



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

October 5, 2012

VIA OVERNIGHT COURIER

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

Re: Sprint Spectrum, L.P. – exempt modification
5 Perryridge Road, Greenwich, Connecticut

Dear Ms. Roberts:

This letter and attachments are submitted on behalf of Sprint Spectrum, L.P. ("Sprint"). Sprint is undertaking modifications to certain existing sites in its Connecticut system in order to implement updated technology. Please accept this letter and attachments as notification, pursuant to R.C.S.A. Section 16-50j-73, of construction that constitutes an exempt modification pursuant to R.C.S.A. Section 16-50j-72(b)(2). In compliance with R.C.S.A. Section 16-50j-73, a copy of this letter and attachments is being sent to the First Selectman of the Town of Greenwich.

Sprint plans to modify the existing wireless communications facility owned by Greenwich Hospital and located at 5 Perryridge Road in the Town of Greenwich (coordinates 41.034189, -73.630803). Attached are a compound plan and elevation depicting the planned changes, and documentation of the structural sufficiency of the structure to accommodate the revised antenna configuration. Also included is a power density report reflecting the modification to Sprint's operations at the site.

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

1. Sprint will replace six (6) of nine existing antennas with three (3) dual-band panel

antennas and three (3) dual-pole CDMA antennas on the existing platform with a center line of approximately 154'. Six (6) RRHs (remote radio heads) will be mounted behind the antennas around the pole. During an interim period of up to one year, the three (3) CDMA antennas will remain; with their removal, six (6) antennas will remain. Sprint will also install three (3) hybri-flex cables along the existing coaxial cable run, and will remove the coaxial cable at the end of the interim period. The proposed modifications will not extend the height of the approximately 164' structure.

2. The proposed changes will not extend the site boundaries. Sprint will replace two (2) existing cabinets and will add one (1) cabinet on its existing concrete pad. Sprint will also install a fiber distribution box on unistruts on the pad. These changes will have no effect on the site boundaries.

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

4. The changes to the facility will not increase the calculated "worst case" power density for the combined operations at the site to a level at or above the applicable standard for uncontrolled environments as calculated for a mixed frequency site. As indicated on the attached report prepared by EBI Consulting, Sprint's operations at the site will result in a power density of approximately 13.630%; the combined site operations will result in a total power density of approximately 56.090%.

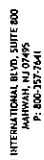
Please feel free to contact me by phone at (860) 798-7454 or by e-mail at jgaudet@hpcwireless.com with questions concerning this matter. Thank you for your consideration.

Respectfully yours,



Jennifer Young Gaudet

cc: Honorable Peter Tesei, First Selectman, Town of Greenwich
Greenwich Hospital (underlying property owner)



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Charles L. Wheeler A.I.A.
CY 10889

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SUBMITTALS			
NO	DATE	DESCRIPTION	BY
	3-20-02	PRELIMINARY	PJP
	5-29-02	VALUES ADJUSTED	AD

SITE NUMBER: CT43XC855
SITE NAME:

GREENWICH HOSPITAL
SITE ADDRESS:
5 PERRYRIDGE ROAD
GREENWICH, CT 06830

1011

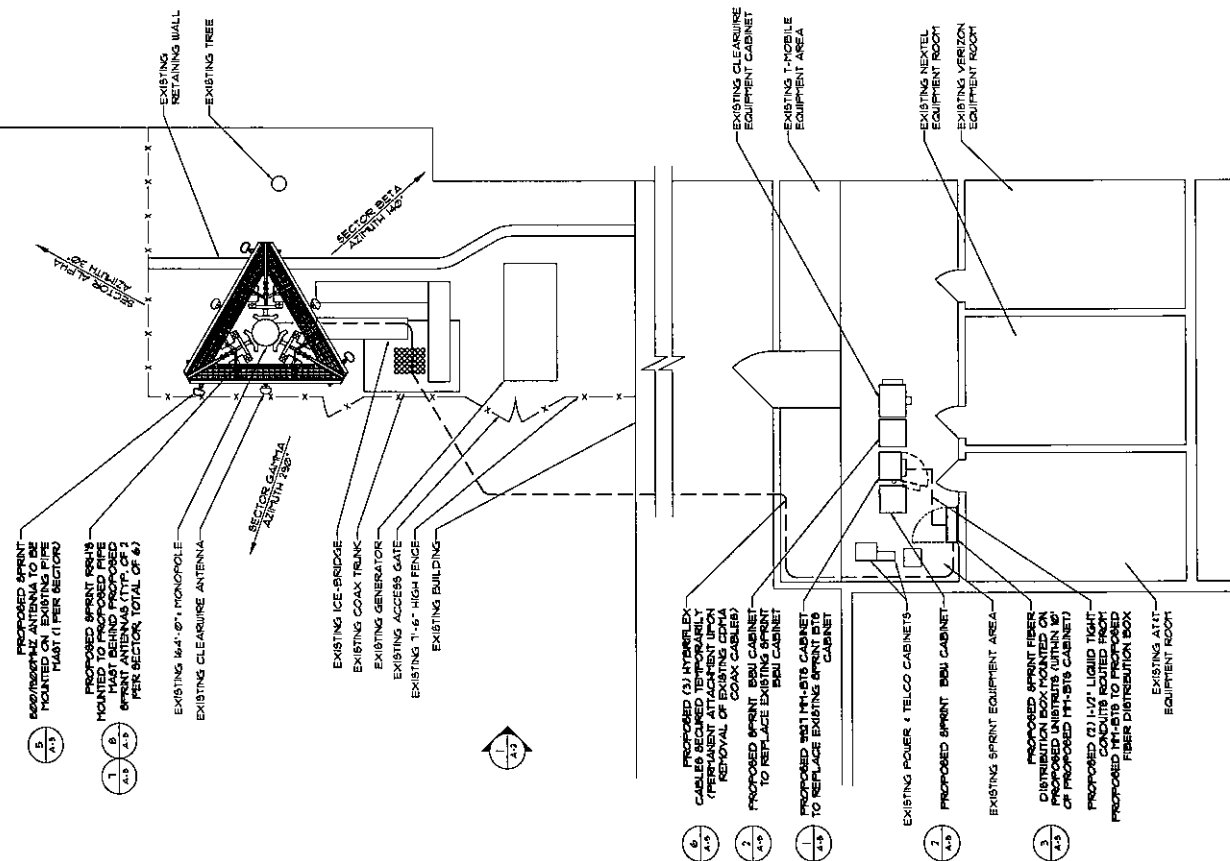
COMPOUND PLAN

WARRANT PROJ. NO:	SHEET NO:
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DATE:
NAME:
SECTION:

ANTENNA CONFIGURATION NOTE.
ALL EXISTING COTA ANTENNAS TO BE
REMOVED / REPLACED WITH NETWORK VISION
ANTENNAS FOR FINAL CONFIGURATION.
ANTENNA SEPARATION TO BE FIELD VERIFIED
BY THE GENERAL CONTRACTOR.



COMPOUND PLAN

SCALE = 3/16" = 1'-0"



Charles J. Pappas A.I.A.
P.E. # 10999

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SUBMITTALS	
NO	DATE
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2	11/01/07
3	11/01/07
4	11/01/07
5	11/01/07
6	11/01/07
7	11/01/07
8	11/01/07
9	11/01/07
10	11/01/07

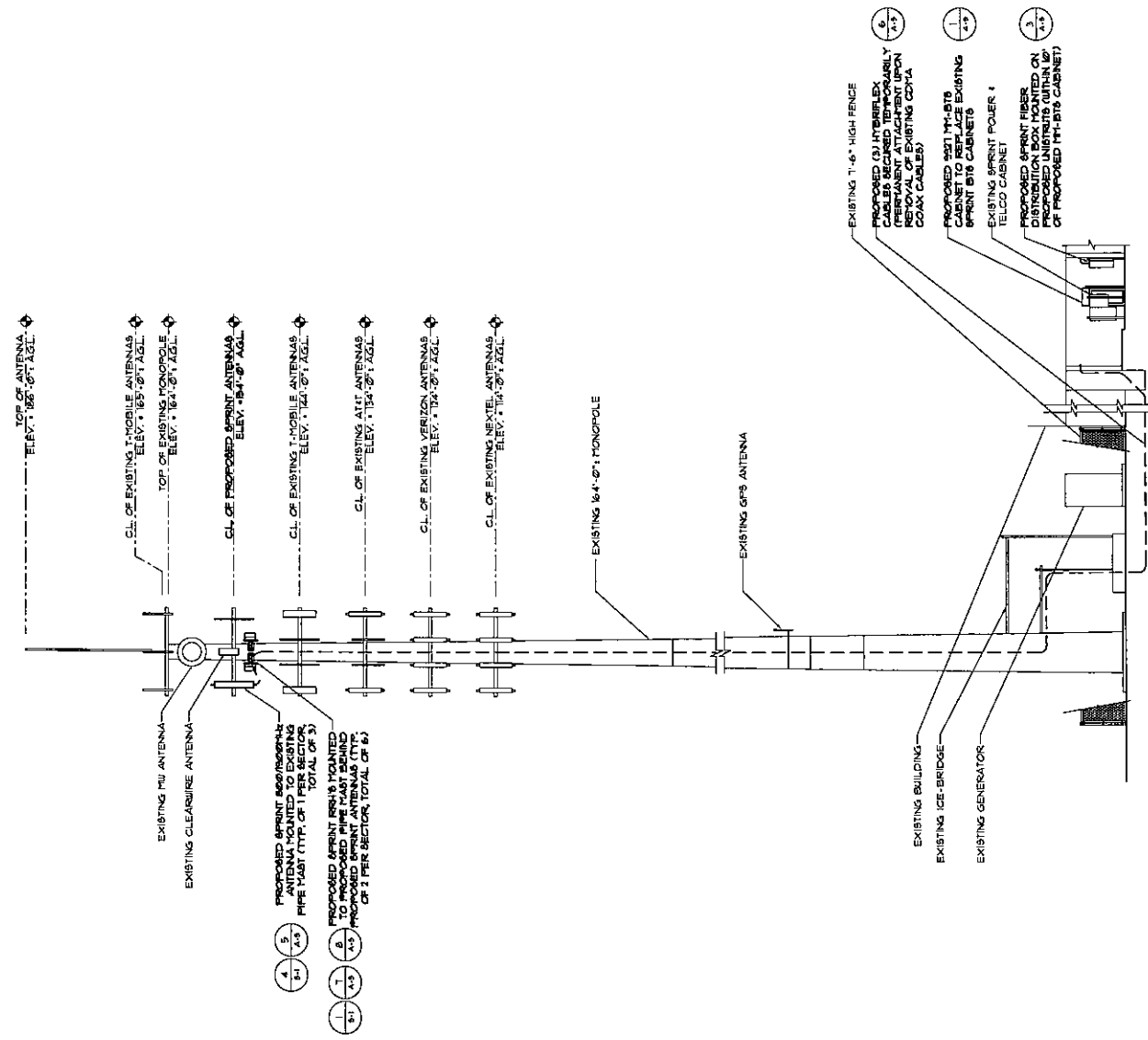
CT43XC855
SITE NUMBER
SITE NAME
GREENWICH HOSPITAL
9 PERRYBRIDGE ROAD
GREENWICH, CT 06830

ELEVATION
ELEVATION
ELEVATION

PROJECT NO.: CT43XC855
DATE: 11/01/07
CREATED BY: JHP

A-2

ANTENNA CONFIGURATION NOTE
ALL EXISTING COMA ANTENNAS TO BE REMOVED / REPLACED WITH NETWORK VISION ANTENNAS FOR FINAL CONFIGURATION. ANTENNA SEPARATION TO BE FIELD VERIFIED BY THE GENERAL CONTRACTOR.



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



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Charles J. Whiting AIA

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SUBMITTALS

NO	DATE	DESCRIPTION	BY
1	08/01/09	PRELIMINARY	PJP
2	08/01/09	ISSUED AS FINAL	AD
3			
4			
5			
6			
7			

SITE NUMBER:
CT43XC085

SITE NAME:
GREENWICH HOSPITAL

SITE ADDRESS:
9 PERRYTRIDGE ROAD
GREENWICH, CT 06830

SHEET TITLE:
ENLARGED INTERIM EQUIPMENT CABINET LAYOUT

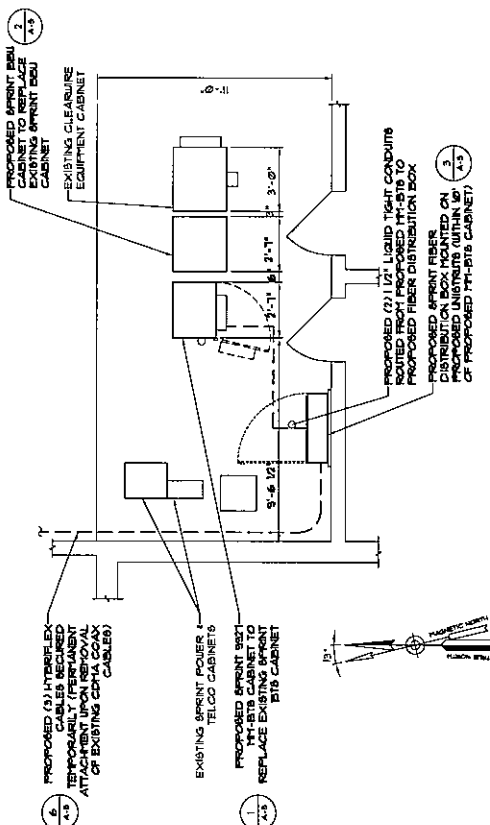
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CT43XC085

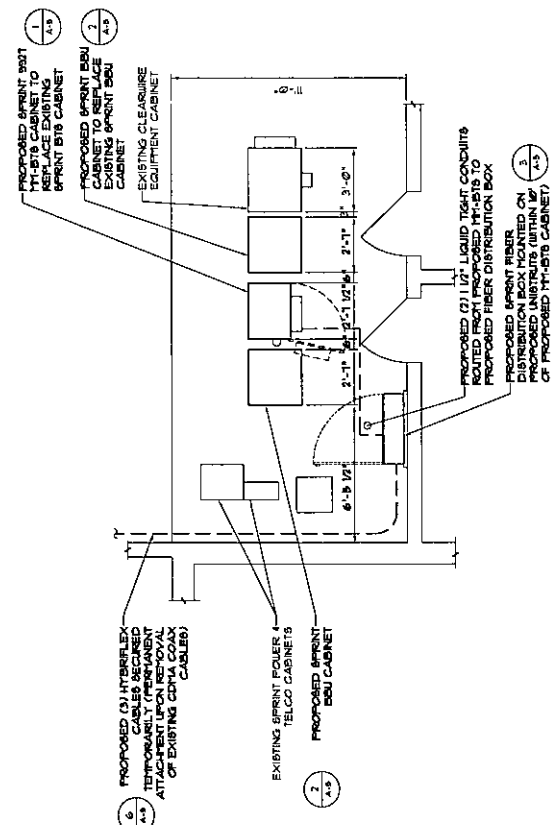
DATE:
JULY 2009

CHECKED BY:
JWP

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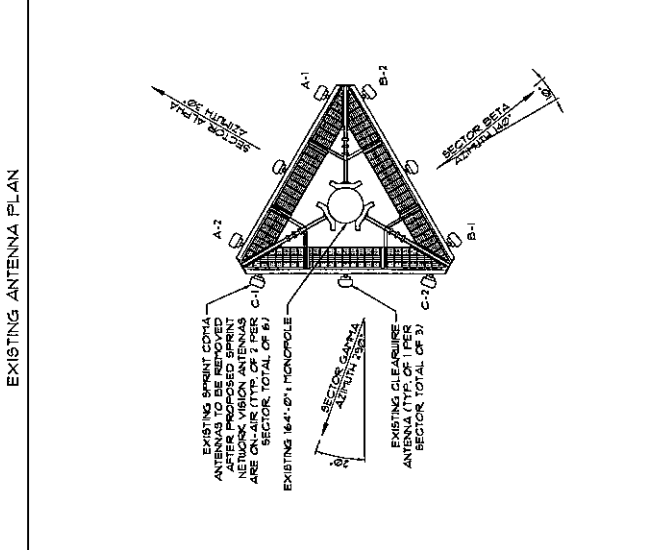
1 ENLARGED EXISTING EQUIPMENT CABINET LAYOUT
SCALE = 3/8" = 1'-0"



2 ENLARGED INTERIM EQUIPMENT CABINET LAYOUT
SCALE = 3/8" = 1'-0"

3 ENLARGED FINAL EQUIPMENT CABINET LAYOUT
SCALE = 3/8" = 1'-0"

EQUIPMENT CABINET CONFIGURATION
EXISTING LAYOUT: 3 CABINETS
PROPOSED LAYOUT: 4 CABINETS



ANTENNA SCENARIO

SCALE = N.T.S.

ID	POSITION	ANTENNA STATUS	FREQUENCY (MHz)	ANTENNA MAKE	ANTENNA MODEL	AZIMUTH		ELECTRICAL DOWN TILT	RAD CENTER (AGL)	HYBRIDEX CABLE LENGTH (FT)	RRH MODEL	TOP COAX JUMPER SIZE (IN)	TOP COAX JUMPER LENGTH (FT)	TOP COAX JUMPER MAKE	TOP COAX JUMPER MODEL	COMBINER	COMBINER JUMPER LENGTH (FT)	ANTENNA COLOR CODING
						EXISTING (NOT REFERRED)	PROPOSED											
1	A-1	PROPOSED	800/1500	RRH	APX06FF10-C-A30	30°	30°	-0°	104°-0°	200	(U) 500FF10-C	1/2	50	RRH	(2) LCPD-500	--	--	TBD

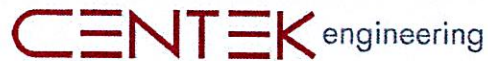
ID	POSITION	ANTENNA STATUS	FREQUENCY (MHz)	ANTENNA MAKE	ANTENNA MODEL	AZIMUTH		ELECTRICAL DOWN TILT	RAD CENTER (AGL)	HYBRIDEX CABLE LENGTH (FT)	RRH MODEL	TOP COAX JUMPER SIZE (IN)	TOP COAX JUMPER LENGTH (FT)	TOP COAX JUMPER MAKE	TOP COAX JUMPER MODEL	COMBINER	COMBINER JUMPER LENGTH (FT)	ANTENNA COLOR CODING
						EXISTING (NOT REFERRED)	PROPOSED											
2	B-1	PROPOSED	800/1500	POWERWAVE	P40-16-XLFP-RR-A	140°	140°	-1°	104°-0°	200	(U) 500FF10-C	1/2	50	RRH	(2) LCPD-500	--	--	TBD

ID	POSITION	ANTENNA STATUS	FREQUENCY (MHz)	ANTENNA MAKE	ANTENNA MODEL	AZIMUTH		ELECTRICAL DOWN TILT	RAD CENTER (AGL)	HYBRIDEX CABLE LENGTH (FT)	RRH MODEL	TOP COAX JUMPER SIZE (IN)	TOP COAX JUMPER LENGTH (FT)	TOP COAX JUMPER MAKE	TOP COAX JUMPER MODEL	COMBINER	COMBINER JUMPER LENGTH (FT)	ANTENNA COLOR CODING
						EXISTING (NOT REFERRED)	PROPOSED											
3	C-1	PROPOSED	800/1500	RRH	APX06FF10-C-A30	130°	130°	-0°	104°-0°	200	(U) 500FF10-C	1/2	50	RRH	(2) LCPD-500	--	--	TBD

* CONTRACTOR TO FIELD VERIFY ALL CABLE/JUMPER LENGTHS AGAINST CURRENT BOM.

RF SYSTEM SCHEDULE

SCALE = N.T.S.



Centered on SolutionsSM

Structural Analysis Report

164-ft Existing EEl Monopole

Proposed Sprint Antenna Upgrade

*Sprint Site Ref: CT43XC855:
Greenwich Hospital*

*5 Perryridge Road
Greenwich, CT*

CENTEK Project No. 12083

Date: September 25, 2012



Prepared for:

*Sprint Nextel
8 Airline Drive, Suite 105
Albany, NY 12205*

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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 installation proposed by Sprint on the existing monopole (tower) owned and operated by Greenwich Hospital located in Greenwich, Connecticut.

The host tower is a 164-ft tall, five-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI); project no. 11030 dated August 21, 2002. The tower geometry, structure member sizes and foundation system information were obtained from the original manufacturers design documents.

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 while the top section is flange connected. The diameter of the pole (flat-flat) is 47.0-in at the top and 76.0-in at the base.

Antenna and appurtenance information were obtained from a previous structural analysis report prepared by Centek engineering; job no; 11009.CO12, dated April 14, 2011, a Sprint RFDS sheet and visual verification conducted from grade by Centek personal.

Sprint proposes the removal of six (6) panel antennas and the installation of six (6) panel antennas mounted to the existing low profile platform together with six (6) Remote Radio Heads (RRH's) 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 tower was designed to support several communication antennas. The existing, proposed and future loads considered in this analysis consist of the following:

- TOWN (EXISTING):
Antennas: One (1) PD1142-1 Omni-directional whip antenna, one (1) PD620-3 Omni-directional whip antenna, one (1) ALR8 Omni-directional whip antenna three (3) BMR10 Omni-directional whip antennas and one (1) camera mounted on a PiROD 13-ft low profile platform with an elevation of 164-ft above grade level.
Coax Cables: Six (6) 1/2" $\varnothing$, one (1) 5/8" $\varnothing$, three (3) 7/8" $\varnothing$ and two (2) 1-1/4" $\varnothing$ coax cables running on the inside of the existing tower.
- TOWN (EXISTING):
Antennas: Two (2) 4 FT Dishes and one (1) 2 Ft Dish mounted on three 4'x4" pipe mounts with a RAD center elevation of 160-ft above grade level.
Coax Cables: Three (3) 1-1/4" $\varnothing$ coax cables running on the inside of the existing tower.

▪ **CLEARWIRE (EXISTING):**

Antennas: Three (3) Argus LLPX310R panel antennas, three (3) Samsung FDD-R6-RRH, two (2) Dragonwave Horizon ODU's and two (2) Dragonwave A-ANT-23-G-2-C dishes mounted on the Sprint 13-ft low profile platform with a RAD center elevation of 154-ft above the existing tower base plate.

Coax Cables: Two (2) 2" Ø conduits and two (2) 5/8" Ø coax cables running on the inside of the existing tower.

▪ **T-MOBILE (EXISTING/RESERVED):**

Antennas: Six (6) Ericsson AIR21 panel antennas, three (3) TMA's and three (3) Bias Tee's mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 144-ft above grade level.

Coax Cables: Fourteen (14) 1-5/8" Ø coax cables and three (3) 1-5/8" Ø fiber cables running on the inside of the existing tower.

▪ **AT&T (EXISTING):**

Antennas: Six (6) Powerwave 7770.00 panel antennas, three (3) Powerwave P65-16-XLH-RR panel antennas and six (6) LGP21401 TMA's mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 134-ft above grade level.

Coax Cables: Twelve (12) 1-5/8" Ø coax cables running on the inside of the existing tower

▪ **AT&T (EXISTING):**

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 138-ft above grade level.

Coax Cables: One (1) fiber cable and two (2) dc control cables running on the inside of the existing tower.

▪ **VERIZON (EXISTING):**

Antennas: Six (6) Decibel 844G65T6ZAXY panel antennas, three (3) Andrew LNX-6514DS-T4M panel antennas, three (3) RYMSA MG D3-800T0 panel antennas and six (6) RFS FD9R6004/2C-3L Diplexers mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 124-ft above grade level.

Coax Cables: Twelve (12) 1-5/8" Ø coax cables running on the inside of the existing tower.

▪ **NEXTEL (EXISTING):**

Antennas: Twelve (12) Decibel DB846G90A-XY panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 114-ft above grade level.

Coax Cables: Twelve (12) 1-5/8" Ø coax cables running on the inside of the existing tower.

▪ **UNKNOWN (EXISTING):**

Antennas: Three GPS antennas mounted on three (3) standoffs with a RAD center elevation of 50-ft above grade level.

Coax Cables: Three (3) 7/8" Ø coax cables running on the exterior of the existing tower.

- **SPRINT (EXISTING TO REMAIN):**
Antennas: One (1) GPS antenna mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 154-ft above grade level.
Coax Cables: Six (6) 1-5/8" Ø and one (1) 1/2 Ø coax cables running on the inside of the existing tower.
- **SPRINT (EXISTING TO REMOVE):**
Antennas: Two (2) Decibel 950F65T2E-M panel antennas and four (4) Decibel DB980F90E-M panel antennas mounted on a PiROD 13-ft low profile platform with a RAD center elevation of 154-ft above grade level.
- **SPRINT (PROPOSED):**
Antennas: Four (4) RFS APXVSP18-C-A20 panel antennas and two (2) Powerwave P40-16-XLPP-RR-A panel antennas mounted to a low profile platform with a RAD center elevation of 154-ft above the existing tower base plate. Three (3) ALU 1900 MHz RRH's and three (3) ALU 800 MHz RRH's mounted on a universal tr-bracket below the existing low profile platform.
Coax Cables: Three (3) 1-5/8" Ø Hybriflex cables running on the 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 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:	Fairfield; v = 85 mph (fastest mile)	[Section 16 of TIA/EIA-222-F-96]
	Greenwich; v = 100 mph (3 second gust) equivalent to v = 80 mph (fastest mile)	[Appendix K of the 2005 CT Building Code Supplement]
	<i>TIA/EIA wind speed controls.</i>	
Load Cases:	<u>Load Case 1</u> ; 85 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	[Section 2.3.16 of TIA/EIA-222-F-96]
	<u>Load Case 2</u> ; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed.	[Section 2.3.16 of TIA/EIA-222-F-96]
	<u>Load Case 3</u> ; Seismic – not checked	[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type

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 **48.4%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L5)	1.5'-39.88'	48.4%	PASS

- The tower deflection (tilt) was found to be within allowable limits.

Deflection (degrees)	Proposed	Allowable ⁽¹⁾	Result
Tilt	1.45	1.9	PASS

(1) Allowable tilt taken from original EEI design documents job no. 11030 dated 8/21/02.

Foundation and Anchors

The existing foundation consists of a 9.0 Ø x 28.0-ft long reinforced concrete cassion. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; project no. 11030 dated August 21, 2002. The base of the tower is connected to the foundation by means of (30) 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:

Base Reactions	Vector	Proposed Load
Base	Shear	45 kips
	Axial	83 kips
	Moment	5051 ft-kips

- The foundation was found to be within allowable limits.

Foundation	Design Limit	Proposed Loading	Result
Reinforced Concrete Caisson	Moment Capacity	56.5%	PASS
	Lateral Deflection	0.61 in. ⁽¹⁾	PASS

(1) Lateral deflection typically limited to 1.0 in. for monopole tower structures.

CEN TEK Engineering, Inc.

Structural Analysis – 164-ft EEI Monopole

Sprint Antenna Upgrade – CT43XC855: Greenwich Hospital

Greenwich, CT

September 25, 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	60.3%	PASS
Flange Plate	Bending	46.1%	PASS
Anchor Bolts	Compression	49.7%	PASS
Base Plate	Bending	39.0%	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 Sprint. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

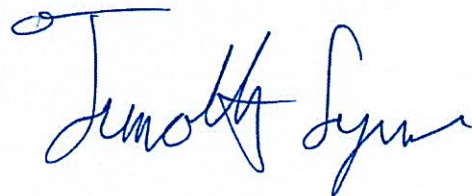
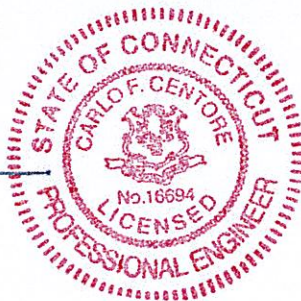
Please feel free to call with any questions or comments.

Respectfully Submitted by:

Prepared by:



Carlo F. Centore, PE
Principal ~ Structural Engineer



Timothy J. Lynn, EIT
Structural Engineer

CEN TEK Engineering, Inc.
Structural Analysis – 164-ft EEI Monopole
Sprint Antenna Upgrade – CT43XC855: Greenwich Hospital
Greenwich, CT
September 25, 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 provide to CENTEK engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the "as new" condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. CENTEK engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

CEN TEK Engineering, Inc.
Structural Analysis – 164-ft EEI Monopole
Sprint Antenna Upgrade – CT43XC855: Greenwich Hospital
Greenwich, CT
September 25, 2012

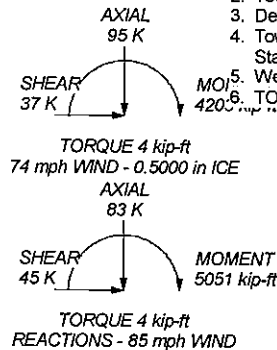
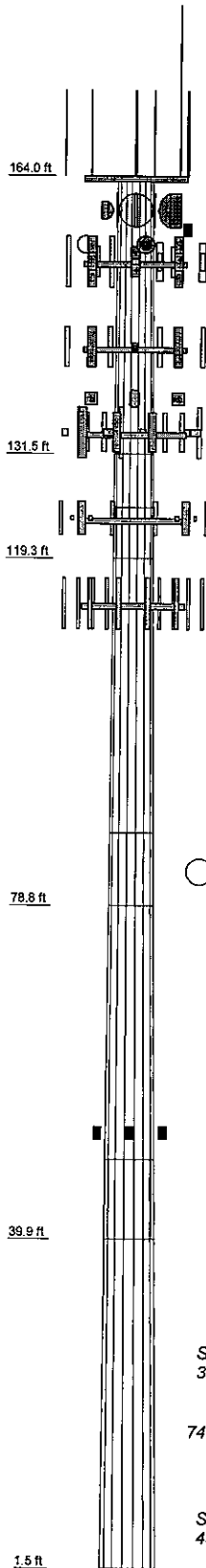
General Description of Structural Analysis Program

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	32.50	18	0.3125	47.0000	53.4200	56.1500	A572-65	5.5
2	12.21	18	0.3750	6.00	53.4200	56.1500		2.7
3	46.50	18	0.4375	8.42	54.0585	62.9700		12.8
4	47.33	18	0.5925	9.25	60.4813	69.6500		18.5
5	47.03	18	0.5925	66.7412	76.0000			20.5



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
PD1142-1 (Town Existing)	164	(2) AIR21 (T-Mobile Reserved)	144
PD620-3 (Town Existing)	164	TMA 10"x8"x3" (T-Mobile Reserved)	144
ALR8 (Town Existing)	164	TMA 10"x8"x3" (T-Mobile Reserved)	144
BMR10 (Town Existing)	164	(2) AIR21 (T-Mobile Reserved)	144
BMR10 (Town Existing)	164	(2) RRUS-11 (ATI Existing)	138
BMR10 (Town Existing)	164	(2) RRUS-11 (ATI Existing)	138
Camera (Town Existing)	164	(2) RRUS-11 (ATI Existing)	138
Low Profile Platform (Town Existing)	164	DC6-48-60-18-8F Surge Arrestor (ATI Existing)	138
4"x4" Pipe Mount (Town Existing)	160	Valmont Uni-Tri Bracket (ATI Existing)	138
4"x4" Pipe Mount (Town Existing)	160	P65-16-XLH-RR (ATI Existing)	134
4"x4" Pipe Mount (Town Existing)	160	7770.00 (ATI Existing)	134
4 FT DISH (Town Existing)	160	7770.00 (ATI Existing)	134
4 FT DISH (Town Existing)	160	P65-16-XLH-RR (ATI Existing)	134
2 FT DISH (Town Existing)	160	(2) LGP214nn TMA (ATI Existing)	134
Horizon ODU (Clearwire Existing)	154	(2) LGP214nn TMA (ATI Existing)	134
Horizon ODU (Clearwire Existing)	154	(2) LGP214nn TMA (ATI Existing)	134
(2) APXVSP18-C-A20 (Sprint Proposed)	154	Low Profile Platform (ATI Existing)	134
(2) P40-16-XLPP-RR-A (Sprint Proposed)	154	7770.00 (ATI Existing)	134
(2) APXVSP18-C-A20 (Sprint Proposed)	154	7770.00 (ATI Existing)	134
(2) FD-RRH 4x40 1900 (Sprint Proposed)	154	P65-16-XLH-RR (ATI Existing)	134
(2) FD-RRH 4x40 1900 (Sprint Proposed)	154	7770.00 (ATI Existing)	134
(2) FD-RRH 4x40 1900 (Sprint Proposed)	154	844G65T6ZAXY (Verizon Existing)	124
(2) FD-RRH 4x40 1900 (Sprint Proposed)	154	MG D3-800TX (Verizon Existing)	124
(2) FD-RRH 4x40 1900 (Sprint Proposed)	154	LNK-6514DS-TOM (Verizon Existing)	124
(2) FD-RRH 4x40 1900 (Sprint Proposed)	154	844G65T6ZAXY (Verizon Existing)	124
GPS (Sprint Existing)	154	(2) FD9R6004/2C-3L Diplexer (Verizon Existing)	124
Low Profile Platform (Sprint Existing)	154	844G65T6ZAXY (Verizon Existing)	124
LLPX310R (Clearwire Existing)	154	MG D3-800TX (Verizon Existing)	124
LLPX310R (Clearwire Existing)	154	LNK-6514DS-TOM (Verizon Existing)	124
LLPX310R (Clearwire Existing)	154	844G65T6ZAXY (Verizon Existing)	124
A-Ant-23G-2-C (Clearwire Existing)	154	(2) FD9R6004/2C-3L Diplexer (Verizon Existing)	124
A-Ant-23G-2-C (Clearwire Existing)	154	Low Profile Platform (Verizon Existing)	124
Remote Radio Head FD R6 RRH (Clearwire Existing)	151.5	844G65T6ZAXY (Verizon Existing)	124
Valmont Uni-Tri Bracket (Sprint Proposed)	151.5	MG D3-800TX (Verizon Existing)	124
Remote Radio Head FD R6 RRH (Clearwire Existing)	151.5	LNK-6514DS-TOM (Verizon Existing)	124
Remote Radio Head FD R6 RRH (Clearwire Existing)	151.5	844G65T6ZAXY (Verizon Existing)	124
(2) FD9R6004/2C-3L Diplexer (Verizon Existing)	144	(4) DB846G90A-XY (Nextel Existing)	114
TMA 10"x8"x3" (T-Mobile Reserved)	144	(4) DB846G90A-XY (Nextel Existing)	114
Smart Bias T (T-Mobile Reserved)	144	(4) DB846G90A-XY (Nextel Existing)	114
Smart Bias T (T-Mobile Reserved)	144	Low Profile Platform (Nextel Existing)	114
Low Profile Platform (T-Mobile Existing)	144	GPS	51.5
(2) AIR21 (T-Mobile Reserved)	144	GPS	51.5

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
5. Welds are fabricated with ER-70S-6 electrodes.
6. TOWER RATING: 48.4%

Centek Engineering Inc.			Job: 12083 - CT43XC855 - Greenwich Hospital		
63-2 North Branford Rd.			Project: 164' EEI Monopole - Greenwich, CT		
Branford, CT 06405			Client: Sprint	Drawn by: TJL	App'd:
Phone: (203) 488-0580			Code: TIA/EIA-222-F	Date: 09/25/12	Scale: NTS
FAX: (203) 488-8587			Path: J:\Jobs\1208300 WNC\Calcs\ERI Files\164' EEI Monopole Greenwich.ctb	Dwg No. E-1	

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12083 - CT43XC855 - Greenwich Hospital	Page 1 of 22
	Project	164' EEI Monopole - Greenwich, CT	Date 08:28:15 09/25/12
	Client	Sprint	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 0.5000 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.

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	164.00-131.50	32.50	0.00	18	47.0000	53.4200	0.3125	1.2500	A572-65 (65 ksi)
L2	131.50-119.29	12.21	6.00	18	53.4200	56.1500	0.3750	1.5000	A572-65 (65 ksi)
L3	119.29-78.79	46.50	8.42	18	54.0585	62.9700	0.4375	1.7500	A572-65 (65 ksi)
L4	78.79-39.88	47.33	9.25	18	60.4813	69.6600	0.5625	2.2500	A572-65 (65 ksi)
L5	39.88-1.50	47.63		18	66.7412	76.0000	0.5625	2.2500	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	Page
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	Project 164' EEI Monopole - Greenwich, CT	Date 08:28:15 09/25/12
	Client Sprint	Designed by TJL

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	47.7251	46.3082	12752.5270	16.5741	23.8760	534.1149	25521.8341	23.1585	7.7220	24.71
	54.2441	52.6760	18769.9004	18.8532	27.1374	691.6627	37564.4987	26.3430	8.8519	28.326
L2	54.2441	63.1368	22444.4518	18.8310	27.1374	827.0684	44918.4365	31.5744	8.7419	23.312
	57.0162	66.3862	26091.2194	19.8001	28.5242	914.7047	52216.7704	33.1994	9.2224	24.593
L3	56.0600	74.4594	27047.4669	19.0354	27.4617	984.9157	54130.5236	37.2368	8.7443	19.987
	63.9414	86.8342	42898.2727	22.1990	31.9888	1341.0421	85852.9920	43.4253	10.3127	23.572
L4	63.0724	106.9776	48524.0652	21.2712	30.7245	1579.3269	97111.9796	53.4990	9.6547	17.164
	70.7346	123.3649	74413.8720	24.5296	35.3873	2102.8424	148925.659	61.6942	11.2702	20.036
L5	69.5966	118.1537	65376.3617	23.4934	33.9045	1928.2498	130838.747	59.0881	10.7564	19.123
	77.1724	134.6842	96834.1984	26.7803	38.6080	2508.1382	193795.813	67.3549	12.3860	22.02

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A _f	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals
ft	ft ²	in					in	in
L1				1	1	1		
164.00-131.50								
L2				1	1	1		
131.50-119.29								
L3				1	1	1		
119.29-78.79								
L4 78.79-39.88				1	1	1		
L5 39.88-1.50				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 plf
1/2	A	No	Inside Pole	164.00 - 4.50	6	No Ice	0.00
(Town Existing)						1/2" Ice	0.25
5/8	A	No	Inside Pole	164.00 - 4.50	1	No Ice	0.00
(Town Existing)						1/2" Ice	0.40
7/8	A	No	Inside Pole	164.00 - 4.50	3	No Ice	0.00
(Town Existing)						1/2" Ice	0.54
1 1/4	A	No	Inside Pole	164.00 - 4.50	5	No Ice	0.00
(Town Existing)						1/2" Ice	0.66
1 5/8	B	No	Inside Pole	154.00 - 7.50	6	No Ice	0.00
(Sprint Existing)						1/2" Ice	1.04
1/2	B	No	Inside Pole	154.00 - 7.50	1	No Ice	0.00
(Sprint Existing)						1/2" Ice	0.25
2" Rigid Conduit	B	No	Inside Pole	154.00 - 7.50	2	No Ice	0.00
(Clearwire Existing)						1/2" Ice	2.80
LDF4.5-50 (5/8 FOAM)	B	No	Inside Pole	154.00 - 7.50	2	No Ice	0.00
(Clearwire Existing)						1/2" Ice	0.15
1 5/8	B	No	Inside Pole	144.00 - 4.50	14	No Ice	0.00
							1.04

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12083 - CT43XC855 - Greenwich Hospital	Page	3 of 22
	Project	164' EEI Monopole - Greenwich, CT	Date	08:28:15 09/25/12
	Client	Sprint	Designed by	TJL

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_{AA} ft ² /ft	Weight plf
(T-Mobile Existing)						1/2" Ice	0.00	1.04
1 5/8	A	No	Inside Pole	134.00 - 11.50	12	No Ice	0.00	1.04
(AT&T Existing)						1/2" Ice	0.00	1.04
1 5/8	C	No	Inside Pole	124.00 - 7.50	12	No Ice	0.00	1.04
(Verizon Existing)						1/2" Ice	0.00	1.04
1 5/8	C	No	Inside Pole	114.00 - 4.50	12	No Ice	0.00	1.04
(Nextel Existing)						1/2" Ice	0.00	1.04
RG6-Fiber	A	No	Inside Pole	134.00 - 11.50	1	No Ice	0.00	0.00
(AT&T Existing)						1/2" Ice	0.00	0.00
#8 AWG Copper Wlre	A	No	Inside Pole	134.00 - 11.50	2	No Ice	0.00	0.00
(AT&T Existing)						1/2" Ice	0.00	0.00
7/8	B	No	CaAa (Out Of Face)	51.50 - 4.50	3	No Ice	0.11	0.54
						1/2" Ice	0.21	1.52
HYBRIFLEX 1-5/8"	B	No	Inside Pole	154.00 - 7.50	3	No Ice	0.00	1.90
(Sprint Proposed)						1/2" Ice	0.00	1.90
HYBRIFLEX 1-5/8"	B	No	Inside Pole	144.00 - 7.50	3	No Ice	0.00	1.90
(T-Mobile - Reserved)						1/2" Ice	0.00	1.90

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	164.00-131.50	A	0.000	0.000	0.000	0.000	0.25
		B	0.000	0.000	0.000	0.000	0.66
		C	0.000	0.000	0.000	0.000	0.00
L2	131.50-119.29	A	0.000	0.000	0.000	0.000	0.24
		B	0.000	0.000	0.000	0.000	0.47
		C	0.000	0.000	0.000	0.000	0.06
L3	119.29-78.79	A	0.000	0.000	0.000	0.000	0.78
		B	0.000	0.000	0.000	0.000	1.55
		C	0.000	0.000	0.000	0.000	0.94
L4	78.79-39.88	A	0.000	0.000	0.000	0.000	0.75
		B	0.000	0.000	0.000	3.869	1.51
		C	0.000	0.000	0.000	0.000	0.97
L5	39.88-1.50	A	0.000	0.000	0.000	0.000	0.60
		B	0.000	0.000	0.000	11.782	1.34
		C	0.000	0.000	0.000	0.000	0.85

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	164.00-131.50	A	0.500	0.000	0.000	0.000	0.000	0.25
		B		0.000	0.000	0.000	0.000	0.66
		C		0.000	0.000	0.000	0.000	0.00
L2	131.50-119.29	A	0.500	0.000	0.000	0.000	0.000	0.24
		B		0.000	0.000	0.000	0.000	0.47
		C		0.000	0.000	0.000	0.000	0.06
L3	119.29-78.79	A	0.500	0.000	0.000	0.000	0.000	0.78
		B		0.000	0.000	0.000	0.000	1.55
		C		0.000	0.000	0.000	0.000	0.94
L4	78.79-39.88	A	0.500	0.000	0.000	0.000	0.000	0.75
		B		0.000	0.000	0.000	7.355	1.55

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	Client	Sprint	Designed by	TJL

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
L5	39.88-1.50	C		0.000	0.000	0.000	0.000	0.97
		A	0.500	0.000	0.000	0.000	0.000	0.60
		B		0.000	0.000	0.000	22.395	1.45
		C		0.000	0.000	0.000	0.000	0.85

Feed Line Center of Pressure

Section	Elevation ft	CP _X in	CP _Z in	CP _X Ice in	CP _Z Ice in
L1	164.00-131.50	0.0000	0.0000	0.0000	0.0000
L2	131.50-119.29	0.0000	0.0000	0.0000	0.0000
L3	119.29-78.79	0.0000	0.0000	0.0000	0.0000
L4	78.79-39.88	0.1320	0.0762	0.2434	0.1405
L5	39.88-1.50	0.3779	0.2182	0.6797	0.3924

Discrete Tower Loads

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
4"x4" Pipe Mount (Town Existing)	A	From Face	0.50	0.0000	160.00	No Ice	1.32	0.04
			0.00			1/2" Ice	1.58	0.06
			0.00					
4"x4" Pipe Mount (Town Existing)	B	From Face	0.50	0.0000	160.00	No Ice	1.32	0.04
			0.00			1/2" Ice	1.58	0.06
			0.00					
4"x4" Pipe Mount (Town Existing)	C	From Face	0.50	0.0000	160.00	No Ice	1.32	0.04
			0.00			1/2" Ice	1.58	0.06
			0.00					
PD1142-1 (Town Existing)	A	From Face	4.00	0.0000	164.00	No Ice	1.32	0.01
			0.00			1/2" Ice	3.21	0.02
			5.00					
PD620-3 (Town Existing)	B	From Face	4.00	0.0000	164.00	No Ice	3.83	0.05
			0.00			1/2" Ice	5.99	0.08
			10.00					
ALR8 (Town Existing)	C	From Face	4.00	0.0000	164.00	No Ice	8.10	0.10
			0.00			1/2" Ice	10.80	0.15
			5.00					
BMR10 (Town Existing)	A	From Face	4.00	0.0000	164.00	No Ice	8.64	0.10
			-6.00			1/2" Ice	10.80	0.15
			5.00					
BMR10 (Town Existing)	B	From Face	4.00	0.0000	164.00	No Ice	8.64	0.10
			-6.00			1/2" Ice	10.80	0.15
			5.00					
BMR10 (Town Existing)	C	From Face	4.00	0.0000	164.00	No Ice	8.64	0.10
			-6.00			1/2" Ice	10.80	0.15
			5.00					

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12083 - CT43XC855 - Greenwich Hospital	Page	5 of 22
	Project	164' EEI Monopole - Greenwich, CT	Date	08:28:15 09/25/12
	Client	Sprint	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _A A ₁ Front ft ²	C _A A ₁ Side ft ²	Weight K	
Camera (Town Existing)	C	From Face	4.00 0.00 2.00	0.0000	164.00	No Ice 1/2" Ice	3.00 4.00	3.00 4.00	0.10 0.15
Low Profile Platform (Town Existing)	C	None		0.0000	164.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
LLPX310R (Clearwire Existing)	A	From Face	3.00 0.00 0.00	0.0000	154.00	No Ice 1/2" Ice	4.83 5.18	1.95 2.21	0.03 0.05
LLPX310R (Clearwire Existing)	B	From Face	3.00 0.00 0.00	0.0000	154.00	No Ice 1/2" Ice	4.83 5.18	1.95 2.21	0.03 0.05
LLPX310R (Clearwire Existing)	C	From Face	3.00 0.00 0.00	0.0000	154.00	No Ice 1/2" Ice	4.83 5.18	1.95 2.21	0.03 0.05
Remote Radio Head FD R6 RRH (Clearwire Existing)	A	From Face	3.00 0.00 0.00	0.0000	151.50	No Ice 1/2" Ice	1.80 1.99	0.78 0.92	0.03 0.04
Remote Radio Head FD R6 RRH (Clearwire Existing)	B	From Face	3.00 0.00 0.00	0.0000	151.50	No Ice 1/2" Ice	1.80 1.99	0.78 0.92	0.03 0.04
Remote Radio Head FD R6 RRH (Clearwire Existing)	C	From Face	3.00 0.00 0.00	0.0000	151.50	No Ice 1/2" Ice	1.80 1.99	0.78 0.92	0.03 0.04
Horizon ODU (Clearwire Existing)	A	None		0.0000	154.00	No Ice 1/2" Ice	0.79 0.91	0.17 0.25	0.00 0.00
Horizon ODU (Clearwire Existing)	C	None		0.0000	154.00	No Ice 1/2" Ice	0.79 0.91	0.17 0.25	0.00 0.00
(2) APXVSPP18-C-A20 (Sprint Proposed)	A	From Face	4.00 0.00 0.00	0.0000	154.00	No Ice 1/2" Ice	8.26 8.81	5.28 5.74	0.06 0.11
(2) P40-16-XLPP-RR-A (Sprint Proposed)	B	From Face	4.00 0.00 0.00	0.0000	154.00	No Ice 1/2" Ice	10.50 10.98	3.52 3.87	0.05 0.11
(2) APXVSPP18-C-A20 (Sprint Proposed)	C	From Face	4.00 0.00 0.00	0.0000	154.00	No Ice 1/2" Ice	8.26 8.81	5.28 5.74	0.06 0.11
(2) FD-RRH 4x40 1900 (Sprint Proposed)	A	From Face	4.00 0.00 0.00	0.0000	154.00	No Ice 1/2" Ice	2.82 3.06	2.82 3.06	0.04 0.07
(2) FD-RRH 4x40 1900 (Sprint Proposed)	B	From Face	4.00 0.00 0.00	0.0000	154.00	No Ice 1/2" Ice	2.82 3.06	2.82 3.06	0.04 0.07
(2) FD-RRH 4x40 1900 (Sprint Proposed)	C	From Face	4.00 0.00 0.00	0.0000	154.00	No Ice 1/2" Ice	2.82 3.06	2.82 3.06	0.04 0.07
Valmont Uni-Tri Bracket (Sprint Proposed)	A	None		0.0000	151.50	No Ice 1/2" Ice	1.75 1.94	1.75 1.94	0.29 0.31
GPS (Sprint Existing)	C	From Face	4.00 -6.00 3.00	0.0000	154.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
Low Profile Platform (Sprint Existing)	C	None		0.0000	154.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
(2) AIR21 (T-Mobile Reserved)	A	From Face	4.00 0.00 0.00	0.0000	144.00	No Ice 1/2" Ice	6.53 6.98	4.36 4.77	0.08 0.12
(2) AIR21 (T-Mobile Reserved)	B	From Face	4.00 0.00	0.0000	144.00	No Ice 1/2" Ice	6.53 6.98	4.36 4.77	0.08 0.12

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	Client	Sprint	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
(2) AIR21 (T-Mobile Reserved)	C	From Face	0.00 4.00 0.00 0.00	0.0000	144.00	No Ice 1/2" Ice	6.53 6.98	4.36 4.77	0.08 0.12
TMA 10"x8"x3" (T-Mobile Reserved)	A	From Face	4.00 0.00 0.00	0.0000	144.00	No Ice 1/2" Ice	0.78 0.90	0.29 0.38	0.02 0.02
TMA 10"x8"x3" (T-Mobile Reserved)	B	From Face	4.00 0.00 0.00	0.0000	144.00	No Ice 1/2" Ice	0.78 0.90	0.29 0.38	0.02 0.02
TMA 10"x8"x3" (T-Mobile Reserved)	C	From Face	4.00 0.00 0.00	0.0000	144.00	No Ice 1/2" Ice	0.78 0.90	0.29 0.38	0.02 0.02
Smart Bias T (T-Mobile Reserved)	A	From Face	4.00 0.00 0.00	0.0000	144.00	No Ice 1/2" Ice	0.16 0.21	0.08 0.12	0.00 0.00
Smart Bias T (T-Mobile Reserved)	B	From Face	4.00 0.00 0.00	0.0000	144.00	No Ice 1/2" Ice	0.16 0.21	0.08 0.12	0.00 0.00
Smart Bias T (T-Mobile Reserved)	C	From Face	4.00 0.00 0.00	0.0000	144.00	No Ice 1/2" Ice	0.16 0.21	0.08 0.12	0.00 0.00
Low Profile Platform (T-Mobile Existing)	C	None		0.0000	144.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
(2) RRUS-11 (AT&T Existing)	A	From Face	0.50 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	0.05 0.07
(2) RRUS-11 (AT&T Existing)	B	From Face	0.50 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	0.05 0.07
(2) RRUS-11 (AT&T Existing)	C	From Face	0.50 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	0.05 0.07
DC6-48-60-18-8F Surge Arrestor (AT&T Existing)	C	From Face	0.50 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	2.23 2.45	2.23 2.45	0.02 0.04
Valmont Uni-Tri Bracket (AT&T Existing)	C	None		0.0000	138.00	No Ice 1/2" Ice	1.75 1.94	1.75 1.94	0.29 0.31
7770.00 (AT&T Existing)	A	From Face	3.00 -2.00 0.00	0.0000	134.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
7770.00 (AT&T Existing)	A	From Face	3.00 2.00 0.00	0.0000	134.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
P65-16-XLH-RR (AT&T Existing)	A	From Face	3.00 6.00 0.00	0.0000	134.00	No Ice 1/2" Ice	8.40 8.95	4.70 5.15	0.06 0.11
7770.00 (AT&T Existing)	B	From Face	3.00 -2.00 0.00	0.0000	134.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
7770.00 (AT&T Existing)	B	From Face	3.00 2.00 0.00	0.0000	134.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
P65-16-XLH-RR (AT&T Existing)	B	From Face	3.00 6.00 0.00	0.0000	134.00	No Ice 1/2" Ice	8.40 8.95	4.70 5.15	0.06 0.11
7770.00	C	From Face	3.00	0.0000	134.00	No Ice	5.88	2.93	0.04

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	Project	164' EEI Monopole - Greenwich, CT	Date	08:28:15 09/25/12
	Client	Sprint	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
(AT&T Existing)			2.00			1/2" Ice	6.31	3.27	0.07
7770.00	C	From Face	0.00						
(AT&T Existing)			3.00	0.0000	134.00	No Ice	5.88	2.93	0.04
			-2.00			1/2" Ice	6.31	3.27	0.07
			0.00						
P65-I6-XLH-RR	C	From Face	3.00	0.0000	134.00	No Ice	8.40	4.70	0.06
(AT&T Existing)			6.00			1/2" Ice	8.95	5.15	0.11
			0.00						
(2) LGP214nn TMA	A	From Face	3.00	0.0000	134.00	No Ice	1.29	0.23	0.01
(AT&T Existing)			-2.00			1/2" Ice	1.45	0.31	0.02
			0.00						
(2) LGP214nn TMA	B	From Face	3.00	0.0000	134.00	No Ice	1.29	0.23	0.01
(AT&T Existing)			-2.00			1/2" Ice	1.45	0.31	0.02
			0.00						
(2) LGP214nn TMA	C	From Face	3.00	0.0000	134.00	No Ice	1.29	0.23	0.01
(AT&T Existing)			-2.00			1/2" Ice	1.45	0.31	0.02
			0.00						
Low Profile Platform	C	None		0.0000	134.00	No Ice	15.70	15.70	1.30
(AT&T Existing)						1/2" Ice	20.10	20.10	1.76
844G65T6ZAXY	A	From Face	4.00	0.0000	124.00	No Ice	4.67	3.73	0.01
(Verizon Existing)			-6.00			1/2" Ice	5.05	4.10	0.04
			0.00						
MG D3-800TX	A	From Face	4.00	0.0000	124.00	No Ice	3.45	2.22	0.00
(Verizon Existing)			-4.00			1/2" Ice	3.80	2.55	0.02
			0.00						
LNK-6514DS-T0M	A	From Face	4.00	0.0000	124.00	No Ice	8.41	5.41	0.04
(Verizon Existing)			0.00			1/2" Ice	8.96	5.86	0.09
			0.00						
844G65T6ZAXY	A	From Face	4.00	0.0000	124.00	No Ice	4.67	3.73	0.01
(Verizon Existing)			6.00			1/2" Ice	5.05	4.10	0.04
			0.00						
(2) FD9R6004/2C-3L	A	From Face	3.00	0.0000	124.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon Existing)			0.00						
844G65T6ZAXY	B	From Face	4.00	0.0000	124.00	No Ice	4.67	3.73	0.01
(Verizon Existing)			-6.00			1/2" Ice	5.05	4.10	0.04
			0.00						
MG D3-800TX	B	From Face	4.00	0.0000	124.00	No Ice	3.45	2.22	0.00
(Verizon Existing)			-4.00			1/2" Ice	3.80	2.55	0.02
			0.00						
LNK-6514DS-T0M	B	From Face	4.00	0.0000	124.00	No Ice	8.41	5.41	0.04
(Verizon Existing)			0.00			1/2" Ice	8.96	5.86	0.09
			0.00						
844G65T6ZAXY	B	From Face	4.00	0.0000	124.00	No Ice	4.67	3.73	0.01
(Verizon Existing)			6.00			1/2" Ice	5.05	4.10	0.04
			0.00						
(2) FD9R6004/2C-3L	B	From Face	3.00	0.0000	124.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon Existing)			0.00						
844G65T6ZAXY	C	From Face	4.00	0.0000	124.00	No Ice	4.67	3.73	0.01
(Verizon Existing)			-6.00			1/2" Ice	5.05	4.10	0.04
			0.00						
MG D3-800TX	C	From Face	4.00	0.0000	124.00	No Ice	3.45	2.22	0.00
(Verizon Existing)			-4.00			1/2" Ice	3.80	2.55	0.02
			0.00						
LNK-6514DS-T0M	C	From Face	4.00	0.0000	124.00	No Ice	8.41	5.41	0.04
(Verizon Existing)			0.00			1/2" Ice	8.96	5.86	0.09

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	Project	164' EEI Monopole - Greenwich, CT	Date	08:28:15 09/25/12
	Client	Sprint	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
844G65T6ZAXY (Verizon Existing)	C	From Face	0.00 4.00 6.00 0.00	0.0000	124.00	No Ice 1/2" Ice	4.67 5.05	3.73 4.10	0.01 0.04
(2) FD9R6004/2C-3L Diplexer (Verizon Existing)	C	From Face	3.00 0.00 0.00	0.0000	124.00	No Ice 1/2" Ice	0.37 0.45	0.08 0.14	0.00 0.01
Low Profile Platform (Verizon Existing)	C	None		0.0000	124.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
(4) DB846G90A-XY (Nextel Existing)	A	From Face	4.00 0.00 0.00	0.0000	114.00	No Ice 1/2" Ice	4.99 5.44	5.87 6.32	0.02 0.05
(4) DB846G90A-XY (Nextel Existing)	B	From Face	4.00 0.00 0.00	0.0000	114.00	No Ice 1/2" Ice	4.99 5.44	5.87 6.32	0.02 0.05
(4) DB846G90A-XY (Nextel Existing)	C	From Face	4.00 0.00 0.00	0.0000	114.00	No Ice 1/2" Ice	4.99 5.44	5.87 6.32	0.02 0.05
Low Profile Platform (Nextel Existing)	C	None		0.0000	114.00	No Ice 1/2" Ice	15.70 20.10	15.70 20.10	1.30 1.76
GPS	A	From Face	1.50 0.00 0.00	0.0000	51.50	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
GPS	B	From Face	1.50 0.00 0.00	0.0000	51.50	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
GPS	C	From Face	1.50 0.00 0.00	0.0000	51.50	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft	Aperture Area ft ²	Weight K
4 FT DISH (Town Existing)	A	Paraboloid w/Shroud (HP)	From Leg	1.00 0.00 0.00	Worst		160.00	4.00	No Ice 1/2" Ice 12.56 13.09	0.17 0.24
4 FT DISH (Town Existing)	B	Paraboloid w/Shroud (HP)	From Leg	1.00 0.00 0.00	Worst		160.00	4.00	No Ice 1/2" Ice 12.56 13.09	0.17 0.24
2 FT DISH (Town Existing)	C	Paraboloid w/Shroud (HP)	From Leg	1.00 0.00 0.00	Worst		160.00	2.00	No Ice 1/2" Ice 3.14 3.41	0.03 0.04
A-Ant-23G-2-C (Clearwire Existing)	A	Paraboloid w/Radome	From Face	3.10 -2.52 2.00	Worst		154.00	2.17	No Ice 1/2" Ice 3.72 4.01	0.03 0.05
A-Ant-23G-2-C (Clearwire Existing)	C	Paraboloid w/Radome	From Face	3.80 -1.24	Worst		154.00	2.17	No Ice 1/2" Ice 3.72 4.01	0.03 0.05

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Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	3 dB Beam Width	Elevation	Outside Diameter	Aperture Area	Weight
				ft	°	°	ft	ft	ft²	K
				2.00						

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 _A A _A In Face ft²	C _A A _A Out Face ft²
ft	ft		psf	ft²		ft²	ft²	ft²		ft²	ft²
L1 164.00-131.50	147.53	1.534	28	135.985	A	0.000	135.985	135.985	100.00	0.000	0.000
					B	0.000	135.985		100.00	0.000	0.000
					C	0.000	135.985		100.00	0.000	0.000
L2 131.50-119.29	125.34	1.464	27	55.744	A	0.000	55.744	55.744	100.00	0.000	0.000
					B	0.000	55.744		100.00	0.000	0.000
					C	0.000	55.744		100.00	0.000	0.000
L3 119.29-78.79	98.89	1.368	25	199.426	A	0.000	199.426	199.426	100.00	0.000	0.000
					B	0.000	199.426		100.00	0.000	0.000
					C	0.000	199.426		100.00	0.000	0.000
L4 78.79-39.88	59.42	1.183	22	213.639	A	0.000	213.639	213.639	100.00	0.000	0.000
					B	0.000	213.639		100.00	0.000	3.869
					C	0.000	213.639		100.00	0.000	0.000
L5 39.88-1.50	20.36	1	18	231.142	A	0.000	231.142	231.142	100.00	0.000	0.000
					B	0.000	231.142		100.00	0.000	11.782
					C	0.000	231.142		100.00	0.000	0.000

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 ft²	C _A A _A Out Face ft²
ft	ft		psf	in	ft²		ft²	ft²	ft²		ft²	ft²
L1 164.00-131.50	147.53	1.534	21	0.5000	138.694	A	0.000	138.694	138.694	100.00	0.000	0.000
						B	0.000	138.694		100.00	0.000	0.000
						C	0.000	138.694		100.00	0.000	0.000
L2 131.50-119.29	125.34	1.464	20	0.5000	56.761	A	0.000	56.761	56.761	100.00	0.000	0.000
						B	0.000	56.761		100.00	0.000	0.000
						C	0.000	56.761		100.00	0.000	0.000
L3 119.29-78.79	98.89	1.368	19	0.5000	202.801	A	0.000	202.801	202.801	100.00	0.000	0.000
						B	0.000	202.801		100.00	0.000	0.000
						C	0.000	202.801		100.00	0.000	0.000
L4 78.79-39.88	59.42	1.183	16	0.5000	216.881	A	0.000	216.881	216.881	100.00	0.000	0.000
						B	0.000	216.881		100.00	0.000	7.355
						C	0.000	216.881		100.00	0.000	0.000
L5 39.88-1.50	20.36	1	14	0.5000	234.341	A	0.000	234.341	234.341	100.00	0.000	0.000
						B	0.000	234.341		100.00	0.000	22.395
						C	0.000	234.341		100.00	0.000	0.000

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	Client	Sprint	Designed by	TJL

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 _d A _A In Face ft ²	C _d A _A Out Face ft ²
ft	ft		psf	ft ²		ft ²	ft ²	ft ²			
L1 164.00-131.50	147.53	1.534	10	135.985	A	0.000	135.985	135.985	100.00	0.000	0.000
					B	0.000	135.985		100.00	0.000	0.000
					C	0.000	135.985		100.00	0.000	0.000
L2 131.50-119.29	125.34	1.464	9	55.744	A	0.000	55.744	55.744	100.00	0.000	0.000
					B	0.000	55.744		100.00	0.000	0.000
					C	0.000	55.744		100.00	0.000	0.000
L3 119.29-78.79	98.89	1.368	9	199.426	A	0.000	199.426	199.426	100.00	0.000	0.000
					B	0.000	199.426		100.00	0.000	0.000
					C	0.000	199.426		100.00	0.000	0.000
L4 78.79-39.88	59.42	1.183	8	213.639	A	0.000	213.639	213.639	100.00	0.000	0.000
					B	0.000	213.639		100.00	0.000	3.869
					C	0.000	213.639		100.00	0.000	0.000
L5 39.88-1.50	20.36	1	6	231.142	A	0.000	231.142	231.142	100.00	0.000	0.000
					B	0.000	231.142		100.00	0.000	11.782
					C	0.000	231.142		100.00	0.000	0.000

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	plf	
L1 164.00-131.50	0.91	5.47	A	1	0.65	1	1	1	135.985	4.24	130.34	C
			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2 131.50-119.29	0.76	2.69	A	1	0.65	1	1	1	55.744	1.66	135.82	C
			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3 119.29-78.79	3.28	12.76	A	1	0.65	1	1	1	199.426	5.53	136.63	C
			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4 78.79-39.88	3.23	18.55	A	1	0.65	1	1	1	213.639	5.25	134.97	C
			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.78	20.49	A	1	0.65	1	1	1	231.142	5.06	131.96	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	10.97	59.96						OTM	1762.61 kip-ft	21.74		

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	plf	

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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	plf	
L1 164.00-131.50	0.91	5.47	A	1	0.65	1	1	1	135.985	4.24	130.34	C
			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2 131.50-119.29	0.76	2.69	A	1	0.65	1	1	1	55.744	1.66	135.82	C
			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3 119.29-78.79	3.28	12.76	A	1	0.65	1	1	1	199.426	5.53	136.63	C
			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4 78.79-39.88	3.23	18.55	A	1	0.65	1	1	1	213.639	5.25	134.97	C
			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.78	20.49	A	1	0.65	1	1	1	231.142	5.06	131.96	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	10.97	59.96						OTM	1762.61 kip-ft	21.74		

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	plf	
L1 164.00-131.50	0.91	5.47	A	1	0.65	1	1	1	135.985	4.24	130.34	C
			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2 131.50-119.29	0.76	2.69	A	1	0.65	1	1	1	55.744	1.66	135.82	C
			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3 119.29-78.79	3.28	12.76	A	1	0.65	1	1	1	199.426	5.53	136.63	C
			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4 78.79-39.88	3.23	18.55	A	1	0.65	1	1	1	213.639	5.25	134.97	C
			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.78	20.49	A	1	0.65	1	1	1	231.142	5.06	131.96	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	10.97	59.96						OTM	1762.61 kip-ft	21.74		

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	plf	
L1 164.00-131.50	0.91	6.49	A	1	0.65	1	1	1	138.694	3.24	99.70	C
			B	1	0.65	1	1	1	138.694			
			C	1	0.65	1	1	1	138.694			

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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	plf	
L2 131.50-119.29	0.76	3.11	A	1	0.65	1	1	1	56.761	1.27	103.72	C
			B	1	0.65	1	1	1	56.761			
			C	1	0.65	1	1	1	56.761			
L3 119.29-78.79	3.28	14.25	A	1	0.65	1	1	1	202.801	4.22	104.21	C
			B	1	0.65	1	1	1	202.801			
			C	1	0.65	1	1	1	202.801			
L4 78.79-39.88	3.27	20.14	A	1	0.65	1	1	1	216.881	4.09	105.20	C
			B	1	0.65	1	1	1	216.881			
			C	1	0.65	1	1	1	216.881			
L5 39.88-1.50	2.89	22.21	A	1	0.65	1	1	1	234.341	4.10	106.72	C
			B	1	0.65	1	1	1	234.341			
			C	1	0.65	1	1	1	234.341			
Sum Weight:	11.11	66.20						OTM	1355.40 kip-ft	16.92		

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	plf	
L1 164.00-131.50	0.91	6.49	A	1	0.65	1	1	1	138.694	3.24	99.70	C
			B	1	0.65	1	1	1	138.694			
			C	1	0.65	1	1	1	138.694			
L2 131.50-119.29	0.76	3.11	A	1	0.65	1	1	1	56.761	1.27	103.72	C
			B	1	0.65	1	1	1	56.761			
			C	1	0.65	1	1	1	56.761			
L3 119.29-78.79	3.28	14.25	A	1	0.65	1	1	1	202.801	4.22	104.21	C
			B	1	0.65	1	1	1	202.801			
			C	1	0.65	1	1	1	202.801			
L4 78.79-39.88	3.27	20.14	A	1	0.65	1	1	1	216.881	4.09	105.20	C
			B	1	0.65	1	1	1	216.881			
			C	1	0.65	1	1	1	216.881			
L5 39.88-1.50	2.89	22.21	A	1	0.65	1	1	1	234.341	4.10	106.72	C
			B	1	0.65	1	1	1	234.341			
			C	1	0.65	1	1	1	234.341			
Sum Weight:	11.11	66.20						OTM	1355.40 kip-ft	16.92		

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	plf	
L1 164.00-131.50	0.91	6.49	A	1	0.65	1	1	1	138.694	3.24	99.70	C
			B	1	0.65	1	1	1	138.694			
			C	1	0.65	1	1	1	138.694			
L2 131.50-119.29	0.76	3.11	A	1	0.65	1	1	1	56.761	1.27	103.72	C
			B	1	0.65	1	1	1	56.761			
			C	1	0.65	1	1	1	56.761			

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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	plf	
L3 119.29-78.79	3.28	14.25	A	1	0.65	1	1	1	202.801	4.22	104.21	C
			B	1	0.65	1	1	1	202.801			
			C	1	0.65	1	1	1	202.801			
L4 78.79-39.88	3.27	20.14	A	1	0.65	1	1	1	216.881	4.09	105.20	C
			B	1	0.65	1	1	1	216.881			
			C	1	0.65	1	1	1	216.881			
L5 39.88-1.50	2.89	22.21	A	1	0.65	1	1	1	234.341	4.10	106.72	C
			B	1	0.65	1	1	1	234.341			
			C	1	0.65	1	1	1	234.341			
Sum Weight:	11.11	66.20						OTM	1355.40 kip-ft	16.92		

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	plf	
L1 164.00-131.50	0.91	5.47	A	1	0.65	1	1	1	135.985	1.47	45.10	C
			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2 131.50-119.29	0.76	2.69	A	1	0.65	1	1	1	55.744	0.57	47.00	C
			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3 119.29-78.79	3.28	12.76	A	1	0.65	1	1	1	199.426	1.91	47.28	C
			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4 78.79-39.88	3.23	18.55	A	1	0.65	1	1	1	213.639	1.82	46.70	C
			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.78	20.49	A	1	0.65	1	1	1	231.142	1.75	45.66	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	10.97	59.96						OTM	609.90 kip-ft	7.52		

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	plf	
L1 164.00-131.50	0.91	5.47	A	1	0.65	1	1	1	135.985	1.47	45.10	C
			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2 131.50-119.29	0.76	2.69	A	1	0.65	1	1	1	55.744	0.57	47.00	C
			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3 119.29-78.79	3.28	12.76	A	1	0.65	1	1	1	199.426	1.91	47.28	C
			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			

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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	plf	
L4	3.23	18.55	A	1	0.65	1	1	1	213.639	1.82	46.70	C
78.79-39.88			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.78	20.49	A	1	0.65	1	1	1	231.142	1.75	45.66	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	10.97	59.96						OTM	609.90 kip-ft	7.52		

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	plf	
L1	0.91	5.47	A	1	0.65	1	1	1	135.985	1.47	45.10	C
164.00-131.50			B	1	0.65	1	1	1	135.985			
			C	1	0.65	1	1	1	135.985			
L2	0.76	2.69	A	1	0.65	1	1	1	55.744	0.57	47.00	C
131.50-119.29			B	1	0.65	1	1	1	55.744			
			C	1	0.65	1	1	1	55.744			
L3	3.28	12.76	A	1	0.65	1	1	1	199.426	1.91	47.28	C
119.29-78.79			B	1	0.65	1	1	1	199.426			
			C	1	0.65	1	1	1	199.426			
L4	3.23	18.55	A	1	0.65	1	1	1	213.639	1.82	46.70	C
78.79-39.88			B	1	0.65	1	1	1	213.639			
			C	1	0.65	1	1	1	213.639			
L5 39.88-1.50	2.78	20.49	A	1	0.65	1	1	1	231.142	1.75	45.66	C
			B	1	0.65	1	1	1	231.142			
			C	1	0.65	1	1	1	231.142			
Sum Weight:	10.97	59.96						OTM	609.90 kip-ft	7.52		

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	59.96					
Bracing Weight	0.00					
Total Member Self-Weight	59.96			1.25	-0.60	
Total Weight	83.00			1.25	-0.60	
Wind 0 deg - No Ice		0.17	-44.50	-4931.82	-26.27	1.08
Wind 30 deg - No Ice		22.49	-38.62	-4283.75	-2504.19	2.80
Wind 60 deg - No Ice		38.79	-22.40	-2487.52	-4311.27	3.76
Wind 90 deg - No Ice		44.69	-0.17	-24.43	-4963.31	3.72
Wind 120 deg - No Ice		38.62	22.10	2445.55	-4285.60	2.68
Wind 150 deg - No Ice		22.20	38.45	4260.57	-2459.72	0.92
Wind 180 deg - No Ice		-0.17	44.50	4934.31	25.07	-1.08
Wind 210 deg - No Ice		-22.49	38.62	4286.24	2502.99	-2.80

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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 240 deg - No Ice		-38.79	22.40	2490.01	4310.07	-3.76
Wind 270 deg - No Ice		-44.69	0.17	26.92	4962.11	-3.72
Wind 300 deg - No Ice		-38.62	-22.10	-2443.05	4284.40	-2.68
Wind 330 deg - No Ice		-22.20	-38.45	-4258.08	2458.52	-0.92
Member Ice	6.24					
Total Weight Ice	94.98			1.96	-1.22	
Wind 0 deg - Ice		0.13	-36.52	-4091.70	-20.68	1.08
Wind 30 deg - Ice		18.44	-31.69	-3552.98	-2076.14	2.65
Wind 60 deg - Ice		31.82	-18.37	-2061.72	-3575.63	3.51
Wind 90 deg - Ice		36.67	-0.13	-17.49	-4117.35	3.43
Wind 120 deg - Ice		31.69	18.15	2031.95	-3556.17	2.44
Wind 150 deg - Ice		18.22	31.56	3537.45	-2042.44	0.78
Wind 180 deg - Ice		-0.13	36.52	4095.63	18.23	-1.08
Wind 210 deg - Ice		-18.44	31.69	3556.91	2073.69	-2.65
Wind 240 deg - Ice		-31.82	18.37	2065.65	3573.18	-3.51
Wind 270 deg - Ice		-36.67	0.13	21.42	4114.91	-3.43
Wind 300 deg - Ice		-31.69	-18.15	-2028.02	3553.72	-2.44
Wind 330 deg - Ice		-18.22	-31.56	-3533.52	2039.99	-0.78
Total Weight	83.00			1.25	-0.60	
Wind 0 deg - Service		0.06	-15.40	-1705.81	-9.29	0.37
Wind 30 deg - Service		7.78	-13.36	-1481.56	-866.70	0.97
Wind 60 deg - Service		13.42	-7.75	-860.03	-1491.99	1.30
Wind 90 deg - Service		15.46	-0.06	-7.75	-1717.60	1.29
Wind 120 deg - Service		13.36	7.65	846.91	-1483.10	0.93
Wind 150 deg - Service		7.68	13.31	1474.95	-851.31	0.32
Wind 180 deg - Service		-0.06	15.40	1708.08	8.48	-0.37
Wind 210 deg - Service		-7.78	13.36	1483.83	865.89	-0.97
Wind 240 deg - Service		-13.42	7.75	862.30	1491.18	-1.30
Wind 270 deg - Service		-15.46	0.06	10.02	1716.80	-1.29
Wind 300 deg - Service		-13.36	-7.65	-844.65	1482.29	-0.93
Wind 330 deg - Service		-7.68	-13.31	-1472.68	850.50	-0.32

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 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp

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Comb. No.	Description
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	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	164 - 131.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-20.23	-0.67	-1.65
			Max. Mx	5	-14.90	-387.29	2.75
			Max. My	8	-14.91	3.44	-383.60
			Max. Vy	5	20.58	-387.29	2.75
			Max. Vx	8	20.38	3.44	-383.60
			Max. Torque	5			-3.63
			Max Tension	1	0.00	0.00	0.00
L2	131.5 - 119.29	Pole	Max. Compression	14	-22.17	-0.67	-1.65
			Max. Mx	5	-16.64	-517.73	3.81
			Max. My	8	-16.64	4.50	-512.82
			Max. Vy	5	21.44	-517.73	3.81
			Max. Vx	8	21.24	4.50	-512.82
			Max. Torque	5			-3.63
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-42.96	-0.67	-1.65
L3	119.29 - 78.79	Pole	Max. Mx	5	-34.19	-1655.40	10.30
			Max. My	8	-34.20	11.02	-1642.95
			Max. Vy	5	33.71	-1655.40	10.30
			Max. Vx	8	33.51	11.02	-1642.95
			Max. Torque	5			-3.63
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-64.88	-0.77	-1.71
			Max. Mx	5	-54.71	-3040.23	16.80
L4	78.79 - 39.88	Pole	Max. My	8	-54.72	17.53	-3020.21
			Max. Vy	5	38.99	-3040.23	16.80
			Max. Vx	8	38.79	17.53	-3020.21
			Max. Torque	5			-3.65
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-94.98	-1.22	-1.96
			Max. Mx	5	-82.99	-5036.28	24.82
			Max. My	8	-82.99	25.48	-5006.82
L5	39.88 - 1.5	Pole	Max. Vy	5	44.72	-5036.28	24.82
			Max. Vx	8	44.52	25.48	-5006.82
			Max. Torque	4			-3.79

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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
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Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	94.98	-36.67	0.13
	Max. H _x	11	83.00	44.69	-0.17
	Max. H _z	2	83.00	-0.17	44.50
	Max. M _x	2	5004.27	-0.17	44.50
	Max. M _z	5	5036.28	-44.69	0.17
	Max. Torsion	10	3.79	38.79	-22.40
	Min. Vert	35	83.00	13.42	-7.75
	Min. H _x	5	83.00	-44.69	0.17
	Min. H _z	8	83.00	0.17	-44.50
	Min. M _x	8	-5006.82	0.17	-44.50
	Min. M _z	11	-5035.06	44.69	-0.17
	Min. Torsion	4	-3.79	-38.79	22.40

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	83.00	0.00	0.00	1.25	-0.60	0.00
Dead+Wind 0 deg - No Ice	83.00	0.17	-44.50	-5004.27	-26.70	1.08
Dead+Wind 30 deg - No Ice	83.00	22.49	-38.62	-4346.70	-2541.04	2.81
Dead+Wind 60 deg - No Ice	83.00	38.79	-22.40	-2524.09	-4374.67	3.79
Dead+Wind 90 deg - No Ice	83.00	44.69	-0.17	-24.82	-5036.28	3.75
Dead+Wind 120 deg - No Ice	83.00	38.62	22.10	2481.45	-4348.59	2.71
Dead+Wind 150 deg - No Ice	83.00	22.20	38.45	4323.16	-2495.85	0.94
Dead+Wind 180 deg - No Ice	83.00	-0.17	44.50	5006.82	25.48	-1.08
Dead+Wind 210 deg - No Ice	83.00	-22.49	38.62	4349.25	2539.82	-2.81
Dead+Wind 240 deg - No Ice	83.00	-38.79	22.40	2526.64	4373.45	-3.79
Dead+Wind 270 deg - No Ice	83.00	-44.69	0.17	27.37	5035.06	-3.75
Dead+Wind 300 deg - No Ice	83.00	-38.62	-22.10	-2478.90	4347.37	-2.70
Dead+Wind 330 deg - No Ice	83.00	-22.20	-38.45	-4320.61	2494.63	-0.94
Dead+Ice+Temp	94.98	0.00	0.00	1.96	-1.22	0.00
Dead+Wind 0 deg+Ice+Temp	94.98	0.13	-36.52	-4166.05	-21.10	1.08
Dead+Wind 30 deg+Ice+Temp	94.98	18.44	-31.69	-3617.56	-2113.94	2.67
Dead+Wind 60 deg+Ice+Temp	94.98	31.82	-18.37	-2099.21	-3640.68	3.55
Dead+Wind 90 deg+Ice+Temp	94.98	36.67	-0.13	-17.83	-4192.24	3.47
Dead+Wind 120 deg+Ice+Temp	94.98	31.69	18.15	2068.86	-3620.83	2.47
Dead+Wind 150 deg+Ice+Temp	94.98	18.22	31.56	3601.75	-2079.56	0.80
Dead+Wind 180 deg+Ice+Temp	94.98	-0.13	36.52	4170.09	18.60	-1.08
Dead+Wind 210 deg+Ice+Temp	94.98	-18.44	31.69	3621.60	2111.44	-2.67
Dead+Wind 240 deg+Ice+Temp	94.98	-31.82	18.37	2103.24	3638.18	-3.55
Dead+Wind 270 deg+Ice+Temp	94.98	-36.67	0.13	21.87	4189.74	-3.47
Dead+Wind 300 deg+Ice+Temp	94.98	-31.69	-18.15	-2064.83	3618.33	-2.47
Dead+Wind 330 deg+Ice+Temp	94.98	-18.22	-31.56	-3597.72	2077.06	-0.80
Dead+Wind 0 deg - Service	83.00	0.06	-15.40	-1730.91	-9.64	0.37
Dead+Wind 30 deg - Service	83.00	7.78	-13.36	-1503.35	-879.74	0.97
Dead+Wind 60 deg - Service	83.00	13.42	-7.75	-872.64	-1514.27	1.31

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Load Combination	Vertical K	Shear _x K	Shear _y K	Overturning Moment, M _x kip-ft	Overturning Moment, M _y kip-ft	Torque kip-ft
Dead+Wind 90 deg - Service	83.00	15.46	-0.06	-7.75	-1743.22	1.30
Dead+Wind 120 deg - Service	83.00	13.36	7.65	859.55	-1505.24	0.94
Dead+Wind 150 deg - Service	83.00	7.68	13.31	1496.88	-864.10	0.32
Dead+Wind 180 deg - Service	83.00	-0.06	15.40	1733.46	8.42	-0.37
Dead+Wind 210 deg - Service	83.00	-7.78	13.36	1505.91	878.52	-0.97
Dead+Wind 240 deg - Service	83.00	-13.42	7.75	875.19	1513.05	-1.31
Dead+Wind 270 deg - Service	83.00	-15.46	0.06	10.31	1742.00	-1.30
Dead+Wind 300 deg - Service	83.00	-13.36	-7.65	-857.00	1504.02	-0.94
Dead+Wind 330 deg - Service	83.00	-7.68	-13.31	-1494.32	862.87	-0.32

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	0.00	-83.00	0.00	0.00	83.00	0.00	0.000%
2	0.17	-83.00	-44.50	-0.17	83.00	44.50	0.000%
3	22.49	-83.00	-38.62	-22.49	83.00	38.62	0.000%
4	38.79	-83.00	-22.40	-38.79	83.00	22.40	0.000%
5	44.69	-83.00	-0.17	-44.69	83.00	0.17	0.000%
6	38.62	-83.00	22.10	-38.62	83.00	-22.10	0.000%
7	22.20	-83.00	38.45	-22.20	83.00	-38.45	0.000%
8	-0.17	-83.00	44.50	0.17	83.00	-44.50	0.000%
9	-22.49	-83.00	38.62	22.49	83.00	-38.62	0.000%
10	-38.79	-83.00	22.40	38.79	83.00	-22.40	0.000%
11	-44.69	-83.00	0.17	44.69	83.00	-0.17	0.000%
12	-38.62	-83.00	-22.10	38.62	83.00	22.10	0.000%
13	-22.20	-83.00	-38.45	22.20	83.00	38.45	0.000%
14	0.00	-94.98	0.00	0.00	94.98	0.00	0.000%
15	0.13	-94.98	-36.52	-0.13	94.98	36.52	0.000%
16	18.44	-94.98	-31.69	-18.44	94.98	31.69	0.000%
17	31.82	-94.98	-18.37	-31.82	94.98	18.37	0.000%
18	36.67	-94.98	-0.13	-36.67	94.98	0.13	0.000%
19	31.69	-94.98	18.15	-31.69	94.98	-18.15	0.000%
20	18.22	-94.98	31.56	-18.22	94.98	-31.56	0.000%
21	-0.13	-94.98	36.52	0.13	94.98	-36.52	0.000%
22	-18.44	-94.98	31.69	18.44	94.98	-31.69	0.000%
23	-31.82	-94.98	18.37	31.82	94.98	-18.37	0.000%
24	-36.67	-94.98	0.13	36.67	94.98	-0.13	0.000%
25	-31.69	-94.98	-18.15	31.69	94.98	18.15	0.000%
26	-18.22	-94.98	-31.56	18.22	94.98	31.56	0.000%
27	0.06	-83.00	-15.40	-0.06	83.00	15.40	0.000%
28	7.78	-83.00	-13.36	-7.78	83.00	13.36	0.000%
29	13.42	-83.00	-7.75	-13.42	83.00	7.75	0.000%
30	15.46	-83.00	-0.06	-15.46	83.00	0.06	0.000%
31	13.36	-83.00	7.65	-13.36	83.00	-7.65	0.000%
32	7.68	-83.00	13.31	-7.68	83.00	-13.31	0.000%
33	-0.06	-83.00	15.40	0.06	83.00	-15.40	0.000%
34	-7.78	-83.00	13.36	7.78	83.00	-13.36	0.000%
35	-13.42	-83.00	7.75	13.42	83.00	-7.75	0.000%
36	-15.46	-83.00	0.06	15.46	83.00	-0.06	0.000%
37	-13.36	-83.00	-7.65	13.36	83.00	7.65	0.000%
38	-7.68	-83.00	-13.31	7.68	83.00	13.31	0.000%

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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	0.00005087
3	Yes	4	0.00000001	0.00061210
4	Yes	4	0.00000001	0.00051545
5	Yes	4	0.00000001	0.00012676
6	Yes	4	0.00000001	0.00059979
7	Yes	4	0.00000001	0.00052880
8	Yes	4	0.00000001	0.00004110
9	Yes	4	0.00000001	0.00052664
10	Yes	4	0.00000001	0.00063746
11	Yes	4	0.00000001	0.00014045
12	Yes	4	0.00000001	0.00050536
13	Yes	4	0.00000001	0.00056210
14	Yes	4	0.00000001	0.00000001
15	Yes	5	0.00000001	0.00002428
16	Yes	5	0.00000001	0.00003244
17	Yes	5	0.00000001	0.00003187
18	Yes	5	0.00000001	0.00002458
19	Yes	5	0.00000001	0.00003210
20	Yes	5	0.00000001	0.00003158
21	Yes	5	0.00000001	0.00002432
22	Yes	5	0.00000001	0.00003191
23	Yes	5	0.00000001	0.00003270
24	Yes	5	0.00000001	0.00002459
25	Yes	5	0.00000001	0.00003142
26	Yes	5	0.00000001	0.00003172
27	Yes	4	0.00000001	0.00001452
28	Yes	4	0.00000001	0.00004455
29	Yes	4	0.00000001	0.00003591
30	Yes	4	0.00000001	0.00002303
31	Yes	4	0.00000001	0.00004413
32	Yes	4	0.00000001	0.00003555
33	Yes	4	0.00000001	0.00001433
34	Yes	4	0.00000001	0.00003572
35	Yes	4	0.00000001	0.00004819
36	Yes	4	0.00000001	0.00002358
37	Yes	4	0.00000001	0.00003436
38	Yes	4	0.00000001	0.00003900

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	164 - 131.5	10.715	35	0.5005	0.0020
L2	131.5 - 119.29	7.371	35	0.4713	0.0011
L3	125.29 - 78.79	6.765	35	0.4594	0.0010
L4	87.21 - 39.88	3.467	35	0.3482	0.0005
L5	49.13 - 1.5	1.168	35	0.2119	0.0002

Critical Deflections and Radius of Curvature - Service Wind

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Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
164.00	PD1142-1	35	10.715	0.5005	0.0020	202459
160.00	4 FT DISH	35	10.295	0.4984	0.0018	202459
156.00	A-Ant-23G-2-C	35	9.876	0.4963	0.0017	126537
154.00	LLPX310R	35	9.667	0.4951	0.0017	101230
151.50	Remote Radio Head FD R6 RRH	35	9.407	0.4935	0.0016	80984
144.00	(2) AIR21	35	8.631	0.4875	0.0014	50615
138.00	(2) RRUS-11	35	8.020	0.4809	0.0013	38934
134.00	7770.00	35	7.619	0.4753	0.0012	33784
124.00	844G65T6ZAXY	35	6.641	0.4566	0.0010	27241
114.00	(4) DB846G90A-XY	35	5.708	0.4319	0.0008	24154
51.50	GPS	35	1.271	0.2213	0.0003	11120

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	164 - 131.5	30.954	10	1.4456	0.0056
L2	131.5 - 119.29	21.293	10	1.3615	0.0033
L3	125.29 - 78.79	19.544	10	1.3272	0.0029
L4	87.21 - 39.88	10.018	10	1.0059	0.0015
L5	49.13 - 1.5	3.373	10	0.6124	0.0007

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
164.00	PD1142-1	10	30.954	1.4456	0.0056	70394
160.00	4 FT DISH	10	29.741	1.4398	0.0053	70394
156.00	A-Ant-23G-2-C	10	28.531	1.4336	0.0050	43996
154.00	LLPX310R	10	27.927	1.4302	0.0048	35197
151.50	Remote Radio Head FD R6 RRH	10	27.174	1.4256	0.0047	28157
144.00	(2) AIR21	10	24.934	1.4083	0.0041	17598
138.00	(2) RRUS-11	10	23.169	1.3892	0.0037	13536
134.00	7770.00	10	22.010	1.3732	0.0034	11744
124.00	844G65T6ZAXY	10	19.187	1.3192	0.0029	9445
114.00	(4) DB846G90A-XY	10	16.490	1.2478	0.0024	8372
51.50	GPS	10	3.671	0.6393	0.0008	3849

Compression Checks

Pole Design Data

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Section No.	Elevation ft	Size	L ft	L _u ft	KI/r	F _a ksi	A in ²	Actual P K	Allow. P _a K	Ratio P P _a
L1	164 - 131.5 (1)	TP53.42x47x0.3125	32.50	162.50	103.4	13.959	52.6760	-14.90	735.30	0.020
L2	131.5 - 119.29 (2)	TP56.15x53.42x0.375	12.21	162.50	100.9	14.665	64.7894	-16.63	950.11	0.018
L3	119.29 - 78.79 (3)	TP62.97x54.0585x0.4375	46.50	162.50	90.2	18.264	84.5934	-34.19	1545.03	0.022
L4	78.79 - 39.88 (4)	TP69.66x60.4813x0.5625	47.33	162.50	81.6	21.155	120.1620	-54.71	2542.07	0.022
L5	39.88 - 1.5 (5)	TP76x66.7412x0.5625	47.63	162.50	72.8	23.922	134.6840	-82.99	3221.92	0.026

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	164 - 131.5 (1)	TP53.42x47x0.3125	389.31	-6.754	36.775	0.184	0.00	0.000	36.775	0.000
L2	131.5 - 119.29 (2)	TP56.15x53.42x0.375	520.36	-7.168	39.000	0.184	0.00	0.000	39.000	0.000
L3	119.29 - 78.79 (3)	TP62.97x54.0585x0.4375	1661.81	-15.671	39.000	0.402	0.00	0.000	39.000	0.000
L4	78.79 - 39.88 (4)	TP69.66x60.4813x0.5625	3050.36	-18.351	39.000	0.471	0.00	0.000	39.000	0.000
L5	39.88 - 1.5 (5)	TP76x66.7412x0.5625	5050.84	-24.165	39.000	0.620	0.00	0.000	39.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio P P _a	Ratio f _{bx} F _{bx}	Ratio f _{by} F _{by}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	164 - 131.5 (1)	TP53.42x47x0.3125	0.020	0.184	0.000	0.204	1.333	H1-3 ✓
L2	131.5 - 119.29 (2)	TP56.15x53.42x0.375	0.018	0.184	0.000	0.201	1.333	H1-3 ✓
L3	119.29 - 78.79 (3)	TP62.97x54.0585x0.4375	0.022	0.402	0.000	0.424	1.333	H1-3 ✓
L4	78.79 - 39.88 (4)	TP69.66x60.4813x0.5625	0.022	0.471	0.000	0.492	1.333	H1-3 ✓
L5	39.88 - 1.5 (5)	TP76x66.7412x0.5625	0.026	0.620	0.000	0.645	1.333	H1-3 ✓

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	SF*P _{allow} K	% Capacity	Pass Fail
L1	164 - 131.5	Pole	TP53.42x47x0.3125	1	-14.90	980.15	15.3	Pass
L2	131.5 - 119.29	Pole	TP56.15x53.42x0.375	2	-16.63	1266.50	15.1	Pass
L3	119.29 - 78.79	Pole	TP62.97x54.0585x0.4375	3	-34.19	2059.52	31.8	Pass
L4	78.79 - 39.88	Pole	TP69.66x60.4813x0.5625	4	-54.71	3388.58	36.9	Pass
L5	39.88 - 1.5	Pole	TP76x66.7412x0.5625	5	-82.99	4294.82	48.4	Pass

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Section No.	Elevation ft	Component Type	Size	Critical Element	P K	SF*P _{allow} K	% Capacity	Pass Fail
							Summary	
							Pole (L5) 48.4	Pass
							RATING = 48.4	Pass

Flange Bolt and Plate Analysis:**Input Data:**Tower Reactions:

Overturning Moment =	OM := 387ft-kips	(Input From RisaTower)
Shear Force =	Shear := 20.6-kips	(Input From RisaTower)
Axial Force =	Axial := 20.3-kips	(Input From RisaTower)

Flange Bolt Data:

Use ASTM A325

Number of Flange Bolts =	N := 12	(User Input)
Diameter of Bolt Circle =	D _{bc} := 58.00-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 := 1.00-in	(User Input)

Flange Plate Data:

Use ASTM A36

Plate Yield Strength =	F _{ybp} := 36.00-ksi	(User Input)
Flange Plate Thickness =	t _{bp} := 1.00-in	(User Input)
Flange Plate Diameter =	D _{bp} := 61.00-in	(User Input)
Outer Pole Diameter =	D _{pole} := 53.42-in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 29\text{-in}$

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

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

$d_1 = 14.50\text{-in}$	$d_7 = -14.50\text{-in}$
$d_2 = 25.11\text{-in}$	$d_8 = -25.11\text{-in}$
$d_3 = 29.00\text{-in}$	$d_9 = -29.00\text{-in}$
$d_4 = 25.11\text{-in}$	$d_{10} = -25.11\text{-in}$
$d_5 = 14.50\text{-in}$	$d_{11} = -14.50\text{-in}$
$d_6 = 0.00\text{-in}$	etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 26.7\text{-in}$

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

$MA_1 = 0.00\text{-in}$	$MA_7 = 0.00\text{-in}$
$MA_2 = 0.00\text{-in}$	$MA_8 = 0.00\text{-in}$
$MA_3 = 2.29\text{-in}$	$MA_9 = 0.00\text{-in}$
$MA_4 = 0.00\text{-in}$	$MA_{10} = 0.00\text{-in}$
$MA_5 = 0.00\text{-in}$	$MA_{11} = 0.00\text{-in}$
$MA_6 = 0.00\text{-in}$	etc

Effective Width of Plate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 23.6\text{-in}$$

Flange Bolt Analysis:

Calculated Flange Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 5.046 \times 10^3 \cdot \text{in}^2$$

Gross Area of Bolt =

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

Check Flange Bolt Tension Force:

Maximum Tensile Force =

$$T_{\text{Max}} := OM \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 25 \cdot \text{kips}$$

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 =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Gross}}} = 60.3\%$$

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 =

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

$$C_1 = 15.0\text{-kips}$$

$$C_7 = -11.7\text{-kips}$$

$$C_2 = 24.8\text{-kips}$$

$$C_8 = -21.4\text{-kips}$$

$$C_3 = 28.4\text{-kips}$$

$$C_9 = -25.0\text{-kips}$$

$$C_4 = 24.8\text{-kips}$$

$$C_{10} = -21.4\text{-kips}$$

$$C_5 = 15.0\text{-kips}$$

$$C_{11} = -11.7\text{-kips}$$

$$C_6 = 1.7\text{-kips}$$

etc.

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot M A_i}{(B_{eff} t_{bp})^2} = 16.6\text{-ksi}$$

Allowable Bending Stress in Plate =

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

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 46.1\%$$

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:

Overturning Moment =	OM := 5051-ft-kips	(Input From RisaTower)
Shear Force =	Shear := 45-kips	(Input From RisaTower)
Axial Force =	Axial := 83-kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 30	(User Input)
Diameter of Bolt Circle =	D _{bc} := 86.00-in	(User Input)
Bolt "Column" Distance =	l := 3.0-in	(User Input)
Bolt Ultimate Strenght =	F _u := 100-ksi	(User Input)
Bolt Yield 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 GR 60

Plate Yield Strength =	F _{ybp} := 60-ksi	(User Input)
Base Plate Thickness =	t _{bp} := 3.0-in	(User Input)
Base Plate Diameter =	D _{bp} := 92.00-in	(User Input)
Outer Pole Diameter =	D _{pole} := 76.00-in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 43\text{-in}$$

Distance to Bolts =

$$i := 1..N$$

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

$$d_1 = 8.94\text{-in}$$

$$d_7 = 42.76\text{-in}$$

$$d_2 = 17.49\text{-in}$$

$$d_8 = 42.76\text{-in}$$

$$d_3 = 25.27\text{-in}$$

$$d_9 = 40.90\text{-in}$$

$$d_4 = 31.96\text{-in}$$

$$d_{10} = 37.24\text{-in}$$

$$d_5 = 37.24\text{-in}$$

$$d_{11} = 31.96\text{-in}$$

$$d_6 = 40.90\text{-in}$$

etc.

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 38\text{-in}$$

Moment Arms of Bolts about Neutral Axis =

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

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

$$MA_7 = 4.76\text{-in}$$

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

$$MA_8 = 4.76\text{-in}$$

$$MA_3 = 0.00\text{-in}$$

$$MA_9 = 2.90\text{-in}$$

$$MA_4 = 0.00\text{-in}$$

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

$$MA_5 = 0.00\text{-in}$$

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

$$MA_6 = 2.90\text{-in}$$

etc

Effective Width of Baseplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 41.5\text{-in}$$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 2.773 \times 10^4 \cdot \text{in}^2$$

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 =

$$T_{\text{Max}} := \text{OM} \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 91.2 \cdot \text{kips}$$

Allowable Tensile Force =

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

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

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} = 46.8\% \quad \text{Bolts are "upset bolts". Use net area per AISC}$$

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 =

$$M_x := \left(\frac{\text{Shear}}{N} \right) \cdot l = 0.375 \cdot \text{ft-kips}$$

Maximum Bending Stress =

$$f_{bx} := \frac{M_x}{S_x} = 5.5 \cdot \text{ksi}$$

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 =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 96.7 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 29.8 \text{ ksi}$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = 49.7\%$$

Condition 2 =

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

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

Base Plate Analysis:

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

$C_1 = 22.3\text{-kips}$

$C_7 = 96.2\text{-kips}$

$C_2 = 41.0\text{-kips}$

$C_8 = 96.2\text{-kips}$

$C_3 = 58.0\text{-kips}$

$C_9 = 92.1\text{-kips}$

$C_4 = 72.6\text{-kips}$

$C_{10} = 84.1\text{-kips}$

$C_5 = 84.1\text{-kips}$

$C_{11} = 72.6\text{-kips}$

$C_6 = 92.1\text{-kips}$

etc.

Maximum Bending Stress in Plate =
$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot M A_i}{(B_{eff} t_{bp}^2)} = 23.3\text{-ksi}$$

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

Plate Bending Stress % of Capacity =
$$\frac{f_{bp}}{F_{bp}} = 39.0\%$$

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 =	$S := 45k$	USER INPUT-FROM RISATower
Overturing Moment =	$M := 5051ft \cdot k$	USER INPUT-FROM RISATower
Applied Axial Load =	$A1 := 83k$	USER INPUT-FROM RISATower
Bending Moment =	$Mu := 5291ft \cdot k$	USER INPUT-FROM LPILE
Moment Capacity =	$Mn := 12301ft \cdot k$	USER INPUT-FROM LPILE
Foundation Diameter =	$d := 9.0ft$	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 =	$n := 33$	USER INPUT
Area of Rebar =	$Ar := 1.560in^2$	USER INPUT
Rebar Yield Strength =	$fy := 60ksi$	USER INPUT
Concrete Comp Strength =	$fc := 3ksi$	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 = $LD1 := 2.0ft + \left(\frac{S \cdot ft^2}{3k \cdot d} \right) + 2ft^5 \left(\frac{M \cdot ft}{3k \cdot d} + \frac{S \cdot ft}{2k} + \frac{S^2 \cdot ft^3}{18k^2 \cdot d^2} \right)^{.5} = 32.72ft$

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 = $FS := \frac{Mn}{Mu} = 2.3$

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

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

FOSCheck = "OK"

Check Axial Capacity:

Concrete Weight = $A2 := .150 \frac{k}{ft^3} \cdot LD \cdot \pi \frac{d^2}{4} = 257.6 \cdot kips$

Total Axial Load = $AT := A1 + A2 = 340.6 \cdot kips$

Area of Concrete = $Ag := \pi \cdot \frac{d^2}{4} = 63.62ft^2$

Axial Capacity = $Po := n \cdot Ar \cdot fy + (Ag - n \cdot Ar) \cdot 0.85 \cdot fc = 26317.8 \cdot kips$

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

AxialCheck = "OK"

Greenwich Hospital 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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TJL
Centek Engineering Inc

Path to file locations: J:\Jobs\1208300.WI\Calcs\Foundation\
Name of input data file: Greenwich Hospital Caisson Analysis.lpd
Name of output file: Greenwich Hospital Caisson Analysis.lpo
Name of plot output file: Greenwich Hospital Caisson Analysis.lpp
Name of runtime file: Greenwich Hospital Caisson Analysis.lpr

Time and Date of Analysis

Date: September 25, 2012 Time: 8:41:54

Problem Title

12083 - CT43XC855: Greenwich Hospital

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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Greenwich Hospital Caisson Analysis.lpo

1	0.0000	108.00000	6678285.	9160.9000	3600000.
2	336.0000	108.00000	6678285.	9160.9000	3600000.

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 =	48.000 in
p-y subgrade modulus k for top of soil layer =	20.000 lbs/in**3
p-y subgrade modulus k for bottom of layer =	20.000 lbs/in**3

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

Distance from top of pile to top of layer =	48.000 in
Distance from top of pile to bottom of layer =	72.000 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 =	72.000 in
Distance from top of pile to bottom of layer =	132.000 in
p-y subgrade modulus k for top of soil layer =	150.000 lbs/in**3
p-y subgrade modulus k for bottom of layer =	150.000 lbs/in**3

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

Distance from top of pile to top of layer =	132.000 in
Distance from top of pile to bottom of layer =	360.000 in
p-y subgrade modulus k for top of soil layer =	250.000 lbs/in**3
p-y subgrade modulus k for bottom of layer =	250.000 lbs/in**3

(Depth of lowest layer extends 24.00 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	.05800
2	48.00	.05800
3	48.00	.06900
4	72.00	.06900
5	72.00	.06900
6	132.00	.06900
7	132.00	.07500
8	360.00	.07500

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	20.00	-----	-----
2	48.000	.00000	20.00	-----	-----
3	48.000	.00000	30.00	-----	-----
4	72.000	.00000	30.00	-----	-----
5	72.000	.00000	35.00	-----	-----
6	132.000	.00000	35.00	-----	-----
7	132.000	.00000	42.00	-----	-----
8	360.000	.00000	42.00	-----	-----

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.

Greenwich Hospital Caisson Analysis.lpo
 (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 = 45000.000 lbs
 Bending moment at pile head = 60612000.000 in-lbs
 Axial load at pile head = 83000.000 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 = 108.0000 in

Material Properties:

Compressive Strength of Concrete = 3.000 kip/in**2
 Yield Stress of Reinforcement = 60. kip/in**2
 Modulus of Elasticity of Reinforcement = 29000. kip/in**2
 Number of Reinforcing Bars = 33
 Area of Single Bar = 1.56000 in**2
 Number of Rows of Reinforcing Bars = 33
 Area of Steel = 51.480 in**2
 Area of Shaft = 9160.884 in**2
 Percentage of Steel Reinforcement = .562 percent
 Cover Thickness (edge to bar center) = 4.000 in

Unfactored Axial Squash Load Capacity = 26317.78 kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement in**2	Distance to Centroidal Axis in
1	1.560	49.943
2	1.560	49.491
3	1.560	48.591
4	1.560	47.250
5	1.560	45.482
6	1.560	43.301
7	1.560	40.729
8	1.560	37.787
9	1.560	34.504
10	1.560	30.908
11	1.560	27.032
12	1.560	22.911
13	1.560	18.583
14	1.560	14.087
15	1.560	9.463
16	1.560	4.753
17	1.560	0.000
18	1.560	-4.753
19	1.560	-9.463
20	1.560	-14.087
21	1.560	-18.583

Greenwich Hospital Caisson Analysis.lpo

22	1.560	-22.911
23	1.560	-27.032
24	1.560	-30.908
25	1.560	-34.504
26	1.560	-37.787
27	1.560	-40.729
28	1.560	-43.301
29	1.560	-45.482
30	1.560	-47.250
31	1.560	-48.591
32	1.560	-49.491
33	1.560	-49.943

Axial Thrust Force = 83000.00 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
11414322.	2.282864E+13	5.000000E-07	.00002985	59.70751923	91.76359740	806.93785
22713361.	2.271336E+13	.00000100	.00005698	56.98147005	173.56484	1534.82027
33889242.	2.259283E+13	.00000150	.00008407	56.04763967	253.86920	2261.60879
44949986.	2.247499E+13	.00000200	.00011124	55.61870295	333.01637	2990.60005
55888681.	2.235547E+13	.00000250	.00013835	55.33852905	410.61091	3717.93746
55888681.	1.862956E+13	.00000300	.00008490	28.29897827	252.30137	6581.06182
55888681.	1.596819E+13	.00000350	.00009712	27.74932927	287.37055	7733.69483
55888681.	1.397217E+13	.00000400	.00010936	27.34067327	322.21221	8885.91247
55888681.	1.241971E+13	.00000450	.00012162	27.02603084	356.82559	10037.71236
55888681.	1.117774E+13	.00000500	.00013417	26.83327228	392.02209	11180.96373
55888681.	1.016158E+13	.00000550	.00014639	26.61582023	425.98955	12333.74370
55888681.	9.314780E+12	.00000600	.00015862	26.43721086	459.73206	13486.07116
55888681.	8.598259E+12	.00000650	.00017088	26.28849632	493.24882	14637.94312
55888681.	7.984097E+12	.00000700	.00018314	26.16328114	526.53896	15789.35742
55888681.	7.451824E+12	.00000750	.00019543	26.05688542	559.60181	16940.30973
55888681.	6.986085E+12	.00000800	.00020773	25.96579117	592.43651	18090.79758
55888681.	6.575139E+12	.00000850	.00022004	25.88731402	625.04232	19240.81705
55888681.	6.209853E+12	.00000900	.00023237	25.81936187	657.41838	20390.36533
55888681.	5.883019E+12	.00000950	.00024472	25.76028353	689.56384	21539.43948
55888681.	5.588868E+12	.00001000	.00025709	25.70876580	721.47803	22688.03433
55888681.	5.322732E+12	.00001050	.00026947	25.66373366	753.15996	23836.14834
55888681.	5.080789E+12	.00001100	.00028187	25.62431484	784.60882	24983.77762
55888681.	4.859885E+12	.00001150	.00029428	25.58979160	815.82387	26130.91738
55888681.	4.657390E+12	.00001200	.00030671	25.55955559	846.80405	27277.56636
55888681.	4.471094E+12	.00001250	.00031916	25.53311116	877.54876	28423.71773
55888681.	4.299129E+12	.00001300	.00033163	25.51002377	908.05692	29569.37038
55888681.	4.139902E+12	.00001350	.00034411	25.48992974	938.32762	30714.52067
56905642.	4.064689E+12	.00001400	.00035662	25.47252327	968.36018	31859.16254
58816659.	4.056321E+12	.00001450	.00036913	25.45753080	998.15350	33003.29411
60725485.	4.048366E+12	.00001500	.00038167	25.44472057	1027.70672	34146.91118
62632105.	4.040781E+12	.00001550	.00039423	25.43388981	1057.01889	35290.00998
64536515.	4.033532E+12	.00001600	.00040680	25.42486471	1086.08920	36432.58504
66438687.	4.026587E+12	.00001650	.00041939	25.41748434	1114.91649	37574.63483
68338620.	4.019919E+12	.00001700	.00043200	25.41161674	1143.50001	38716.15286
70236298.	4.013503E+12	.00001750	.00044462	25.40713960	1171.83875	39857.13539
72131703.	4.007317E+12	.00001800	.00045727	25.40394348	1199.93168	40997.57906
74024817.	4.001341E+12	.00001850	.00046994	25.40193182	1227.77776	42137.47995
75915632.	3.995560E+12	.00001900	.00048262	25.40102094	1255.37609	43276.83265
77804133.	3.989956E+12	.00001950	.00049532	25.40113360	1282.72564	44415.63297
81574128.	3.979226E+12	.00002050	.00052079	25.40415913	1336.67425	46691.55906
85334687.	3.969055E+12	.00002150	.00054633	25.41053528	1389.61535	48965.22055
89085671.	3.959363E+12	.00002250	.00057195	25.41986936	1441.54023	51236.58218
92826960.	3.950083E+12	.00002350	.00059765	25.43184274	1492.44026	53505.60375
96558435.	3.941161E+12	.00002450	.00062343	25.44619149	1542.30664	55772.24317
1.002799E+08	3.932547E+12	.00002550	.00064930	25.46268708	1591.12996	58036.46277
1.039545E+08	3.922811E+12	.00002650	.00067517	25.47801751	1638.74495	60000.00000
1.068591E+08	3.885784E+12	.00002750	.00069939	25.43224508	1682.11908	60000.00000
1.092912E+08	3.834780E+12	.00002850	.00072258	25.35358125	1722.59072	60000.00000
1.114123E+08	3.776688E+12	.00002950	.00074508	25.25684470	1760.88683	60000.00000
1.135610E+08	3.723312E+12	.00003050	.00076860	25.20000011	1800.02423	60000.00000
1.150353E+08	3.651915E+12	.00003150	.00079106	25.11301929	1836.39637	60000.00000
1.166051E+08	3.587851E+12	.00003250	.00081200	24.98469168	1869.39726	60000.00000
1.179747E+08	3.521634E+12	.00003350	.00083237	24.84695917	1900.70865	60000.00000
1.193035E+08	3.458073E+12	.00003450	.00085267	24.71499449	1931.16409	60000.00000
1.204592E+08	3.393218E+12	.00003550	.00087244	24.57564300	1960.09125	60000.00000
1.216115E+08	3.331821E+12	.00003650	.00089224	24.44505912	1988.38710	60000.00000
1.225975E+08	3.269266E+12	.00003750	.00091151	24.30687279	2015.19998	60000.00000
1.235703E+08	3.209619E+12	.00003850	.00093077	24.17592198	2041.36013	60000.00000
1.244896E+08	3.151636E+12	.00003950	.00094988	24.04760081	2066.64765	60000.00000
1.253032E+08	3.093907E+12	.00004050	.00096862	23.91663390	2090.80438	60000.00000
1.261140E+08	3.038891E+12	.00004150	.00098740	23.79284137	2114.38849	60000.00000
1.268980E+08	2.985836E+12	.00004250	.00100612	23.67334253	2137.26841	60000.00000
1.275698E+08	2.932638E+12	.00004350	.00102440	23.54940838	2158.99865	60000.00000
1.282389E+08	2.881773E+12	.00004450	.00104272	23.43180853	2180.18206	60000.00000
1.288288E+08	2.831402E+12	.00004550	.00106470	23.39999861	2205.03779	60000.00000
1.296233E+08	2.787598E+12	.00004650	.00108366	23.30448192	2225.63891	60000.00000
1.301569E+08	2.740146E+12	.00004750	.00110094	23.17771214	2243.77987	60000.00000
1.306885E+08	2.694607E+12	.00004850	.00111826	23.05682284	2261.43238	60000.00000

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1.312178E+08	2.650865E+12	.00004950	.00113560	22.94146317	2278.59368	60000.00000
1.317450E+08	2.608813E+12	.00005050	.00115298	22.83130807	2295.26090	60000.00000
1.322083E+08	2.567152E+12	.00005150	.00117003	22.71897715	2311.07969	60000.00000
1.326332E+08	2.526348E+12	.00005250	.00118689	22.60740906	2326.21926	60000.00000
1.330562E+08	2.487032E+12	.00005350	.00120378	22.50057560	2340.89053	60000.00000
1.334772E+08	2.449124E+12	.00005450	.00122070	22.39821929	2355.09085	60000.00000
1.338963E+08	2.412545E+12	.00005550	.00123766	22.30010194	2368.81755	60000.00000
1.343133E+08	2.377226E+12	.00005650	.00125464	22.20600468	2382.06806	60000.00000
1.346556E+08	2.341836E+12	.00005750	.00127117	22.10723072	2394.46013	60000.00000
1.349883E+08	2.307491E+12	.00005850	.00128767	22.01143080	2406.35967	60000.00000
1.353191E+08	2.274270E+12	.00005950	.00130420	21.91933876	2417.80654	60000.00000
1.359753E+08	2.210981E+12	.00006150	.00133735	21.74557990	2439.33271	60000.00000
1.367504E+08	2.153550E+12	.00006350	.00137160	21.60000032	2459.59723	60000.00000
1.372794E+08	2.095869E+12	.00006550	.00141090	21.54051000	2480.46875	60000.00000
1.377607E+08	2.040900E+12	.00006750	.00144201	21.36313015	2494.87517	60000.00000
1.382361E+08	1.989009E+12	.00006950	.00147323	21.19756275	2507.65629	60000.00000
1.387054E+08	1.939935E+12	.00007150	.00150456	21.04283577	2518.79347	60000.00000
1.391458E+08	1.893140E+12	.00007350	.00153577	20.89485186	2528.19857	60000.00000
1.394994E+08	1.847674E+12	.00007550	.00156624	20.74492067	2535.74814	60000.00000
1.398474E+08	1.804483E+12	.00007750	.00159682	20.60413367	2541.71868	60000.00000
1.401898E+08	1.763393E+12	.00007950	.00162751	20.47181815	2546.09207	60000.00000
1.405264E+08	1.724250E+12	.00008150	.00165831	20.34737223	2548.84982	60000.00000
1.408572E+08	1.686912E+12	.00008350	.00168923	20.23025519	2549.97299	60000.00000
1.411503E+08	1.650881E+12	.00008550	.00171994	20.11623770	2545.85447	60000.00000
1.413869E+08	1.615850E+12	.00008750	.00175009	20.00106150	2540.88089	60000.00000
1.416209E+08	1.582357E+12	.00008950	.00178036	19.89227110	2543.67572	60000.00000
1.416209E+08	1.547770E+12	.00009150	.00181170	19.79999882	2547.09008	60000.00000
1.417490E+08	1.516032E+12	.00009350	.00185130	19.79999882	2549.59126	60000.00000
1.424324E+08	1.491439E+12	.00009550	.00188621	19.75092083	2548.41987	60000.00000
1.426387E+08	1.462962E+12	.00009750	.00191564	19.64757639	2544.20559	60000.00000
1.428436E+08	1.435614E+12	.00009950	.00194515	19.54927558	2539.97579	60000.00000
1.430384E+08	1.409246E+12	.00010150	.00197459	19.45409364	2539.97929	60000.00000
1.431827E+08	1.383408E+12	.00010350	.00200316	19.35420281	2543.47045	60000.00000
1.433257E+08	1.358538E+12	.00010550	.00203181	19.25888890	2546.22690	60000.00000
1.434675E+08	1.334581E+12	.00010750	.00206055	19.16790730	2548.23919	60000.00000
1.436080E+08	1.311489E+12	.00010950	.00208937	19.08103269	2549.49764	60000.00000
1.437473E+08	1.289213E+12	.00011150	.00211828	18.99805588	2549.99234	60000.00000
1.438830E+08	1.267692E+12	.00011350	.00214739	18.91973966	2546.96793	60000.00000
1.440177E+08	1.246906E+12	.00011550	.00217658	18.84483200	2543.42689	60000.00000
1.441515E+08	1.226822E+12	.00011750	.00220583	18.77299172	2539.87517	60000.00000
1.442847E+08	1.207403E+12	.00011950	.00223514	18.70407075	2536.31268	60000.00000
1.444170E+08	1.188617E+12	.00012150	.00226451	18.63793391	2535.92826	60000.00000
1.445381E+08	1.170349E+12	.00012350	.00229368	18.57227987	2539.53743	60000.00000
1.446297E+08	1.152428E+12	.00012550	.00232217	18.50335246	2542.49816	60000.00000
1.447206E+08	1.135064E+12	.00012750	.00235072	18.43704182	2544.97568	60000.00000
1.448110E+08	1.118231E+12	.00012950	.00237933	18.37323529	2546.96471	60000.00000
1.449006E+08	1.101906E+12	.00013150	.00240800	18.31182021	2548.45976	60000.00000
1.449896E+08	1.086065E+12	.00013350	.00243674	18.25270003	2549.45533	60000.00000
1.450780E+08	1.070686E+12	.00013550	.00246553	18.19577497	2549.94572	60000.00000
1.451645E+08	1.055742E+12	.00013750	.00249445	18.14148921	2548.44761	60000.00000
1.452497E+08	1.041217E+12	.00013950	.00252349	18.08952409	2545.56500	60000.00000
1.455127E+08	1.014026E+12	.00014350	.00258300	18.00000054	2539.54654	60000.00000
1.466286E+08	9.940921E+11	.00014750	.00265500	18.00000054	2531.33751	60000.00000
1.476109E+08	9.743296E+11	.00015150	.00272700	18.00000054	2536.11274	60000.00000
1.476109E+08	9.492664E+11	.00015550	.00279332	17.96349782	2542.87812	60000.00000
1.476109E+08	9.254604E+11	.00015950	.00285083	17.87355262	2546.44404	60000.00000
1.476109E+08	9.028191E+11	.00016350	.00290743	17.78245515	2548.72067	60000.00000
1.476109E+08	8.812593E+11	.00016750	.00296422	17.69681329	2549.86266	60000.00000
1.476109E+08	8.607051E+11	.00017150	.00302244	17.62353748	2547.55621	60000.00000
1.476109E+08	8.410879E+11	.00017550	.00308145	17.55809587	2542.88879	60000.00000
1.476109E+08	8.223450E+11	.00017950	.00314058	17.49623984	2538.20030	60000.00000
1.476109E+08	8.044192E+11	.00018350	.00319983	17.43774408	2533.49046	60000.00000
1.476109E+08	7.872583E+11	.00018750	.00325920	17.38241225	2528.75864	60000.00000
1.476109E+08	7.708143E+11	.00019150	.00331871	17.33006090	2524.00435	60000.00000
1.476109E+08	7.550431E+11	.00019550	.00337834	17.28052264	2519.72001	60000.00000
1.476109E+08	7.399044E+11	.00019950	.00343918	17.23898274	2526.56916	60000.00000
1.476109E+08	7.253608E+11	.00020350	.00350067	17.20229334	2532.71154	60000.00000
1.476109E+08	7.113780E+11	.00020750	.00356234	17.16788918	2537.96116	60000.00000
1.476109E+08	6.979240E+11	.00021150	.00362365	17.13310522	2542.20165	60000.00000
1.476109E+08	6.849695E+11	.00021550	.00368332	17.09195477	2545.30471	60000.00000
1.476109E+08	6.724872E+11	.00021950	.00374314	17.05301875	2547.63985	60000.00000
1.476109E+08	6.604516E+11	.00022350	.00380312	17.01619738	2549.18881	60000.00000

Unfactored (Nominal) Moment Capacity at Concrete Strain of 0.003 = 147610.93014 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 = 45000.000 lbs
 Specified moment at pile head = 60612000.000 in-lbs
 Specified axial load at pile head = 83000.000 lbs

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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.

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	.605112	6.06E+07	45000.	-.004136	499.163	4.05E+12	0.000	0.000
26.880	.499396	6.18E+07	43839.	-.003729	508.969	4.04E+12	-148.620	999.936
53.760	.404724	6.29E+07	35069.	-.003314	517.888	4.04E+12	-792.773	6581.556
80.640	.321300	6.35E+07	1800.042	-.002893	522.452	4.04E+12	-1778.348	18597.
107.520	.249218	6.28E+07	-59678.	-.002471	516.718	4.04E+12	-2784.366	37539.
134.400	.188333	6.02E+07	-1.38E+05	-.002062	495.475	4.05E+12	-3570.347	63698.
161.280	.137847	5.52E+07	-2.34E+05	-.001760	455.064	2.24E+13	-3539.579	86277.
188.160	.091402	4.76E+07	-3.23E+05	-.001698	394.242	2.24E+13	-2961.200	1.09E+05
215.040	.046485	3.80E+07	-3.88E+05	-.001646	316.388	2.25E+13	-1818.380	1.31E+05
241.920	.002783	2.71E+07	-4.16E+05	-.001608	228.172	2.27E+13	-127.571	1.54E+05
268.800	-.040054	1.61E+07	-3.90E+05	-.001582	139.470	2.28E+13	2105.168	1.77E+05
295.680	-.082376	6.71E+06	-2.98E+05	-.001569	63.328	2.28E+13	4883.050	1.99E+05
322.560	-.124476	8.56E+05	-1.23E+05	-.001565	15.980	2.28E+13	8215.103	2.22E+05

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 = .60511242 in
 Computed slope at pile head = -.00413550
 Maximum bending moment = 63492107. lbs-in
 Maximum shear force = -415784.77992 lbs
 Depth of maximum bending moment = 80.64000000 in
 Depth of maximum shear force = 245.28000 in
 Number of iterations = 69
 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= 45000.	M= 6.06E+07	83000.0000	.6051124	6.3492E+07	-415785.

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
.00120060	4500.00007	909541.22832	3748138.	7.575747E+08
.00361415	13546.34980	2737992.	3748138.	7.575747E+08
.00572830	21470.45646	4339614.	3748138.	7.575747E+08
.00722831	27092.69961	5475984.	3748138.	7.575747E+08
.00839181	31453.65020	6357420.	3748138.	7.575747E+08
.00934245	35016.80627	7077606.	3748138.	7.575747E+08
.01014621	38029.41180	7686515.	3748138.	7.575747E+08
.01084246	40639.04942	8213976.	3748138.	7.575747E+08
.01145660	42940.91293	8679229.	3748138.	7.575747E+08
.01200596	45000.00000	9095412.	3748138.	7.575747E+08
Top Rota. rad	Shear React. lbs	Mom. React. in-lbs	K23 lbs/rad	K33 in-lbs/rad

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.00003274 24802.77593 6061200. 7.575747E+08 1.851330E+11
.00009868 74666.54041 18246030. 7.566620E+08 1.849031E+11
.00015675 118358.13823 28919273. 7.550928E+08 1.844971E+11
.00019813 149366.38704 36492060. 7.538948E+08 1.841858E+11
.00023033 173423.18732 42365970. 7.529177E+08 1.839321E+11
.00025671 193082.25804 47165304. 7.521430E+08 1.837303E+11
.00027907 209706.01534 51223082. 7.514591E+08 1.835524E+11
.00029846 224107.91739 54738090. 7.508687E+08 1.833988E+11
.00031728 236817.01813 57838547. 7.464030E+08 1.822963E+11
.00034213 248219.88254 60612000. 7.255136E+08 1.771608E+11

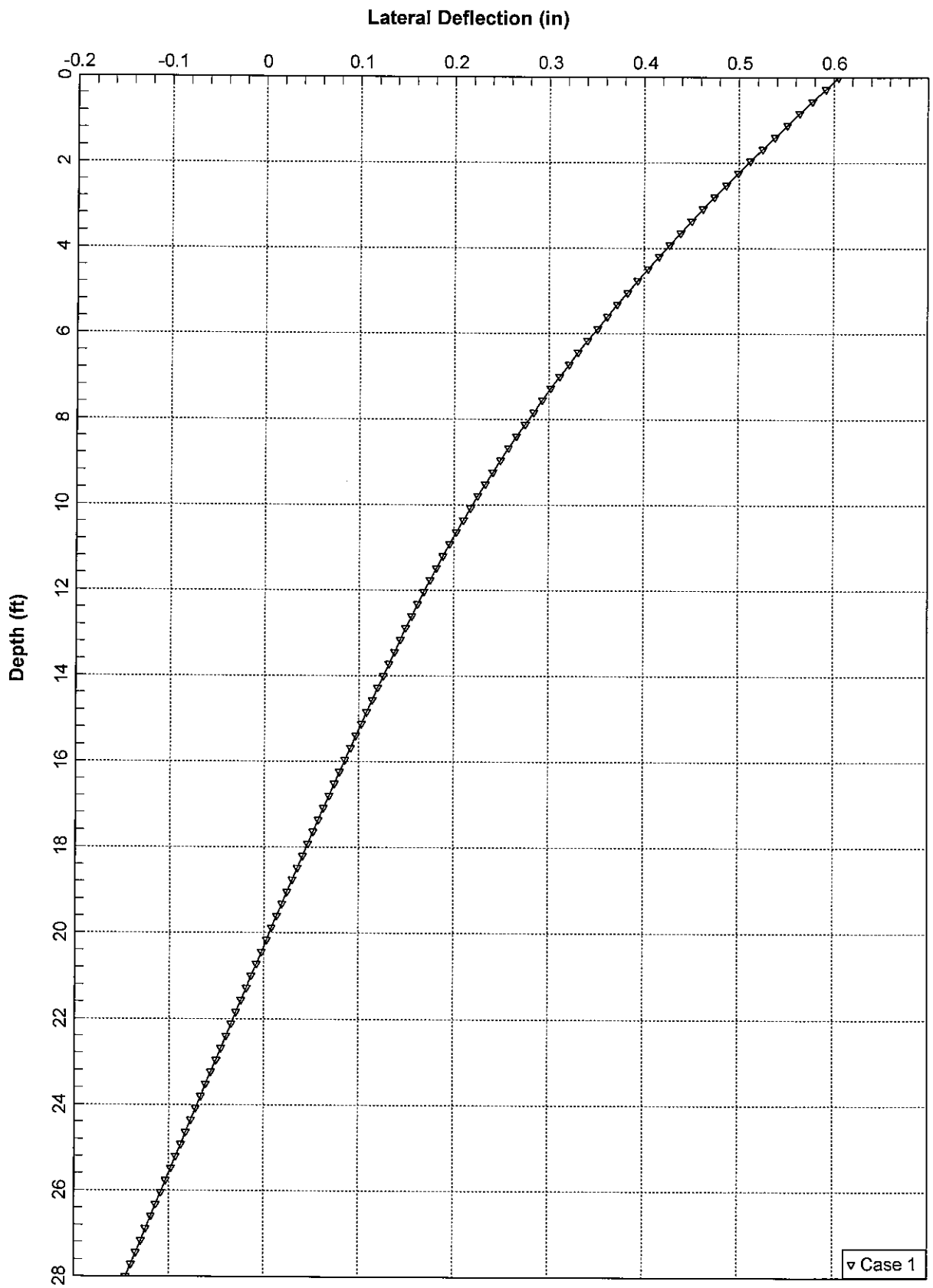
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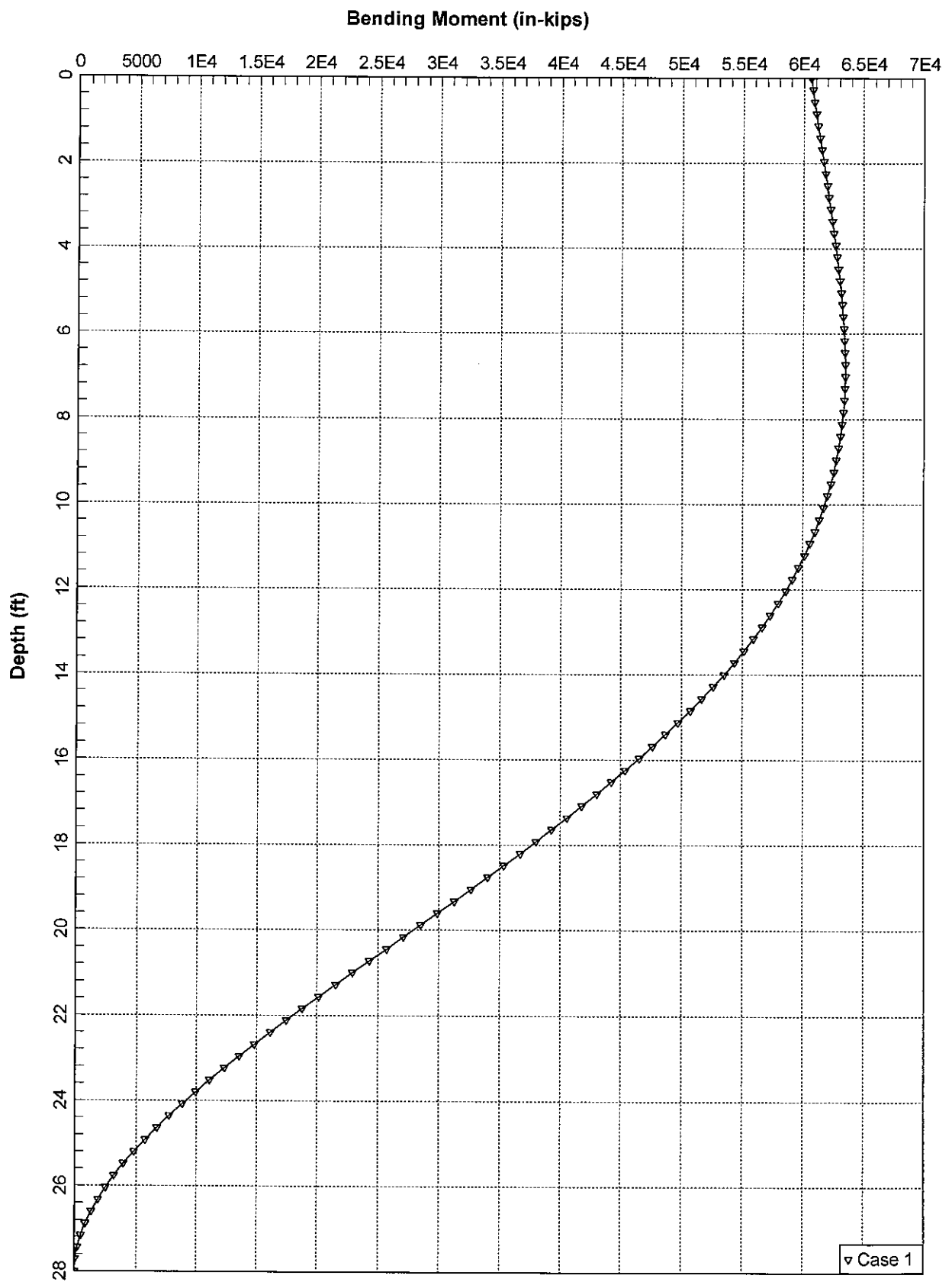
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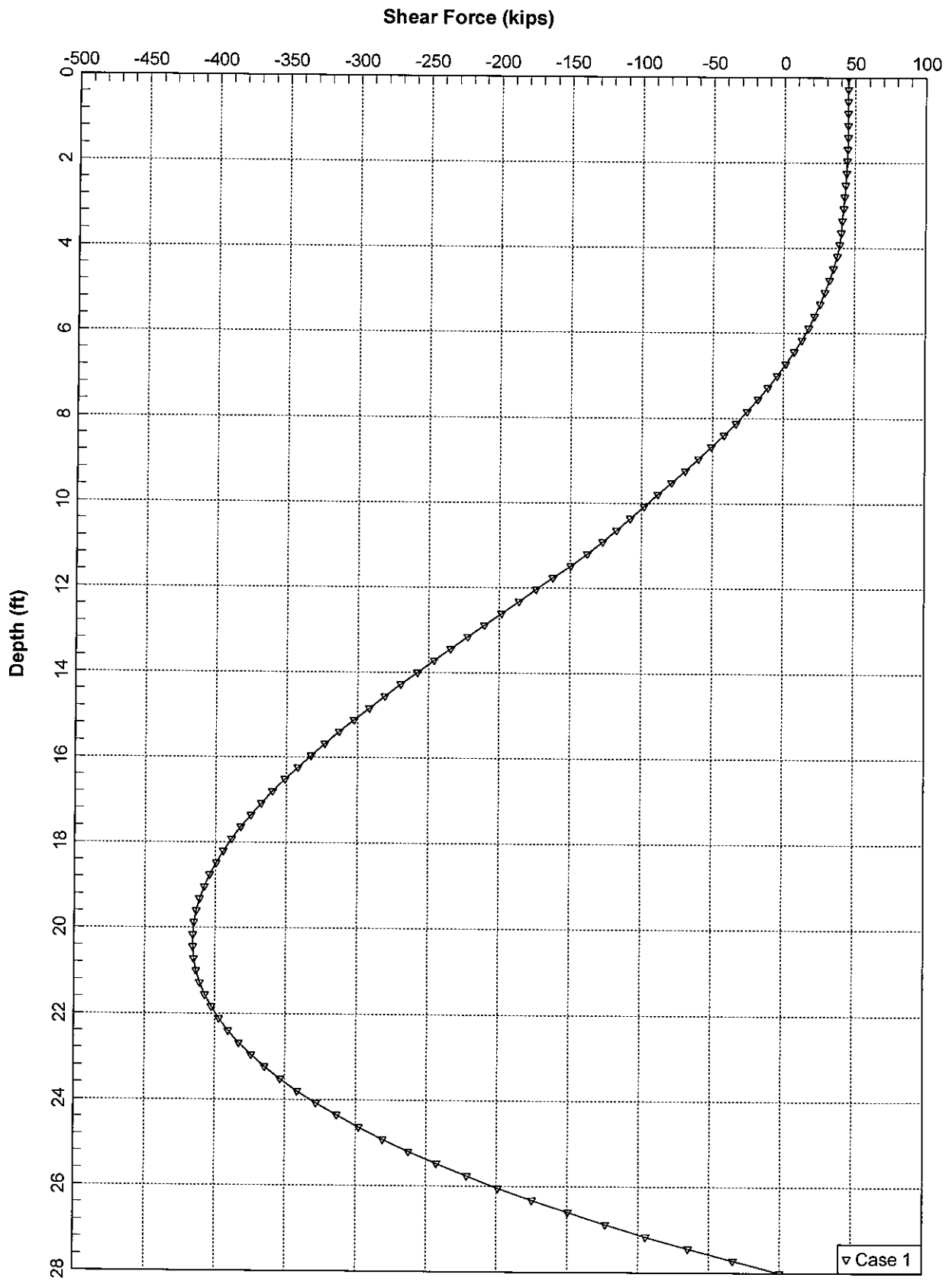
K22 = abs(Shear Reaction/Top y)
K23 = abs(Shear Reaction/Top Rotation)
K32 = abs(Moment Reaction/Top y)
K33 = abs(Moment Reaction/Top Rotation)

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The analysis ended normally.







		Southern Connecticut		
Market		CT43XC855		
Cascade ID				
		SECTOR 1	SECTOR 2	SECTOR 3
1900	Split sector present	No	No	No
	1900MHz_Azimuth	30	140	290
	1900MHz_No_of_Antennas	1	1	1
	1900MHz_RADCenter(ft)	155.5	155.5	155.5
	1900MHz_Antenna Make	RFS	Powerwave	RFS
	1900MHz_Antenna Model	APXVSP18-C-A20	P40-16-XLPP-RR-A	APXVSP18-C-A20
	1900MHz_Horizontal_Beamwidth	65	40	65
	1900MHz_Vertical_Beamwidth	5.5	6.5	5.5
	1900MHz_AntennaHeight (ft)	6	4.5	6
	1900MHz_AntennaGain(dBd)	15.9	15.9	15.9
	1900MHz_E_Tilt	0	-3	-2
	1900MHz_M_Tilt	0	0	0
	1900MHz_Carrier_Forecast_Year_2013	3	3	3
	1900MHz_RRH Manufacturer	ALU	ALU	ALU
	1900MHz_RRH Model	RRH 1900 4X45 65MHz	RRH 1900 4X45 65MHz	RRH 1900 4X45 65MHz
	1900MHz_RRH Count	1	1	1
	1900MHz_RRH Location	Top of the Tower/Pole	Top of the Tower/Pole	Top of the Tower/Pole
	1900MHz Combiner Model	No Combiner needed	No Combiner needed	No Combiner needed
	1900MHz_Top_Jumper #1_Length (RRH or Combiner-to-Antenna, ft)	10	10	10
	1900MHz_Top_Jumper #1_Cable_Model (RRH or Combiner-to-Antenna)	LCF12-50J	LCF12-50J	LCF12-50J
	1900MHz_Top_Jumper #2_Length (RRH-to-Combiner, ft)	N/A	N/A	N/A
	1900MHz_Top_Jumper #2_Cable_Model (RRH-to-Combiner)	N/A	N/A	N/A
	1900MHz_Main_Coax_Cable_Length (ft)	N/A	N/A	N/A
	1900MHz_Main_Coax_Cable_Model	N/A	N/A	N/A
	1900MHz_Bottom_Jumper #1_Length (Ground-based-RRH-OR_Combiner-to-Main-Coax, ft)	N/A	N/A	N/A
	1900MHz_Bottom_Jumper #1_Cable_Model (Ground-based-RRH-OR_Combiner-to-Main-Coax)	N/A	N/A	N/A
	1900MHz_Bottom_Jumper #2_Length (Ground-based-Combiner-to-Main-Coax)	N/A	N/A	N/A
	1900MHz_Bottom_Jumper #2_Cable_Model (Ground-based-Combiner-to-Main-Coax)	N/A	N/A	N/A
800	800MHz_Azimuth	30	140	290
	800MHz_No_of_Antennas	0	0	0
	800MHz_RADCenter(ft)	155.5	155.5	155.5
	800MHz_AntennaMake	RFS	Powerwave	RFS
	800MHz_AntennaModel	APXVSP18-C-A20 (Shared w/1900)	P40-16-XLPP-RR-A (Shared w/1900)	APXVSP18-C-A20 (Shared w/1900)
	800MHz_Horizontal_Beamwidth	65	40	65
	800MHz_Vertical_Beamwidth	11.5	16	11.5
	800MHz_AntennaHeight (ft)	6	4.5	6
	800MHz_AntennaGain (dBd)	13.4	14.2	13.4
	800MHz_E_Tilt	0	-7	-8
	800MHz_M_Tilt	0	0	0
	800MHz_RRH Manufacturer	ALU	ALU	ALU
	800MHz_RRH Model	TBD	TBD	TBD
	800MHz_RRH Count	1	1	1
	800MHz_RRH Location	Top of the Tower/Pole	Top of the Tower/Pole	Top of the Tower/Pole
	800MHz_Top_Jumper #1_Length (RRH or Combiner-to-Antenna, ft)	10	10	10
	800MHz_Top_Jumper_Cable_Model (RRH or Combiner-to-Antenna)	LCF12-50J	LCF12-50J	LCF12-50J
	800MHz_Main_Coax_Cable_Length (ft)	N/A	N/A	N/A
	800MHz_Main_Coax_Cable_Model	N/A	N/A	N/A
	800MHz_Bottom_Jumper #1_Length (Ground-based-RRH-Main-Coax, ft)	N/A	N/A	N/A
	800MHz_Bottom_Jumper #1_Cable_Model (Ground-based-RRH-OR_Combiner-to-Main-Coax)	N/A	N/A	N/A
Comment	5/22/2012			
	0			
	0			

Product Data Sheet APXVSPP18-C

Triple Band Dual Polarized Antenna, 806-1995, 65deg, 16-18dBi, 1.8m, VET, 0-10deg, 0.5m AISG Cable

Product Description

This antenna is an ideal choice for dual band site upgrade for high traffic areas. It features 4 ports in 1900 MHz and 2 ports in 800 MHz.

Features/Benefits

- Variable electrical downtilt – provides enhanced precision in controlling intercell interference. The tilt is infield adjustable 0-10 deg.
- High suppression of all upper sidelobes (Typically < 18 dB)
- Independent control of electrical downtilt for 800 and PCS bands
- Remote tilt – AISG compatible
- Low profile for low visual impact
- Quick and easy to adjust
- High front-to-back ratio



Technical Specifications

Electrical Specifications

Frequency Range, MHz	806-869	1850-1995	1850-1995
Horizontal Beamwidth, deg	65	65	65
Vertical Beamwidth, deg	11.5	5.5	5.5
Electrical Downtilt, deg		0-10	
Gain, dBi (dBd)	15.5 (13.4)	18.4 (16.3)	18.4 (16.3)
1st Upper Sidelobe Suppression, dB, typ. @ T0° & T8°		>18	
Front-To-Back Ratio, dB, @ 180° ± 15°	>30	>27	>27
Polarization		Dual pol +/-45°	
Return Loss, dB		> 14	
Isolation between Ports, dB		>28	
3rd Order IMP @ 2 x 43 dBm, @ 2 min. duration		>110	
Cross Polar Discrimination (XPD) 0°, dB	>15	>20	>20
Cross Polar Discrimination (XPD) ± 60°, dB	>9.5	>11	>11
HBW Squint across same band ports, °		±5	
Impedance, Ohms		50	
Maximum Power Input, W		250	
Lightning Protection		Direct Ground	
Connector Type		(6) 7-16 DIN Female	

Mechanical Specifications

Dimensions-HxWxD, mm(in)	1829x302x178(72.0x11.8x7)
Weight w/o Mntg Hardware, kg(lb)	25.8(57)
Radome Material	ASA
Radome Color	Light Grey RA17035
Mounting Hardware Material	Diecasted Aluminum and Galvanized Steel

Ordering Information

Mounting Hardware	APM40-2Downtilt Kit
AISG System Cable	0.5m, included
Mounting Pole Diameter, mm(in)	60-120(2.4-4.7)
Mounting Hardware Weight, kg(lb)	3.4(7.5)

RFS The Clear Choice™

APXVSPP18-C



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RADIO FREQUENCY EMISSIONS ANALYSIS REPORT EVALUATION OF HUMAN EXPOSURE POTENTIAL TO NON-IONIZING EMISSIONS

Sprint Existing Facility

Site ID: CT43XC855

Greenwich Hospital
9 Perryridge Road
Greenwich, CT 06830

October 04, 2012



EBI Consulting

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October 04, 2012

Sprint
Attn: RF Engineering Manager
1 International Boulevard, Suite 800
Mahwah, NJ 07495

Re: Emissions Values for Site **CT43XC855 - Greenwich Hospital**

EBI Consulting was directed to analyze the proposed upgrades to the existing Sprint facility located at 9 Perryridge Road, Greenwich, CT, for the purpose of determining whether the emissions from the proposed Sprint equipment upgrades on this property are within specified federal limits.

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

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

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

Public exposure to radio frequencies is regulated and enforced in units of microwatts per square centimeter ($\mu\text{W}/\text{cm}^2$). The general population exposure limit for the cellular band is approximately $567 \mu\text{W}/\text{cm}^2$, and the general population exposure limit for the PCS band is $1000 \mu\text{W}/\text{cm}^2$. Because each carrier will be using different frequency bands, and each frequency band has different exposure limits, it is necessary to report percent of MPE rather than power density.



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

Additional details can be found in FCC OET 65.

CALCULATIONS

Calculations were done for the proposed upgrades to the existing Sprint Wireless antenna facility located at 9 Perryridge Road, Greenwich, CT, using the equipment information listed below. All calculations were performed per the specifications under FCC OET 65. All calculations were performed assuming the main lobe of the antenna was focused at the base of the tower to present a worst case scenario. Actual values seen from this site will be dramatically less than those shown in this report. For this report the sample point is the top of a 6 foot person standing at the base of the tower.

For all calculations, all emissions were calculated using the following assumptions:

- 1) 3 CDMA Carriers (1900 MHz) were considered for each sector of the proposed installation.
- 2) 1 CDMA Carrier (850 MHz) was considered for each sector of the proposed installation
- 3) All radios at the proposed installation were considered to be running at full power and were uncombined in their RF transmissions paths per carrier prescribed configuration. Per FCC OET Bulletin No. 65 - Edition 97-01 recommendations to achieve the maximum anticipated value at each sample point, all power levels emitting from the proposed antenna installation are increased by a factor of 2.56 to account for possible in-phase reflections from the surrounding environment. This is rarely the case, and if so, is never continuous.
- 4) For the following calculations the sample point was the top of a six foot person standing at the base of the tower. The actual gain in this direction was used per the manufactures supplied specifications.
- 5) The antenna used in this modeling is the RFS APXVSP18-C-A20. This is based on feedback from the carrier with regards to anticipated antenna selection. This antenna has a 15.9 dBd gain value at its main lobe at 1900 MHz and 13.4 dBd at its main lobe for 850 MHz. All calculations were performed assuming the main lobe of the antenna was focused at the base of the tower to present a worst case scenario.

- 6) The antenna mounting height centerline of the proposed antennas is **154 feet** above ground level (AGL)
- 7) Emissions values for additional carriers were taken from the Connecticut Siting Council active database. Values in this database are provided by the individual carriers themselves.

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

Site IDCT43XC855 - Greenwich Hospital																	
Site Address9 Perryridge Road, Greenwich, CT 06830																	
Site TypeMonopole																	
Sector 1																	
Antenna Number	Antenna Make	Antenna Model	Radio Type	Frequency Band	Technology	Power Out Per Channel (Watts)	Number of Channels	Composite Power	Antenna Gain in direction of sample point (dBd)	Antenna Height (ft)	analysis height	Cable Size	Cable Loss (dB)	Additional Loss	ERP	Power Density Value	Power Density Percentage
1a	RFS	APXVSP18-C-A20	RRH	1900 MHz	CDMA / LTE	20	3	60	15.9	154	148	1/2 "	0.5	0	2080.4211	34.14553	3.41455%
1a	RFS	APXVSP18-C-A20	RRH	850 MHz	CDMA / LTE	20	1	20	13.4	154	148	1/2 "	0.5	0	389.96892	6.40048	1.12883%
Sector total Power Density Value:															4.543%		
Sector 2																	
Antenna Number	Antenna Make	Antenna Model	Radio Type	Frequency Band	Technology	Power Out Per Channel (Watts)	Number of Channels	Composite Power	Antenna Gain in direction of sample point (dBd)	Antenna Height (ft)	analysis height	Cable Size	Cable Loss (dB)	Additional Loss	ERP	Power Density Value	Power Density Percentage
2a	RFS	APXVSP18-C-A20	RRH	1900 MHz	CDMA / LTE	20	3	60	15.9	154	148	1/2 "	0.5	0	2080.4211	34.14553	3.41455%
2a	RFS	APXVSP18-C-A20	RRH	850 MHz	CDMA / LTE	20	1	20	13.4	154	148	1/2 "	0.5	0	389.96892	6.40048	1.12883%
Sector total Power Density Value:															4.543%		
Sector 3																	
Antenna Number	Antenna Make	Antenna Model	Radio Type	Frequency Band	Technology	Power Out Per Channel (Watts)	Number of Channels	Composite Power	Antenna Gain in direction of sample point (dBd)	Antenna Height (ft)	analysis height	Cable Size	Cable Loss (dB)	Additional Loss	ERP	Power Density Value	Power Density Percentage
3a	RFS	APXVSP18-C-A20	RRH	1900 MHz	CDMA / LTE	20	3	60	15.9	154	148	1/2 "	0.5	0	2080.4211	34.14553	3.41455%
3a	RFS	APXVSP18-C-A20	RRH	850 MHz	CDMA / LTE	20	1	20	13.4	154	148	1/2 "	0.5	0	389.96892	6.40048	1.12883%
Sector total Power Density Value:															4.543%		

Site Composite MPE %	
Carrier	MPE %
Sprint	13.630%
Verizon Wireless	6.220%
AT&T	26.020%
Clearwire	0.780%
T-Mobile	4.800%
Nextel	4.640%
Total Site MPE %	56.090%



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Summary

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

The anticipated Maximum Composite contributions from the Sprint facility are **13.630%** (**4.543% from each sector**) of the allowable FCC established general public limit considering all three sectors simultaneously sampled at the ground level.

The anticipated composite MPE value for this site assuming all carriers present is **56.090%** of the allowable FCC established general public limit sampled at the ground level. This is based upon values listed in the Connecticut Siting Council database for existing carrier emissions

FCC guidelines state that if a site is found to be out of compliance (over allowable thresholds), that carriers over a 5% contribution to the composite value will require measures to bring the site into compliance. For this facility, the composite values calculated were well within the allowable 100% threshold standard per the federal government

Scott Heffernan
RF Engineering Director

EBI Consulting

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Burlington, MA 01803