335.47377	8816.87869
40130099.	8.026020E+12	.00000500	.00011152	22.30483675	379.78186	10095.00472
40130099.	7.134240E+12	.00000563	.00012460	22.15037584	422.71762	11382.07675
40130099.	6.420816E+12	.00000625	.00013768	22.02937746	465.40027	12668.68290
40130099.	5.837105E+12	.00000688	.00015079	21.93273211	507.82902	13954.81985
40130099.	5.350680E+12	.00000750	.00016391	21.85436583	550.00304	15240.48451
40130099.	4.939089E+12	.00000813	.00017704	21.79007292	591.92146	16525.67390
40130099.	4.586297E+12	.00000875	.00019020	21.73685217	633.58350	17810.38435
40130099.	4.280544E+12	.00000938	.00020337	21.69249773	674.98820	19094.61352
40130099.	4.013010E+12	.00001000	.00021655	21.65536451	716.13489	20378.35639
40130099.	3.776950E+12	.00001063	.00022976	21.62418222	757.02247	21661.61171
40130099.	3.567120E+12	.00001125	.00024298	21.59797525	797.65027	22944.37419
40130099.	3.379377E+12	.00001188	.00025621	21.57596540	838.01730	24226.64128
40130099.	3.210408E+12	.00001250	.00026947	21.55753183	878.12264	25508.40983
40130099.	3.057531E+12	.00001313	.00028274	21.54217100	917.96532	26789.67704
40130099.	2.918553E+12	.00001375	.00029603	21.52947950	957.54469	28070.43668
40130099.	2.791659E+12	.00001438	.00030934	21.51911116	996.85955	29350.68793
40130099.	2.675340E+12	.00001500	.00032266	21.51078844	1035.90917	30630.42518
40854322.	2.614677E+12	.00001563	.00033600	21.50427103	1074.69247	31909.64609
42423499.	2.610677E+12	.00001625	.00034936	21.49935865	1113.20849	33188.34690
43991073.	2.606878E+12	.00001688	.00036274	21.49588251	1151.45638	34466.52291
45557038.	2.603259E+12	.00001750	.00037614	21.49369669	1189.43518	35744.17010
47121376.	2.599800E+12	.00001813	.00038955	21.49267244	1227.14376	37021.28598
48684079.	2.596484E+12	.00001875	.00040299	21.49270105	1264.58116	38297.86649
50245146.	2.593298E+12	.00001938	.00041644	21.49369097	1301.74654	39573.90583
51804560.	2.590228E+12	.00002000	.00042991	21.49555635	1338.63874	40849.40151
53362315.	2.587264E+12	.00002063	.00044340	21.49822569	1375.25682	42124.34872
54918396.	2.584395E+12	.00002125	.00045691	21.50163317	1411.59963	43398.74427
56472800.	2.581614E+12	.00002188	.00047044	21.50572443	1447.66627	44672.58253
58025513.	2.578912E+12	.00002250	.00048399	21.51044798	1483.45562	45945.85992
59576523.	2.576282E+12	.00002313	.00049755	21.51575804	1518.96655	47218.57275
61125819.	2.573719E+12	.00002375	.00051114	21.52161455	1554.19798	48490.71671
62673394.	2.571216E+12	.00002438	.00052474	21.52798319	1589.14890	49762.28638
65763339.	2.566374E+12	.00002500	.00053829	21.54213095	1658.20475	52303.68495
68846265.	2.561722E+12	.00002563	.00055188	21.55797815	1726.12498	54842.73329
71922083.	2.557230E+12	.00002625	.00056547	21.57534456	1792.90038	57379.39362
74990697.	2.552875E+12	.00002688	.00057906	21.59408140	1858.52150	59913.62745
77463992.	2.529436E+12	.00002750	.00059265	21.55594397	1918.70914	60000.00000
79479115.	2.493462E+12	.00002813	.00060624	21.47865343	1974.53682	60000.00000
81192444.	2.451093E+12	.00002875	.00062083	21.37959337	2027.18010	60000.00000
82688109.	2.405472E+12	.00002938	.00063443	21.26787901	2077.28497	60000.00000
84048424.	2.359254E+12	.00003000	.00064802	21.15209627	2125.51405	60000.00000
85263186.	2.312222E+12	.00003063	.00066161	21.03123236	2171.80547	60000.00000
86361702.	2.265225E+12	.00003125	.00067520	20.90778208	2216.38083	60000.00000
87056334.	2.210955E+12	.00003188	.00068879	20.79999876	2260.78127	60000.00000
88376044.	2.175410E+12	.00003250	.00070238	20.74359369	2308.08237	60000.00000
89196013.	2.130054E+12	.00003313	.00071597	20.60448790	2347.09947	60000.00000
90013838.	2.087277E+12	.00003375	.00072956	20.47426558	2385.47692	60000.00000
90747621.	2.045017E+12	.00003438	.00074315	20.34267569	2422.38888	60000.00000
91406853.	2.003438E+12	.00003500	.00075674	20.21081686	2457.96374	60000.00000
92064202.	1.964036E+12	.00003563	.00077033	20.08667707	2492.93972	60000.00000
92710337.	1.926449E+12	.00003625	.00078392	19.96855402	2527.21576	60000.00000
93233238.	1.888268E+12	.00003688	.00079751	19.84298944	2559.63387	60000.00000
93754470.	1.851940E+12	.00003750	.00081110	19.72420835	2591.49079	60000.00000
94274023.	1.817331E+12	.00003813	.00082469	19.61172438	2622.78383	60000.00000
94791867.	1.784317E+12	.00003875	.00083828	19.50509405	2653.50998	60000.00000
95232614.	1.751404E+12	.00003938	.00085187	19.39497900	2682.85497	60000.00000
95639636.	1.719364E+12	.00004000	.00086546	19.28658342	2711.31757	60000.00000
96156989.	1.690672E+12	.00004063	.00087905	19.20000029	2740.75740	60000.00000
96535364.	1.660823E+12	.00004125	.00089264	19.18292856	2775.52803	60000.00000
96927250.	1.632459E+12	.00004188	.00090623	19.07628965	2801.20335	60000.00000
97317084.	1.605230E+12	.00004250	.00091982	18.97440290	2826.37182	60000.00000
97617773.	1.577661E+12	.00004313	.00093341	18.86522341	2849.96783	60000.00000
97917281.	1.551165E+12	.00004375	.00094700	18.76075888	2873.10362	60000.00000
98215603.	1.525679E+12	.00004438	.00096059	18.66073751	2895.77715	60000.00000

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98512730.	1.501146E+12	.00006563	.00121832	18.56490755	2917.98629	60000.00000
98808662.	1.477513E+12	.00006688	.00123538	18.47303724	2939.72899	60000.00000
99103398.	1.454729E+12	.00006813	.00125247	18.38491201	2961.00319	60000.00000
99396929.	1.432749E+12	.00006938	.00126959	18.30033159	2981.80670	60000.00000
99634294.	1.410751E+12	.00007063	.00128619	18.21150255	3001.46863	60000.00000
99856921.	1.389314E+12	.00007188	.00130268	18.12423563	3020.52378	60000.00000
1.000785E+08	1.368594E+12	.00007313	.00131919	18.04027319	3039.13995	60000.00000
1.002989E+08	1.348557E+12	.00007438	.00133573	17.95945501	3057.31559	60000.00000
1.007366E+08	1.310395E+12	.00007688	.00136889	17.80663633	3092.33644	60000.00000
1.011700E+08	1.274582E+12	.00007938	.00140213	17.66466379	3125.57010	60000.00000
1.012966E+08	1.237210E+12	.00008188	.00144100	17.59999895	3162.33870	60000.00000
1.020178E+08	1.209100E+12	.00008438	.00147647	17.49890471	3193.43005	60000.00000
1.023154E+08	1.177732E+12	.00008688	.00150715	17.34849501	3218.33871	60000.00000
1.026096E+08	1.148080E+12	.00008938	.00153792	17.20746946	3241.71561	60000.00000
1.029004E+08	1.120004E+12	.00009188	.00156877	17.07507563	3263.54711	60000.00000
1.031876E+08	1.093379E+12	.00009438	.00159972	16.95063829	3283.81909	60000.00000
1.034713E+08	1.068091E+12	.00009688	.00163075	16.83355379	3302.51727	60000.00000
1.037150E+08	1.043673E+12	.00009938	.00166126	16.71707296	3319.28184	60000.00000
1.039165E+08	1.020040E+12	.00010188	.00169120	16.60072088	3334.17801	60000.00000
1.041149E+08	9.975084E+11	.00010438	.00172122	16.49075747	3347.59442	60000.00000
1.043101E+08	9.760011E+11	.00010688	.00175133	16.38673925	3359.51738	60000.00000
1.045021E+08	9.554474E+11	.00010938	.00178153	16.28827143	3369.93333	60000.00000
1.046907E+08	9.357830E+11	.00011188	.00181181	16.19499063	3378.82825	60000.00000
1.048760E+08	9.169490E+11	.00011438	.00184219	16.10656214	3386.18775	60000.00000
1.050580E+08	8.988920E+11	.00011688	.00187265	16.02268839	3391.99746	60000.00000
1.057681E+08	8.860156E+11	.00011938	.00191000	16.00000048	3397.01895	60000.00000
1.066627E+08	8.751810E+11	.00012188	.00195000	16.00000048	3399.70675	60000.00000
1.066627E+08	8.575894E+11	.00012438	.00198008	15.92021513	3397.17077	60000.00000
1.066627E+08	8.406911E+11	.00012688	.00200799	15.82655954	3390.32244	60000.00000
1.066627E+08	8.244459E+11	.00012938	.00203600	15.73716402	3383.45222	60000.00000
1.066627E+08	8.088166E+11	.00013188	.00206408	15.65179682	3385.45811	60000.00000
1.066627E+08	7.937688E+11	.00013438	.00209225	15.57024050	3390.25296	60000.00000
1.066627E+08	7.792707E+11	.00013688	.00212051	15.49229479	3394.10496	60000.00000
1.066627E+08	7.652928E+11	.00013938	.00214885	15.41777658	3397.00305	60000.00000
1.066627E+08	7.518075E+11	.00014188	.00217729	15.34650850	3398.93581	60000.00000
1.066627E+08	7.387891E+11	.00014438	.00220581	15.27833319	3399.89167	60000.00000
1.066627E+08	7.262140E+11	.00014688	.00223451	15.21371126	3396.79105	60000.00000
1.066627E+08	7.140598E+11	.00014938	.00226337	15.15225935	3390.75208	60000.00000
1.066627E+08	7.023057E+11	.00015188	.00229229	15.09326792	3384.69556	60000.00000
1.067262E+08	6.913439E+11	.00015438	.00232128	15.03661966	3378.62140	60000.00000
1.068002E+08	6.807982E+11	.00015688	.00234996	14.97983408	3378.87038	60000.00000
1.068517E+08	6.704423E+11	.00015938	.00237788	14.92001009	3383.69428	60000.00000
1.069028E+08	6.604034E+11	.00016188	.00240585	14.86242056	3387.90756	60000.00000
1.069533E+08	6.506665E+11	.00016438	.00243389	14.80696249	3391.50361	60000.00000
1.070033E+08	6.412182E+11	.00016688	.00246200	14.75354433	3394.47597	60000.00000
1.070528E+08	6.320458E+11	.00016938	.00249017	14.70208311	3396.81811	60000.00000
1.071017E+08	6.231371E+11	.00017188	.00251840	14.65249586	3398.52324	60000.00000
1.071501E+08	6.144808E+11	.00017438	.00254670	14.60470819	3399.58452	60000.00000
1.072433E+08	5.978719E+11	.00017938	.00260366	14.51515245	3395.69670	60000.00000
1.073326E+08	5.821430E+11	.00018438	.00266102	14.43267488	3385.82267	60000.00000
1.073326E+08	5.667729E+11	.00018938	.00272700	14.39999914	3373.67456	60000.00000
1.073326E+08	5.521935E+11	.00019438	.00279900	14.39999914	3375.30202	60000.00000
1.074675E+08	5.390220E+11	.00019938	.00287100	14.39999914	3387.05715	60000.00000
1.077648E+08	5.272897E+11	.00020438	.00293341	14.35306120	3393.62604	60000.00000
1.078264E+08	5.149916E+11	.00020938	.00299025	14.28178453	3397.35851	60000.00000
1.078868E+08	5.032619E+11	.00021438	.00304731	14.21487093	3399.48319	60000.00000
1.079130E+08	4.919113E+11	.00021938	.00310262	14.14298201	3398.87772	60000.00000
1.079236E+08	4.809967E+11	.00022438	.00315925	14.08021116	3391.31261	60000.00000
1.079338E+08	4.705563E+11	.00022938	.00321600	14.02069044	3383.71637	60000.00000
1.079437E+08	4.605596E+11	.00023438	.00327286	13.96421957	3376.08854	60000.00000
1.079531E+08	4.509789E+11	.00023938	.00332985	13.91061831	3368.42841	60000.00000
1.079621E+08	4.417885E+11	.00024438	.00338697	13.85972071	3360.73534	60000.00000
1.079706E+08	4.329649E+11	.00024938	.00344421	13.81137514	3353.00859	60000.00000
1.079787E+08	4.244865E+11	.00025438	.00350158	13.76544142	3361.18685	60000.00000
1.079864E+08	4.163332E+11	.00025938	.00355909	13.72179079	3369.09304	60000.00000
1.079932E+08	4.084848E+11	.00026438	.00361682	13.68065786	3376.16959	60000.00000
1.079932E+08	4.009028E+11	.00026938	.00367630	13.64750147	3382.77999	60000.00000
1.079932E+08	3.935970E+11	.00027438	.00373595	13.61622477	3388.35815	60000.00000
1.079932E+08	3.865528E+11	.00027938	.00379580	13.58674192	3392.87934	60000.00000
1.079932E+08	3.797562E+11	.00028438	.00385584	13.55898428	3396.31826	60000.00000

Unfactored (Nominal) Moment Capacity at Concrete Strain of 0.003 = 107836.68681 in-kip

 Computed values of Load Distribution and Deflection
 for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
 Specified shear force at pile head = 28000.000 lbs
 Specified moment at pile head = 41820000.000 in-lbs
 Specified axial load at pile head = 40000.000 lbs

Non-zero moment for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

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Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res. p lbs/in	Es*h F/L
0.000	.762254	4.18E+07	28000.	-.004820	486.998	2.61E+12	0.000	0.000
26.880	.638504	4.26E+07	27934.	-.004386	495.716	2.61E+12	-8.601	45.262
53.760	.526539	4.33E+07	22918.	-.003943	504.062	2.61E+12	-564.854	3604.504
80.640	.426558	4.36E+07	-5130.907	-.003495	507.550	2.61E+12	-1525.556	12017.
107.520	.338633	4.28E+07	-57144.	-.003049	498.437	2.61E+12	-2190.858	21738.
134.400	.262449	4.05E+07	-1.19E+05	-.002659	471.384	8.80E+12	-2332.885	29867.
161.280	.191940	3.64E+07	-1.79E+05	-.002591	425.155	1.61E+13	-1997.485	34967.
188.160	.123064	3.10E+07	-2.28E+05	-.002535	361.977	1.61E+13	-1578.418	43095.
215.040	.055571	2.44E+07	-2.61E+05	-.002489	285.881	1.62E+13	-847.186	51224.
241.920	-.010837	1.71E+07	-2.70E+05	-.002454	202.950	1.62E+13	188.804	58539.
268.800	-.076481	1.01E+07	-2.48E+05	-.002432	121.793	1.63E+13	1517.487	66667.
295.680	-.141672	4.16E+06	-1.86E+05	-.002420	53.467	1.63E+13	3153.716	74796.
322.560	-.206671	5.27E+05	-75801.	-.002417	11.588	1.63E+13	5100.608	82924.

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection = .76225372 in
 Computed slope at pile head = -.00482030
 Maximum bending moment = 43613323. lbs-in
 Maximum shear force = -270798.26680 lbs
 Depth of maximum bending moment = 77.28000000 in
 Depth of maximum shear force = 238.56000 in
 Number of iterations = 72
 Number of zero deflection points = 1

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacement in
 Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
 Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
 Type 4 = Deflection and Moment, S = Pile-head Slope, radians
 Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1	V= 28000.	M= 4.18E+07	40000.0000	.7622537	4.3613E+07	-270798.

Computed Pile-head Stiffness Matrix Members
 K22, K23, K32, K33 for Superstructure

Top y in	Shear React. lbs	Mom. React. in-lbs	K22 lbs/in	K32 in-lbs/in
.00136420	2800.00004	580754.21008	2052479.	4.257091E+08
.00410666	8428.83988	1748244.	2052479.	4.257091E+08
.00650891	13359.39513	2770902.	2052479.	4.257091E+08
.00821622	16857.67976	3497565.	2051757.	4.256904E+08
.00954160	19571.16012	4061618.	2051141.	4.256749E+08
.01062458	21788.23501	4522510.	2050738.	4.256648E+08
.01154027	23662.74512	4912204.	2050450.	4.256575E+08
.01233351	25286.51964	5249781.	2050230.	4.256520E+08
.01303321	26718.79026	5547553.	2050055.	4.256476E+08
.01365912	28000.00000	5813923.	2049912.	4.256440E+08
Top Rota. rad	Shear React. lbs	Mom. React. in-lbs	K23 lbs/rad	K33 in-lbs/rad
.00003992	16993.34204	4182000.	4.257091E+08	1.047655E+11
.00012020	51155.23434	12589074.	4.255927E+08	1.047365E+11

Colchester South Caisson Analysis.lpo

.00019077	81083.50600	19953211.	4.250414E+08	1.045951E+11
.00024096	102320.27946	25178149.	4.246420E+08	1.044925E+11
.00027997	118792.88191	29230926.	4.243103E+08	1.044085E+11
.00031188	132252.21692	32542285.	4.240466E+08	1.043419E+11
.00033891	143632.42563	35342000.	4.238077E+08	1.042815E+11
.00036235	153490.82094	37767223.	4.236014E+08	1.042293E+11
.00038304	162186.96618	39906422.	4.234250E+08	1.041846E+11
.00040389	169969.14251	41820000.	4.208319E+08	1.035434E+11

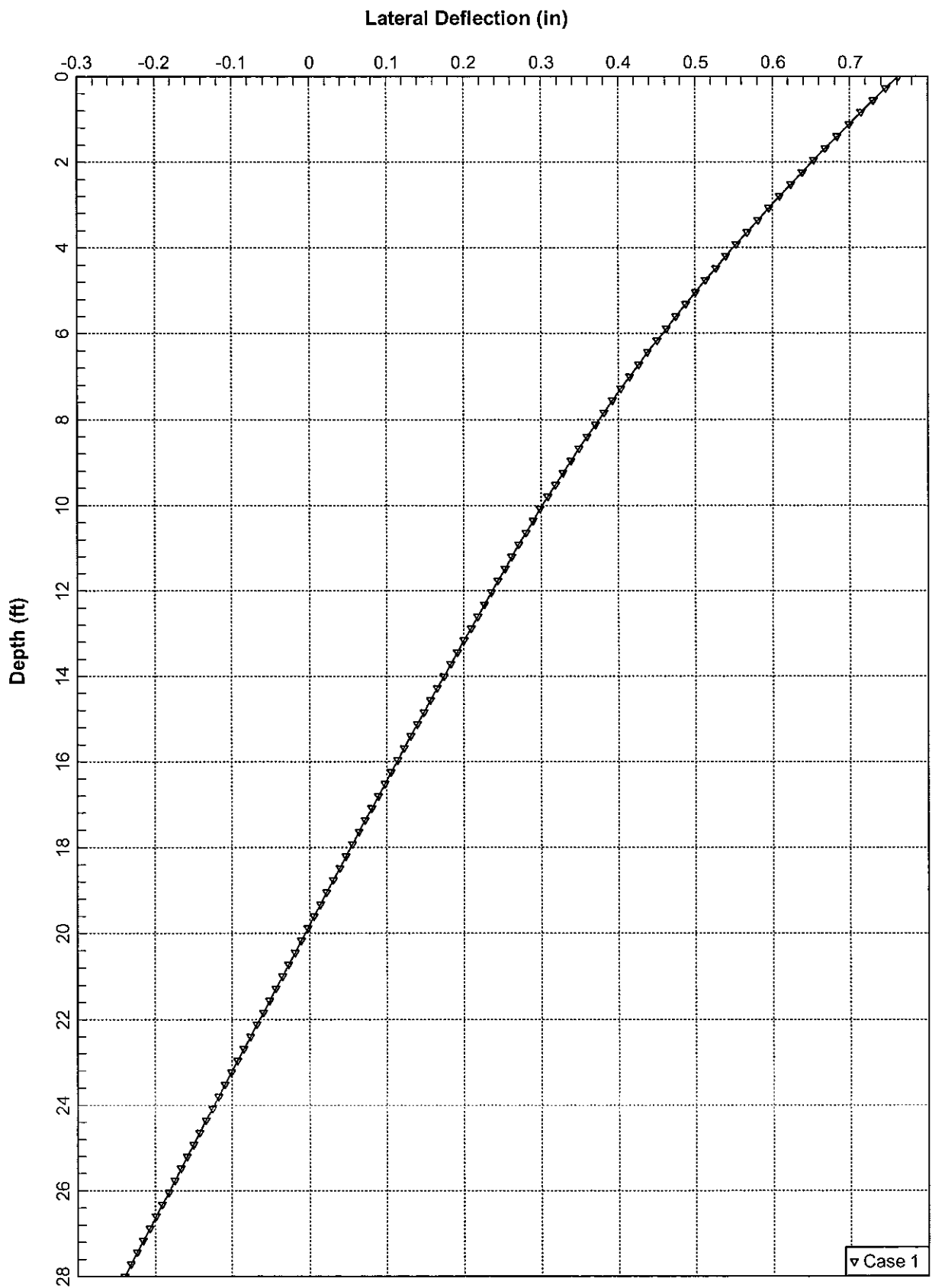
K22 = abs(Shear Reaction/Top y)
 K23 = abs(Shear Reaction/Top Rotation)
 K32 = abs(Moment Reaction/Top y)
 K33 = abs(Moment Reaction/Top Rotation)

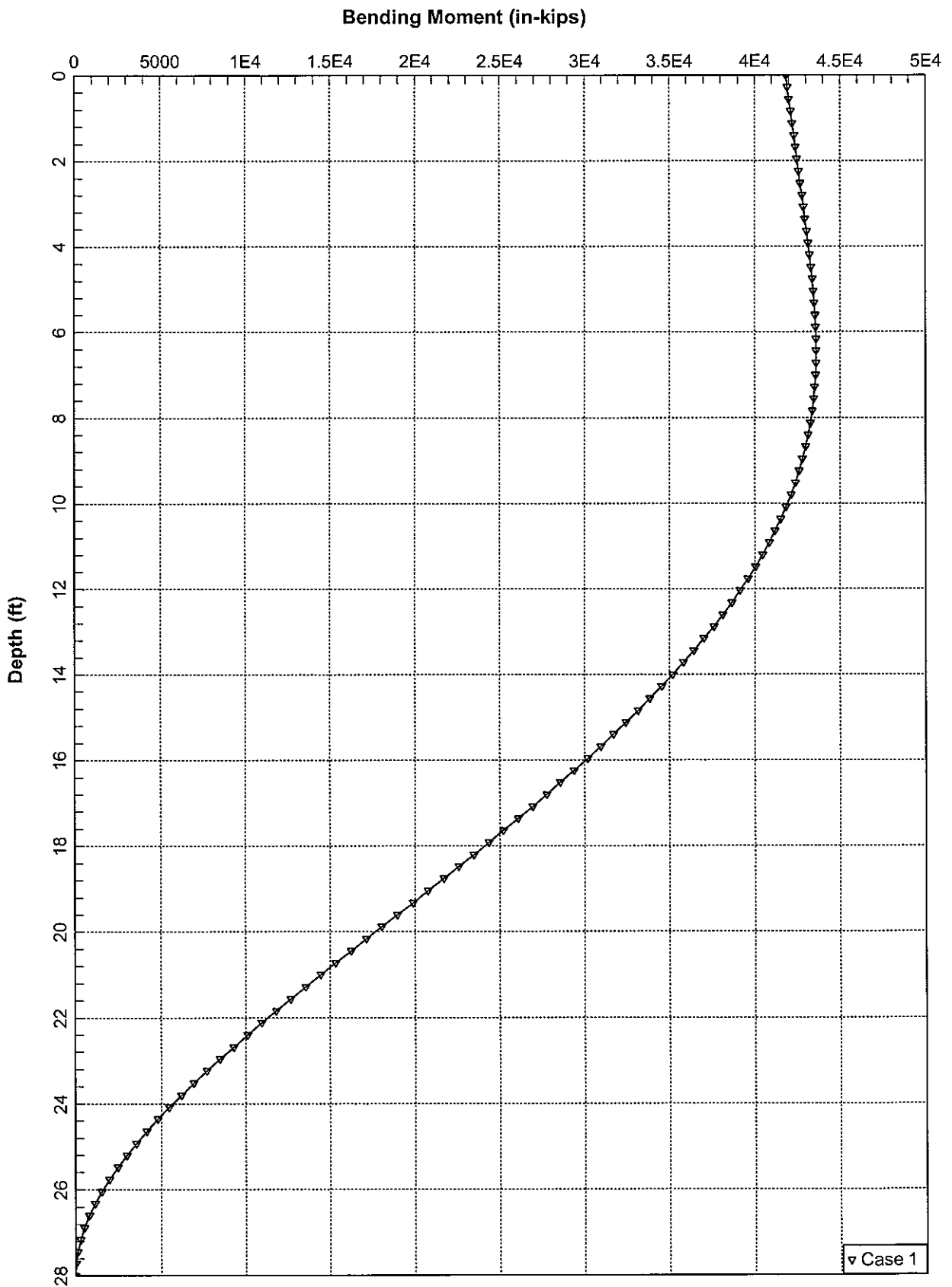
The analysis ended normally.

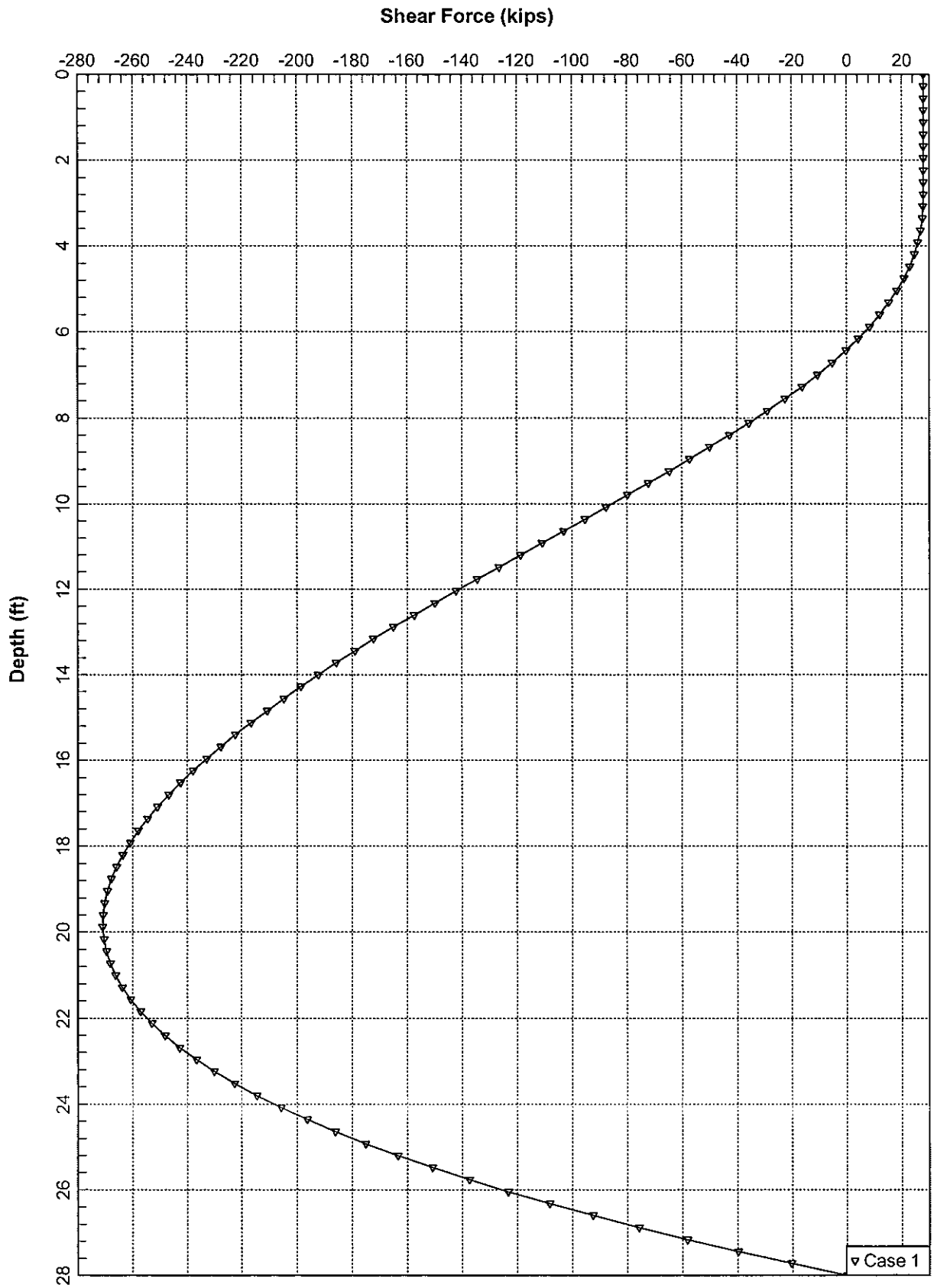
 Summary of Warning Messages

**** WARNING ****

An unreasonable value was input for friction angle has been specified for a soil layer defined using the sand criteria. The input value is either smaller than 20 degrees or higher than 48 degrees. The input data should be checked for correctness.







AM-X-CD-14-65-00T-RET (4' 65° Dual Broadband Antenna)

Dual Band Electrical DownTilt Antenna

698 ~ 894MHz, X-pol., H65° / V17.0°

1710 ~ 2170MHz, X-pol., H65° / V8.5°

Electrical Specification

Frequency Range	698~894MHz	1710~2170MHz
Impedance	50Ω	
Polarization	Dual, Slant ±45°	
Gain	14.0dBi / 11.85dBd @ 698-806MHz 14.8dBi / 12.65dBd @ 824-894MHz	16.1dBi / 13.95dBd @ 1710-1755MHz 16.3dBi / 14.15dBd @ 1850-1900MHz 16.0dBi / 13.85dBd @ 2110-2155MHz
Beamwidth	Horizontal	67° @ 698-806MHz 65° @ 824-894MHz
	Vertical	60° @ 1710-1755MHz 61° @ 1850-1900MHz 64° @ 2110-2155MHz
	Horizontal	17.5° @ 698-806MHz 16.5° @ 824-894MHz
	Vertical	8.8° @ 1710-1755MHz 8.5° @ 1850-1900MHz 8.0° @ 2110-2155MHz
VSWR	≤1.5:1	
Front-to-Back Ratio	≥28 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 15° from Boresight)	> 16 dB @ 0-6° Tilt > 18 dB @ 7-10° Tilt (Up to 15° 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)	11.8×5.9×48 inches (300×150×1219mm)
Weight (Without clamp)	36.4 lbs (16.5 kg)
Connector	4 x 7/16 DIN(F), Long Neck
Max Wind Speed	150 mph
Wind Load (@150 mph)	1260 N

P65-17-XLH-RR

Dual Broadband Antennas

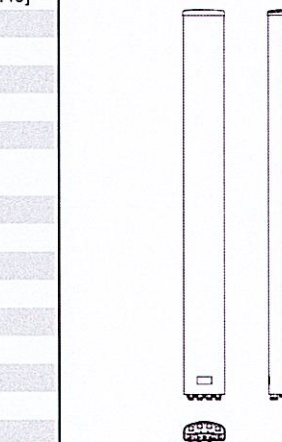
POLARIZATION: Dual linear $\pm 45^\circ$
 FREQUENCY (MHz): 698-894, 1710-2170
 HORIZONTAL BEAM WIDTH ($^\circ$): 65, 65
 GAIN (dBi dBd): 17.2/15.1 17.5/15.4
 TILT: 0-7, 0-8
 LENGTH: 96"

ELECTRICAL SPECIFICATIONS*

	698-894		1710-2170		
Frequency range (MHz)	698-806	806-894	1710-1880	1850-1990	1900-2170
Frequency band (MHz)	16.4/14.3	17.2/15.1	16.9/14.8	17.2/15.1	17.5/15.4
Gain (dBi/dBd)	Dual Linear +/- 45		Dual Linear +/- 45		
Polarization	50		50		
Nominal Impedance (Ω)	< 1.5:1		< 1.5:1		
VSWR	70	63	60	63	60
Horizontal beam width, -3 dB ($^\circ$)	8.4		6.5		
Vertical beam width, -3 dB ($^\circ$)	0 to 7		0 to 8		
Electrical down tilt ($^\circ$)	> 16		> 16		
Side lobe suppression, vertical 1st upper (dB)	> 30		> 30		
Isolation between inputs (dB)	> 40		> 40		
Inter band Isolation (dB)	< 2		< 2		
Tracking, horizontal plane $\pm 60^\circ$ (dB)	< 0.5		< 0.5		
Vertical beam squint ($^\circ$)	> 25		> 30		
Front to back ratio (dB) $180^\circ \pm 30^\circ$ copolar	> 22		> 25		
Front to back ratio (dB) $180^\circ \pm 30^\circ$ total power	> 15		> 15		
Cross polar discrimination (XPD) 0° (dB)	10		10		
Cross polar discrimination (XPD) $\pm 60^\circ$ (dB)	< -153		< -153		
IM3, 2Tx&43dBm (dBc)	500		300		
Power handling, average per input (W)	1000		600		
Power handling, average total (W)					

MECHANICAL SPECIFICATIONS*

Connector	4 x 7/16 DIN Female, IP67, 4 x AISG [2 x i-RET 8510.40]
Connector position	Bottom
Dimensions, HxWxD, mm(ft)	2445x312x148(96"x12"x6")
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, kg (lbs)	28.2 (62)
Weight, without brackets, kg (lbs)	22.7 (50)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.6 (N)	1006 / 147 / 1273
Maximum operational wind speed, m/s (mph)	45 (100)
Survival wind speed, m/s (mph)	67 (150)
Lightning protection	DC Ground
Operating Temperature	-40°C to +60°C
Radome Material	PVC, IP55
Radome colour	Light Grey
Packing size, HxWxD, mm (ft)	2610 x 427 x 275 (102.8" x 17" x 11")
Shipping weight, kg (lbs)	37 (81)
RET	iRET AISGv1.1, MET and AISGv2.0 Available
Brackets	7256.00, 7454.00A



*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

ANTENNA PATTERNS*

For detailed patterns visit <http://www.powerwave.com/rpa/>.

RRUS 11

Frequency (AT&T)

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

RF Characteristics

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

RET/TMA Support

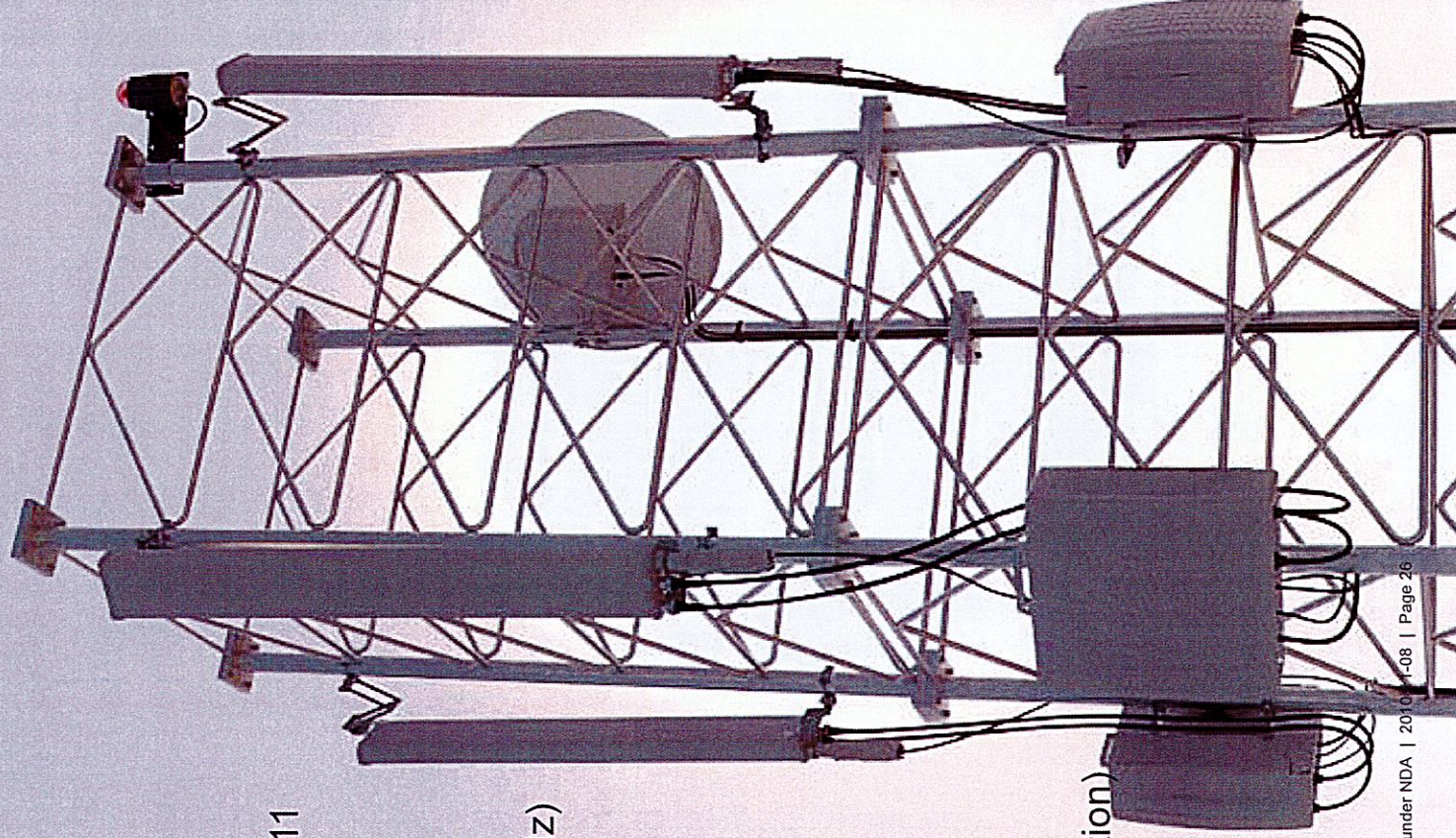
- ✓ AISG 2.0 Compatible
- ✓ Via RET Port and Centre Conductor
- ✓ Cascading
- ✓ 30 VDC Bias

Environmental

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

Power

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



RRUS 11 Mechanics

Wall and pole mounting brackets

- Reused from RRUW and RRU22
- Vertical Mount Only

Clearing distances:

- Above ≥ 16 in.
- Below ≥ 12 in.
- Side ≥ 0 mm

DC connector

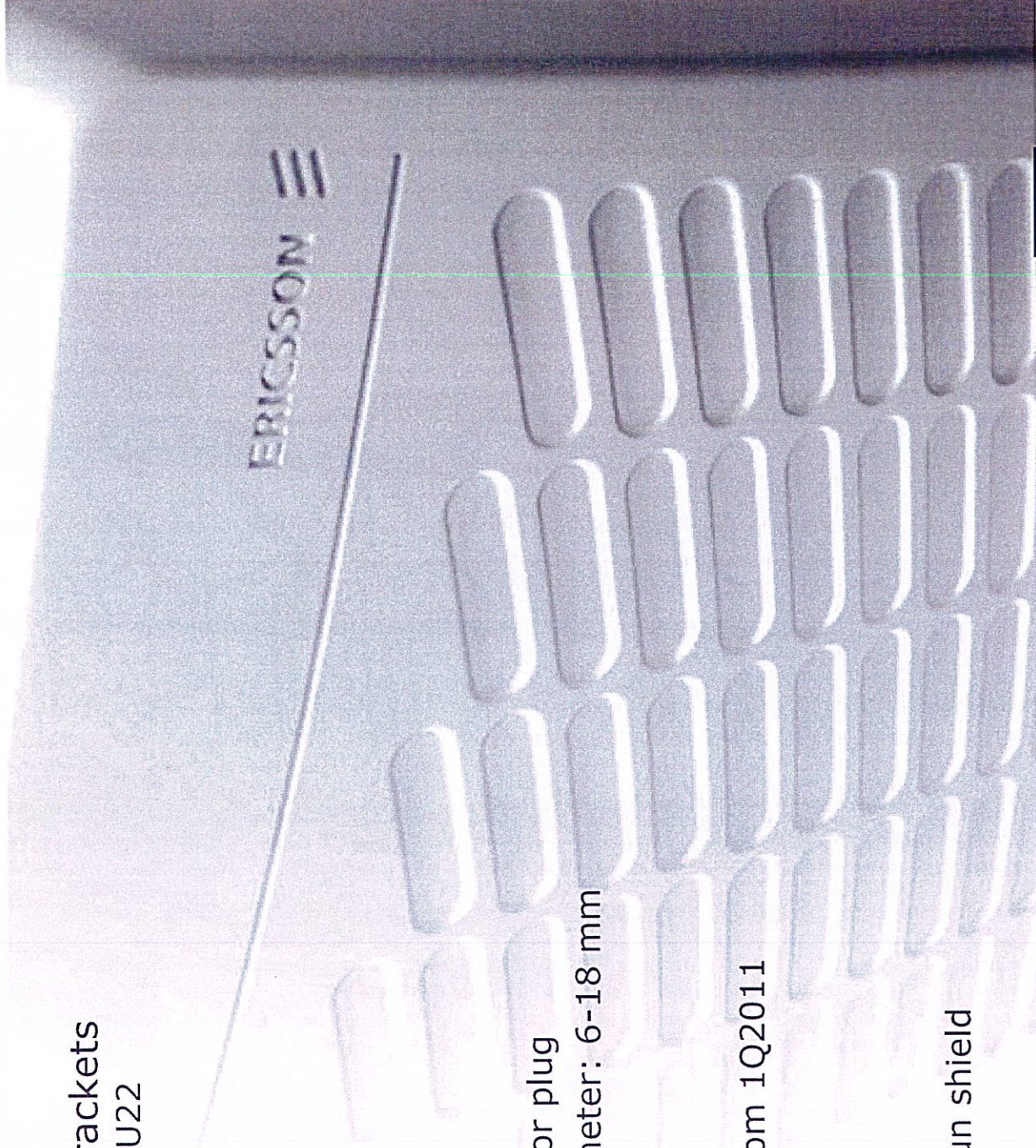
- Bayonet
- Screw terminals in connector plug
- Supported outer cable diameter: 6-18 mm

CPRI connector

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

Size & Weight

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



POWER

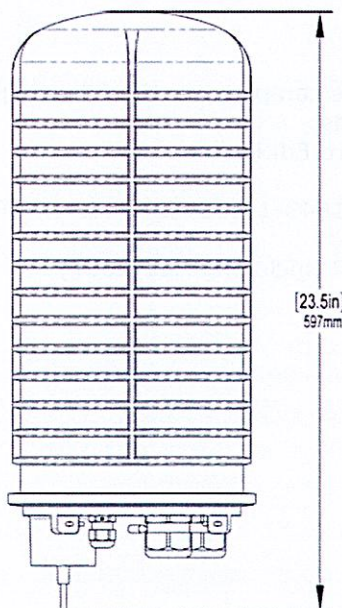
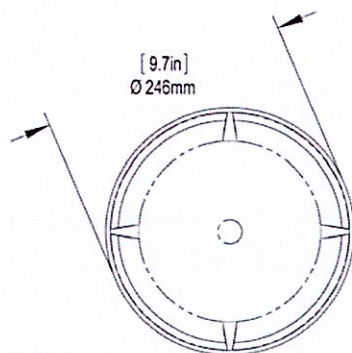
DC6-48-60-18-8F

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 μ s
Maximum Discharge Current (I_{max}) per NEMA LS-1	60 kA 8/20 μ 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 psi
Resistance to Aggressive Materials	CEI IEC 61073-2 including acids and bases
UV Protection	ISO 4892-2 Method A Xenon-Arc 2160 hrs
Weight	20 lbs without Mounting Bracket

STANDARDS

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

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



Raycap

G02-00-068 REV 050610



GS-07F-0435V



Certified to
ISO 9001:2000



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