Robinson+Cole

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Also admitted in Massachusetts

May 28, 2015

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

Re: **Notice of Exempt Modification – Facility Modification**
15 Pent Road, Deep River, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 170-foot level on an existing 178-foot monopole tower at 15 Pent Road in Deep River, Connecticut (the "Property"). The tower is owned by Crown Castle. Cellco's use of the tower was approved by the Council in 2004. Cellco now intends to modify its facility by replacing nine (9) of its existing antennas with three (3) model LNX-6514DS-VTM, 850 MHz antennas; three (3) model HBXX-6517DS-VTM, 1900 MHz antennas; and three (3) model HBXX-6517DS-VTM, 2100 MHz antennas, all at the 170-foot level. Cellco also intends to install six (6) remote radio heads ("RRHs") behind its 1900 MHz and 2100 MHz antennas and one (1) HYBRIFLEX™ antenna cable inside the monopole. Included in Attachment 1 are specifications for Cellco's replacement antennas, RRHs and HYBRIFLEX™ cable.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Deep River's First Selectman, Richard H. Smith. A copy of this letter is also being sent to Robert R. Stalsburg, Jr., Robert R. Stalsburg, Sr. and Grace Stalsburg, the owners of the Property.

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

1. The proposed modifications will not result in an increase in the height of the existing tower. The replacement antennas and RRHs will be installed on Cellco's existing antenna height of 170 feet.

2. The proposed modifications will not involve any change to ground-mounted equipment and, therefore, will not require the extension of the site boundary.

3. The proposed modifications will not increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.

4. The operation of the replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. A cumulative General Power Density table with Cellco's modified facility is included in Attachment 2.

5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.

6. The tower and its foundation can support Cellco's proposed modifications. (*See* Structural Analysis Report dated April 1, 2015, included in Attachment 3).

For the foregoing reasons, Cellco respectfully submits that the proposed modifications to the above-referenced telecommunications facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2).

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
First Selectman Richard H. Smith
Robert R. Stalsburg, Jr., Robert R. Stalsburg, Sr. and Grace Stalsburg
Tim Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6517DS-VTM

Andrew® Quad Port Antenna, 1710–2180 MHz, 65° horizontal beamwidth, RET compatible

- Superior azimuth tracking and pattern symmetry with excellent passive intermodulation suppression

Electrical Specifications

Frequency Band, MHz	1710–1880	1850–1990	1920–2180
Gain, dBi	19.0	19.1	19.2
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	18	18
Front-to-Back Ratio at 180°, dB	30	30	30
CPR at Boresight, dB	21	22	21
CPR at Sector, dB	10	11	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	1710–1880	1850–1990	1920–2180
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4	0 ° | 18.4	0 ° | 18.7
	3 ° | 18.7	3 ° | 18.7	3 ° | 18.9
	6 ° | 18.4	6 ° | 18.5	6 ° | 18.6
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	9

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® quad
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2180 MHz

Product Specifications

HBXX-6517DS-VTM

Performance Note	Outdoor usage

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Low loss circuit board
Radome Material	PVC, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	166.0 mm | 6.5 in
Length	1903.0 mm | 74.9 in
Width	305.0 mm | 12.0 in
Net Weight	19.5 kg | 43.0 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 2.0 Actuator	HBXX-6517DS-A2M
RET System	Teletilt®

Regulatory Compliance/Certifications

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

Included Products

600899A-2 — Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

Product Specifications

COMMSCOPE®

LNX-6514DS-VTM

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

POWERED BY ANDREW.

Electrical Specifications

Frequency Band, MHz	698–806	806–896
Gain, dBi	15.7	16.3
Beamwidth, Horizontal, degrees	65	65
Beamwidth, Vertical, degrees	12.5	11.2
Beam Tilt, degrees	0–10	0–10
USLS, typical, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	20	20
CPR at Sector, dB	10	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896
Beamwidth, Horizontal Tolerance, degrees	±3	±3

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

Mechanical Specifications

Color | Radome Material	Light gray | Fiberglass, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 2
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph
Antenna Dimensions, L x W x D	1847.0 mm x 301.0 mm x 181.0 mm | 72.7 in x 11.9 in x 7.1 in
Net Weight	14.2 kg | 31.3 lb
Model with factory installed AISG 2.0 RET	LNX-6514DS-A1M

PCS RF MODULES

RRH1900 2X60 - HW CHARACTERISTICS

LA6.0.1/13.3

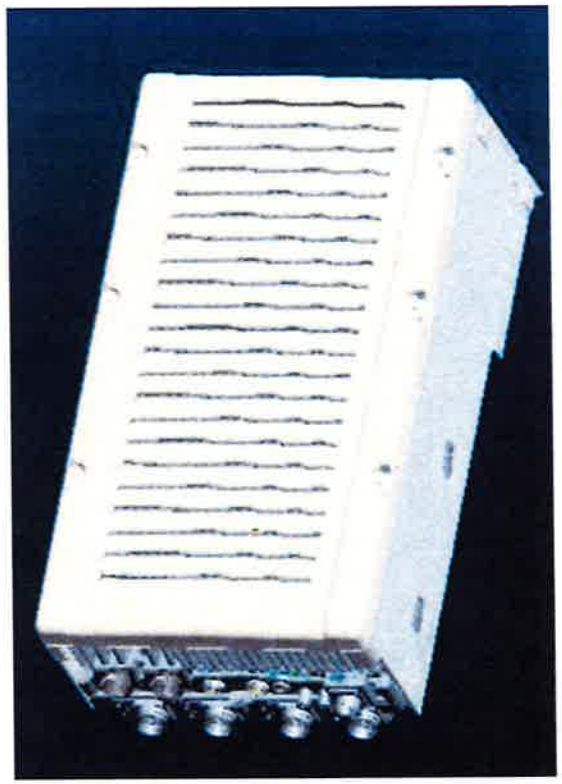
		RRH2x60
RF Output Power		2x60W
Instantaneous Bandwidth		20MHz
Transmitter		2 TX
Receiver	1900 HW version	2 Branch RX – LA6.0.1
	1900A HW version	4 Branch RX – LR13.3
Features		AISG 2.0 for RET/TMA
		Internal Smart Bias-T
Power		-48VDC
CPRI Ports		2 CPRI Rate 3 Ports
External Alarms		4 External User Alarms
Monitor Ports		TX
Environmental		GR487 Compliance
RF Connectors		7/16 DIN (top mounted)

** Not a Verizon Wireless deployed product

NEW PCS RF MODULES FOR VZW
RRH2X60 - HW CHARACTERISTICS

LR14.3

	RRH2x60
RF Output Power	2x60W (4x30W HW Ready)
Instantaneous Bandwidth	60MHz
Target Reliability (Annual Return Rate)	<2%
Receiver	4 Branch Rx
Features	AISG 2.0 for RET/TMA
Power	-48VDC
	Internal Smart Bias-T
CPRI Ports	2 CPRI Rate 5 Ports
External Alarms	4 External User Alarms
Monitor Ports	TX, RX
Environmental	GR487 Compliance
RF Connectors	7/16 DIN (downward facing)
Dimensions	22"(h) x 12"(w)x 9.4" (d)**
Weight	55lb**



**- Includes solar shield but not mounting brackets (8 lbs.)

ALCATEL-LUCENT
WIRELESS PRODUCT DATASHEET
RRH2X60-AWS FOR BAND 4 APPLICATIONS

The Alcatel-Lucent RRH2x60-AWS is a high power, small form factor Remote Radio Head operating in the AWS frequency band (3GPP Band 4) for LTE technology. It is designed with an eco-efficient approach, providing operators with the means to achieve high quality and high capacity coverage with minimum site requirements and efficient operation.

A distributed Node B expands the deployment options by using two components, a Base Band Unit (BBU) containing the digital assets and a separate RRH containing the radio-frequency (RF) elements. This modular design optimizes available space and allows the main components of a Node B to be installed separately, within the same site or several kilometers apart.

The Alcatel-Lucent RRH2x60-AWS is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information.

SUPERIOR RF PERFORMANCE

The Alcatel-Lucent RRH2x60-AWS integrates all the latest technologies. This allows to offer best-in-class characteristics.

It delivers an outstanding 120 watts of total RF power thanks to its two transmit RF paths of 60 W each.

It is ideally suited to support multiple-input multiple-output (MIMO) 2x2 operation.

It includes four RF receivers to natively support 4-way uplink reception diversity. This improves the radio uplink coverage and this can be used to extend the cell radius commensurate with 2x2MIMO 2x60 W for the downlink.

It supports multiple discontinuous LTE carriers within an instantaneous bandwidth of 45 MHz corresponding to the entire AWS B4 spectrum.

The latest generation power amplifiers (PA) used in this product achieve high efficiency (>40%), resulting in improved power consumption figures.

OPTIMIZED TCO

The Alcatel-Lucent RRH2x60-AWS is designed to make available all the benefits of a distributed Node B, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX).

The Alcatel-Lucent RRH2x60-AWS is a very cost-effective solution to deploy LTE MIMO.

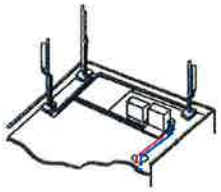
EASY INSTALLATION

The RRH2x60-AWS includes a reversible mounting bracket which allows for ease of installation behind an antenna, or on a rooftop knee wall while providing easy access to the mid body RF connectors.

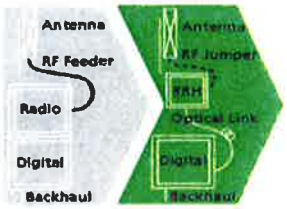
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

The Alcatel-Lucent RRH2x60-AWS is a zero-footprint solution and is convection cooled without fans for silent operation, simplifying negotiations with site property owners and minimizing environmental impacts.

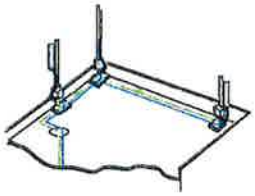
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

FEATURES

- RRH2x60-AWS integrates two power amplifiers of 60W rating (at each antenna connector)
- Support multiple carriers over the entire 3GPP band 4
- RRH2x60-AWS is optimized for LTE operation
- RRH2x60-AWS is a very compact and lightweight product
- Advanced power management techniques are embedded to provide power savings, such as PA bias control

BENEFITS

- MIMO LTE operation with only one single unit per sector
- Improved uplink coverage with built-in 4-way receive diversity capability
- RRH can be mounted close to the antenna, eliminating nearly all losses in RF cables and thus reducing power consumption by 50% compared to conventional solutions
- Distributed configurations provide easily deployable and cost-effective solutions, near zero footprint and silent solutions, with minimum impact on the neighborhood, which ease the deployment
- RETA and TMA support without additional hardware thanks to the AISG v2.0 port and the integrated Bias-Tees. Bias-Tees support AISG DC supply and signaling.

TECHNICAL SPECIFICATIONS

Specifications listed are hardware capabilities. Some capabilities depend on support in a specific software release or future release.

Dimensions and weights

- HxWxD : 510x285x186mm (27 l with solar shield)
- Weight : 20 kg (44 lbs)

Electrical Data

- Power Supply : -48V DC (-40.5 to -57V)
- Power Consumption (ETSI average traffic load reference) : 250W @2x60W

RF Characteristics

- Frequency band: 1710-1755, UL / 2110-2155 MHz, DL (3GPP band 4)
- Output power: 2x60W at antenna connectors
- Technology supported: LTE
- Instantaneous bandwidth: 45 MHz
- Rx diversity: 2-way and 4-way uplink reception
- Typical sensitivity without Rx diversity: -105 dBm for LTE

Connectivity

- Two CPRI optical ports for daisychaining and up to six RRHs per fiber
- Type of optical fiber: Single-Mode (SM) and Multi-Mode (MM) SFPs
- Optical fiber length: up to 500m using MM fiber, up to 20km using SM fiber
- TMA/RETA : AISG 2.0 (RS485 connector and internal Bias-Tee)
- Six external alarms
- Surge protection for all external ports (DC and RF)

Environmental specifications

- Operating temperature: -40°C to 55°C including solar load
- Operating relative humidity: 8% to 100%
- Environmental Conditions : ETS 300 019-1-4 class 4.1E
- Ingress Protection : IEC 60529 IP65
- Acoustic Noise : Noiseless (natural convection cooling)

Safety and Regulatory Data

- EMC : 3GPP 25113, EN 301 489-1, EN 301 489-23, GR 1089, GR 3108, OET-65
- Safety : IEC60950-1, EN 60825-1, UL, ANSI/NFPA 70, CAN/CSA-C22.2
- Regulatory : FCC Part 15 Class B, CE Mark – European Directive : 2002/95/EC (ROHS); 2002/96/EC (WEEE); 1999/5/EC (R&TTE)
- Health : EN 50385

Alcatel·Lucent

AT THE SPEED OF IDEAS™

Product Data Sheet HB158-1-08U8-S8J18

HYBRIFLEX™ RRH Hybrid Feeder Cabling Solution, 1-5/8", Single-Mode Fiber

Product Description

RFS' HYBRIFLEX Remote Radio Head (RRH) hybrid feeder cabling solution combines optical fiber and DC power for RRHs in a single lightweight aluminum corrugated cable, making it the world's most innovative solution for RRH deployments.

It was developed to reduce installation complexity and costs at Cellular sites. HYBRIFLEX allows mobile operators deploying an RRH architecture to standardize the RRH installation process and eliminate the need for and cost of cable grounding. HYBRIFLEX combines optical fiber (multi-mode or single-mode) and power in a single corrugated cable. It eliminates the need for junction boxes and can connect multiple RRHs with a single feeder. Standard RFS CELLFLEX® accessories can be used with HYBRIFLEX cable. Both pre-connectorized and on-site options are available.

Figure 1: HYBRIFLEX Series

Features/Benefits

- Aluminum corrugated armor with outstanding bending characteristics – minimizes installation time and enables mechanical protection and shielding
- Same accessories as 1 5/8" coaxial cable
- Outer conductor grounding – Eliminates typical grounding requirements and saves on installation costs
- Lightweight solution and compact design – Decreases tower loading
- Robust cabling – Eliminates need for expensive cable trays and ducts
- Installation of tight bundled fiber optic cable pairs directly to the RRH – Reduces CAPEX and wind load by eliminating need for interconnection
- Optical fiber and power cables housed in single corrugated cable – Saves CAPEX by standardizing RRH cable installation and reducing installation requirements
- Outdoor polyethylene jacket – Ensures long-lasting cable protection

Technical Specifications

Outer Conductor Armor	Corrugated Aluminum	[mm (in)]	46.5 (1.83)
Jacket	Polyethylene, PE	[mm (in)]	50.3 (1.98)
UV-Protection	Individual and External Jacket		Yes
Weight, Approximate		[kg/m (lb/ft)]	1.9 (1.30)
Minimum Bending Radius, Single Bending		[mm (in)]	200 (8)
Minimum Bending Radius, Repeated Bending		[mm (in)]	500 (20)
Recommended/Maximum Clamp Spacing		[m (ft)]	1.0 / 1.2 (3.25 / 4.0)
DC-Resistance Outer Conductor Armor		[Ω/km (Ω/1000ft)]	068 (0.205)
DC-Resistance Power Cable, 8.4mm² (8AWG)		[Ω/km (Ω/1000ft)]	2.1 (0.307)
Version			Single-mode OM3
Quantity, Fiber Count			16 (8 pairs)
Core/Clad		[µm]	50/125
Primary Coating (Acrylate)		[µm]	245
Buffer Diameter, Nominal		[µm]	900
Secondary Protection, Jacket, Nominal		[mm (in)]	2.0 (0.08)
Minimum Bending Radius		[mm (in)]	104 (4.1)
Insertion Loss @ wavelength 850nm		dB/km	3.0
Insertion Loss @ wavelength 1310nm		dB/km	1.0
Standards (Meets or exceeds)			UL94-V0, UL1666 RoHS Compliant
Size (Power)		[mm² (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm² (AWG)]	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-95-658 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

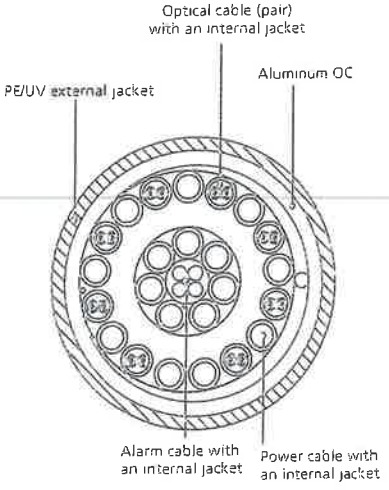


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

	General	Power	Density					
Site Name: Deep River								
Tower Height: 178 Ft.								
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE	Total
T-Mobile PCS/AWS*	6	584	177	0.0402	1900	1.0000	4.02%	
T-Mobile LTE*	1	445	177	0.0051	700	0.4667	1.09%	
AT&T UMTS*	**2**	**565**	**160**	**0.0159**	**880**	**0.5867**	**2.71%**	
AT&T UMTS*	**2**	**875**	**160**	**0.0246**	**1900**	**1.0000**	**2.46%**	
AT&T GSM*	**1**	**283**	**160**	**0.0040**	**880**	**0.5867**	**0.68%**	
AT&T GSM*	**4**	**525**	**160**	**0.0295**	**1900**	**1.0000**	**2.95%**	
AT&T LTE*	**1**	**1771**	**160**	**0.0249**	**734**	**0.4893**	**5.08%**	
Pocket (now MetroPCS)*	**3**	**631**	**150**	**0.0303**	**2130**	**1.0000**	**3.03%**	
Verizon Cellular	**9**	**408**	**112**	**0.1053**	**869**	**0.5793**	**18.17%**	
Verizon PCS	**11**	**447**	**112**	**0.1409**	**1970**	**1.0000**	**14.09%**	
Verizon AWS	**1**	**1750**	**112**	**0.0502**	**2145**	**1.0000**	**5.02%**	
Verizon LTE	**1**	**1050**	**112**	**0.0301**	**746**	**0.4973**	**6.05%**	
* Source: Siting Council								
								65.35%

ATTACHMENT 3

Date: **April 01, 2015**

Charles McGuirt
Crown Castle
3530 Toringdon Way Suite 300
Charlotte, NC 28277

AW Solutions Inc
300 Crown Oak Centre
Longwood, Fl 32750
(407) 260-0231

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Number:	119622
	Carrier Site Name:	Deep River CT
Crown Castle Designation:	**Crown Castle BU Number:**	823666
	Crown Castle Site Name:	Deep River/Rt 9
	Crown Castle JDE Job Number:	281067
	Crown Castle Work Order Number:	774237
	Crown Castle Application Number:	226400 Rev. 8
Engineering Firm Designation:	**AW Solutions Inc Project Number:**	823666
Site Data:	**15 Pent Rd., Deep River, Middlesex County, CT** **Latitude *41° 22' 22.17"*, Longitude *-72° 26' 3.97"*** **178 Foot - Monopole Tower**	

Dear Charles McGuirt,

AW Solutions Inc is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 772821, in accordance with application 226400, revision 8.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC7: Installed + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA/EIA-222-F standard and 2005 CT State Building Code based upon a wind speed of 85 mph fastest mile.

We at *AW Solutions Inc* appreciate the opportunity of providing our continuing professional services to you and Crown Castle. If you have any questions or need further assistance on this or any other projects please give us a call.

Structural analysis prepared by: Arturo Mo[illegible], EP

Respectfully submitted by:

STATE OF CONNECTICUT EMMANUEL POULIN No. 22947 LICENSED PROFESSIONAL ENGINEER

4/2/15

Emmanuel Poulin, PE
VP of Engineering

tnxTower Report - version 6.1.4.1

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 178 ft Monopole tower designed by PIROD MANUFACTURES INC. in August of 2000. The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-F.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 85 mph with no ice, 37.6 mph with 0.75 inch ice thickness and 50 mph under service loads.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
170.0	170.0	3	alcatel lucent	RRH2X60-AWS	1	1-5/8	-
		3	alcatel lucent	RRH2X60-PCS			
		6	commscope	HBXX-6517DS-A2M w/ Mount Pipe			
		3	commscope	LNX-6514DS-A1M w/ Mount Pipe			
		1	rfs celwave	DB-T1-6Z-8AB-0Z			

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
178.0	178.0	1	tower mounts	Platform Mount [LP 405-1]	6	1-5/8	1
		1	tower mounts	Side Arm Mount [SO 310-3]			
	177.0	3	andrew	ETW190VS12UB			
		3	commscope	ATBT-BOTTOM-24V	6	1-5/8	2
		3	commscope	LNX-6515DS-VTM w/ Mount Pipe			
		3	ems wireless	RR90-17-02DP w/ Mount Pipe	-	-	1
170.0	170.0	3	antel	BXA-171085-8BF-EDIN-2 w/ Mount Pipe	-	-	3
		3	antel	BXA-70063/6CF w/ Mount Pipe	12	1-5/8	1
		6	rfs celwave	FD9R6004/2C-3L			
		6	antel	LPA-80080/4CF w/ Mount Pipe	-	-	3
		1	tower mounts	Platform Mount [LP 303-1]	-	-	1

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
160.0	160.0	1	commscope	SBNH-1D6565C w/ Mount Pipe	12	1-5/8	1
		6	ericsson	RRUS 11			
		2	kmw communications	AM-X-CD-17-65-00T-RET w/ Mount Pipe			
		6	powerwave technologies	219nn			
		6	powerwave technologies	7770.00 w/ Mount Pipe			
		6	powerwave technologies	LGP21401			
		1	raycap	DC6-48-60-18-8F			
		1	tower mounts	Platform Mount [LP 303-1]			
150.0	150.0	3	kathrein	742 213 w/ Mount Pipe	6	1-5/8	1
		1	tower mounts	Pipe Mount [PM 602-3]			

Notes:
1) Existing equipment
2) Reserved equipment
3) Equipment To Be Removed

Table 3 - Design Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Dr. Clarence Welti, PE	3585271	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	PIROD	3845247	CCISITES
4-TOWER MANUFACTURER DRAWINGS	PIROD	3585272	CCISITES
4-TOWER STRUCTURAL ANALYSIS REPORTS	Pier Structural Engineering	5310832	CCISITES

3.1) Analysis Method

tnxTower (version 6.1.4.1), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) When applicable, transmission cables are considered as structural components for calculating wind loads as allowed by TIA/EIA-222-F.

This analysis may be affected if any assumptions are not valid or have been made in error. AW Solutions Inc should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	178 - 164.25	Pole	TP26x12.75x0.25	1	-4.27	946.29	14.6	Pass
L2	164.25 - 129.667	Pole	TP34.0625x22.6894x0.3125	2	-10.77	1680.35	58.1	Pass
L3	129.667 - 96	Pole	TP41.75x32.2749x0.375	3	-17.37	2487.22	67.9	Pass
L4	96 - 63.1667	Pole	TP49.0625x39.8209x0.375	4	-25.25	2928.79	78.2	Pass
L5	63.1667 - 31.1667	Pole	TP56.125x46.9571x0.375	5	-34.26	3355.12	84.2	Pass
L6	31.1667 - 0	Pole	TP62.9375x53.847x0.375	6	-46.41	3684.96	92.3	Pass
							Summary	
						Pole (L6)	92.3	Pass
						Rating =	92.3	Pass

Table 6 - Tower Component Stresses vs. Capacity - LC7

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	82.4	Pass
1	Base Foundation	0	83.7	Fail
Structure Rating (max from all components) =				**92.3%**

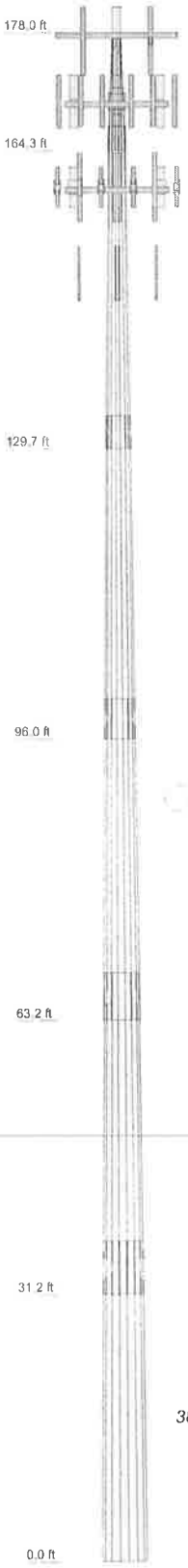
4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the existing, reserved, and proposed loads. No modifications are required at this time.

APPENDIX A

TNXTOWER OUTPUT

Section	6	5	4	3	2	1
Length (ft)	3'7 5-1/32"	3'7 6"	3'7 6"	3'7 6"	3'7 6"	13'9"
Number of Sides	18	18	18	18	18	18
Thickness (in)	0.3750	0.3750	0.3750	0.3750	0.3125	0.2500
Socket Length (ft)		6'3"	5'6"	4'8-1/32"	3'9-31/32"	2'11-1/32"
Top Dia (in)	53.8470	46.9571	39.8209	32.2749	22.6894	12.7500
Bot Dia (in)	62.9375	56.1250	49.0625	41.7500	34.0625	26.0000
Grade			A572-65			
Weight (K)	8.8	7.8	5.7	5.6	3.6	0.7



AXIAL
64 K

SHEAR
8 K

MOMENT
1098 kip-ft

TORQUE 0 kip-ft
38 mph WIND - 0.7500 in ICE

AXIAL
46 K

SHEAR
34 K

MOMENT
4321 kip-ft

TORQUE 0 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Platform Mount [LP 405-1]	178	LNX-6514DS-A1M w/ Mount Pipe	170
Side Arm Mount [SO 310-3]	178	RRH2X60-AWS	170
ETW190VS12UB	178	RRH2X60-PCS	170
RR90-17-02DP w/ Mount Pipe	178	(2) HBXX-6517DS-A2M w/ Mount Pipe	170
ETW190VS12UB	178	LNX-6514DS-A1M w/ Mount Pipe	170
RR90-17-02DP w/ Mount Pipe	178	Platform Mount [LP 303-1]	160
ETW190VS12UB	178	(2) RRUS 11	160
RR90-17-02DP w/ Mount Pipe	178	AM-X-CD-17-65-00T-RET w/ Mount Pipe	160
ATBT-BOTTOM-24V	178	(2) 219nn	160
LNX-6515DS-VTM w/ Mount Pipe	178	(2) 7770.00 w/ Mount Pipe	160
ATBT-BOTTOM-24V	178	(2) LGP21401	160
LNX-6515DS-VTM w/ Mount Pipe	178	(2) RRUS 11	160
ATBT-BOTTOM-24V	178	AM-X-CD-17-65-00T-RET w/ Mount Pipe	160
LNX-6515DS-VTM w/ Mount Pipe	178	(2) 219nn	160
Platform Mount [LP 303-1]	170	(2) 7770.00 w/ Mount Pipe	160
BXA-70063/6CF w/ Mount Pipe	170	(2) LGP21401	160
(2) FD9R6004/2C-3L	170	SBNH-1D6565C w/ Mount Pipe	160
BXA-70063/6CF w/ Mount Pipe	170	(2) RRUS 11	160
(2) FD9R6004/2C-3L	170	(2) 219nn	160
BXA-70063/6CF w/ Mount Pipe	170	(2) 7770.00 w/ Mount Pipe	160
(2) FD9R6004/2C-3L	170	(2) LGP21401	160
RRH2X60-AWS	170	DC6-48-60-18-8F	160
RRH2X60-PCS	170	Pipe Mount [PM 602-3]	150
(2) HBXX-6517DS-A2M w/ Mount Pipe	170	742 213 w/ Mount Pipe	150
LNX-6514DS-A1M w/ Mount Pipe	170	742 213 w/ Mount Pipe	150
DB-T1-6Z-8AB-0Z	170	742 213 w/ Mount Pipe	150
RRH2X60-AWS	170		
RRH2X60-PCS	170		
(2) HBXX-6517DS-A2M w/ Mount Pipe	170		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Middlesex County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 92.3%

AW Solutions Inc
300 Crown Oak Centre
Longwood, Fl 32750
AW Solutions
Phone: (407) 260-0231
FAX: (407) 260-0749

Job: BU 823666			
Project: WO 774237			
Client: Crown Castle	Drawn by: arturo.modesto		App'd:
Code: TIA/EIA-222-F	Date: 04/01/15		Scale: NTS
Path:			Dwg No. E-1

Tower Input Data

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

4) Tower is located in Middlesex County, Connecticut.
5) Basic wind speed of 85 mph.
6) Nominal ice thickness of 0.7500 in.
7) Ice thickness is considered to increase with height.
8) Ice density of 56 pcf.
9) A wind speed of 38 mph is used in combination with ice.
10) Temperature drop of 50 °F.
11) Deflections calculated using a wind speed of 50 mph.
12) A non-linear (P-delta) analysis was used.
13) Pressures are calculated at each section.
14) Stress ratio used in pole design is 1.333.
15) Local bending stresses due to climbing loads, feed line 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	Use TIA-222-G Tension Splice	
	Capacity Exemption	

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	178'-164'3"	13'9"	2'11-1/32"	18	12.7500	26.0000	0.2500	1.0000	A572-65 (65 ksi)
L2	164'3"-129'8-1/32"	37'6"	3'9-31/32"	18	22.6894	34.0625	0.3125	1.2500	A572-65 (65 ksi)
L3	129'8-1/32"-96'	37'6"	4'8-1/32"	18	32.2749	41.7500	0.3750	1.5000	A572-65 (65 ksi)
L4	96'-63'2-1/32"	37'6"	5'6"	18	39.8209	49.0625	0.3750	1.5000	A572-65 (65 ksi)
L5	63'2-1/32"-31'2-1/32"	37'6"	6'3"	18	46.9571	56.1250	0.3750	1.5000	A572-65 (65 ksi)
L6	31'2-1/32"-0'	37'5-1/32"		18	53.8470	62.9375	0.3750	1.5000	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	12.9467	9.9187	195.8008	4.4375	6.4770	30.2302	391.8592	4.9603	1.8040	7.216
	26.4011	20.4326	1711.6544	9.1412	13.2080	129.5922	3425.5610	10.2183	4.1360	16.544
L2	23.9376	22.1951	1404.0863	7.9438	11.5262	121.8168	2810.0202	11.0996	3.4433	11.019
	34.5880	33.4758	4817.4335	11.9812	17.3038	278.4040	9641.2058	16.7411	5.4450	17.424
L3	33.7563	37.9689	4881.3984	11.3245	16.3957	297.7251	9769.2200	18.9880	5.0204	13.388
	42.3941	49.2466	10650.9822	14.6881	21.2090	502.1916	21315.9793	24.6280	6.6880	17.835
L4	41.6030	46.9505	9229.5499	14.0033	20.2290	456.2533	18471.2443	23.4797	6.3485	16.929
	49.8194	57.9503	17355.1378	17.2841	24.9238	696.3293	34733.1119	28.9807	7.9750	21.267
L5	49.0468	55.4443	15199.5863	16.5366	23.8542	637.1873	30419.1726	27.7274	7.6044	20.279
	56.9908	66.3564	26056.1506	19.7913	28.5115	913.8821	52146.5865	33.1845	9.2180	24.581
L6	56.2196	63.6451	22990.8574	18.9826	27.3543	840.4848	46011.9669	31.8286	8.8171	23.512
	63.9084	74.4650	36822.8946	22.2097	31.9722	1151.7142	73694.2417	37.2396	10.4170	27.779

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 178'-164'3"				1	1	1		
L2 164'3"-129'8-1/32"				1	1	1		
L3 129'8-1/32"-96'				1	1	1		
L4 96'-63'2-1/32"				1	1	1		
L5 63'2-1/32"-31'2-1/32"				1	1	1		
L6 31'2-1/32"-0'				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
Safety Line 5/8	C	No	CaAa (Out Of Face)	178' - 0'	1	No Ice	0.09	0.40
						1/2" Ice	0.19	1.24
						1" Ice	0.29	2.70
						2" Ice	0.49	7.44
						4" Ice	0.89	24.25
a LDF7-50A(1-5/8")	A	No	Inside Pole	160' - 0'	12	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
						4" Ice	0.00	0.82
b LDF7-50A(1-5/8")	B	No	CaAa (Out Of Face)	170' - 0'	1	No Ice	0.20	0.82
						1/2" Ice	0.30	2.33
						1" Ice	0.40	4.46
						2" Ice	0.60	10.54
						4" Ice	1.00	30.04
LDF7-50A(1-5/8")	B	No	CaAa (Out Of Face)	170' - 0'	4	No Ice	0.00	0.82
						1/2" Ice	0.00	2.33

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
						1" Ice	0.00	4.46
						2" Ice	0.00	10.54
						4" Ice	0.00	30.04
LDF7-50A(1-5/8")	B	No	Inside Pole	170' - 0'	7	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
						4" Ice	0.00	0.82
HB158-1-08U8-S8J18(1-5/8)	B	No	Inside Pole	170' - 0'	1	No Ice	0.00	1.30
						1/2" Ice	0.00	1.30
						1" Ice	0.00	1.30
						2" Ice	0.00	1.30
						4" Ice	0.00	1.30
LDF7-50A(1-5/8")	B	No	Inside Pole	150' - 0'	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
						4" Ice	0.00	0.82
C LDF7-50A(1-5/8")	C	No	Inside Pole	178' - 0'	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
						4" Ice	0.00	0.82
AVA7-50(1-5/8)	C	No	Inside Pole	178' - 0'	6	No Ice	0.00	0.70
						1/2" Ice	0.00	0.70
						1" Ice	0.00	0.70
						2" Ice	0.00	0.70
						4" Ice	0.00	0.70

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	178'-164'3"	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	1.139	0.06
		C	0.000	0.000	0.000	1.210	0.13
L2	164'3"-129'8-1/32"	A	0.000	0.000	0.000	0.000	0.30
		B	0.000	0.000	0.000	6.847	0.49
		C	0.000	0.000	0.000	3.043	0.33
L3	129'8-1/32"-96'	A	0.000	0.000	0.000	0.000	0.33
		B	0.000	0.000	0.000	6.666	0.54
		C	0.000	0.000	0.000	2.963	0.32
L4	96'-63'2-1/32"	A	0.000	0.000	0.000	0.000	0.32
		B	0.000	0.000	0.000	6.501	0.53
		C	0.000	0.000	0.000	2.889	0.31
L5	63'2-1/32"-31'2-1/32"	A	0.000	0.000	0.000	0.000	0.31
		B	0.000	0.000	0.000	6.336	0.51
		C	0.000	0.000	0.000	2.816	0.30
L6	31'2-1/32"-0'	A	0.000	0.000	0.000	0.000	0.31
		B	0.000	0.000	0.000	6.171	0.50
		C	0.000	0.000	0.000	2.743	0.30

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	178'-164'3"	A	0.913	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	2.189	0.16
		C		0.000	0.000	0.000	3.721	0.16
L2	164'3"-129'8-	A	0.897	0.000	0.000	0.000	0.000	0.30

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
	1/32"	B		0.000	0.000	0.000	13.164	1.05
		C		0.000	0.000	0.000	9.360	0.40
L3	129'8-1/32"-96'	A	0.869	0.000	0.000	0.000	0.000	0.33
		B		0.000	0.000	0.000	12.703	1.08
		C		0.000	0.000	0.000	9.000	0.39
L4	96'-63'2-1/32"	A	0.833	0.000	0.000	0.000	0.000	0.32
		B		0.000	0.000	0.000	12.206	1.03
		C		0.000	0.000	0.000	8.594	0.38
L5	63'2-1/32"-31'2-1/32"	A	0.783	0.000	0.000	0.000	0.000	0.31
		B		0.000	0.000	0.000	11.669	0.98
		C		0.000	0.000	0.000	8.149	0.36
L6	31'2-1/32"-0'	A	0.750	0.000	0.000	0.000	0.000	0.31
		B		0.000	0.000	0.000	11.051	0.92
		C		0.000	0.000	0.000	7.622	0.35

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	178'-164'3"	0.0132	0.1270	-0.0762	0.2544
L2	164'3"-129'8-1/32"	0.1277	0.1917	0.1071	0.3660
L3	129'8-1/32"-96'	0.1309	0.1965	0.1139	0.3855
L4	96'-63'2-1/32"	0.1328	0.1993	0.1183	0.3935
L5	63'2-1/32"-31'2-1/32"	0.1341	0.2013	0.1217	0.3956
L6	31'2-1/32"-0'	0.1351	0.2027	0.1245	0.3914

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Platform Mount [LP 405-1]	C	None		0.0000	178'	No Ice	20.80	20.80	1.80
						1/2" Ice	28.10	28.10	2.07
						1" Ice	35.40	35.40	2.33
						2" Ice	50.00	50.00	2.86
						4" Ice	79.20	79.20	3.93
Side Arm Mount [SO 310-3]	C	None		0.0000	178'	No Ice	6.70	6.70	0.17
						1/2" Ice	10.11	10.11	0.25
						1" Ice	13.52	13.52	0.34
						2" Ice	20.34	20.34	0.51
						4" Ice	33.98	33.98	0.85
Platform Mount [LP 303-1]	C	None		0.0000	170'	No Ice	14.66	14.66	1.25
						1/2" Ice	18.87	18.87	1.48
						1" Ice	23.08	23.08	1.71
						2" Ice	31.50	31.50	2.18
						4" Ice	48.34	48.34	3.10
Platform Mount [LP 303-1]	C	None		0.0000	160'	No Ice	14.66	14.66	1.25
						1/2" Ice	18.87	18.87	1.48
						1" Ice	23.08	23.08	1.71
						2" Ice	31.50	31.50	2.18
						4" Ice	48.34	48.34	3.10

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Pipe Mount [PM 602-3]	C	None		0.0000	150'	No Ice	7.68	7.68	0.28
						1/2" Ice	9.50	9.50	0.35
						1" Ice	11.32	11.32	0.43
						2" Ice	14.96	14.96	0.58
						4" Ice	22.24	22.24	0.87
178									
a									
ETW190VS12UB	A	From Leg	4.00 0' -1'	0.0000	178'	No Ice	0.66	0.37	0.01
						1/2" Ice	0.78	0.46	0.02
						1" Ice	0.90	0.56	0.03
						2" Ice	1.17	0.80	0.04
						4" Ice	1.82	1.36	0.11
RR90-17-02DP w/ Mount Pipe	A	From Leg	4.00 0' -1'	0.0000	178'	No Ice	4.59	3.32	0.03
						1/2" Ice	5.09	4.09	0.07
						1" Ice	5.58	4.78	0.12
						2" Ice	6.59	6.23	0.22
						4" Ice	8.73	9.31	0.56
b									
ETW190VS12UB	B	From Leg	4.00 0' -1'	0.0000	178'	No Ice	0.66	0.37	0.01
						1/2" Ice	0.78	0.46	0.02
						1" Ice	0.90	0.56	0.03
						2" Ice	1.17	0.80	0.04
						4" Ice	1.82	1.36	0.11
RR90-17-02DP w/ Mount Pipe	B	From Leg	4.00 0' -1'	0.0000	178'	No Ice	4.59	3.32	0.03
						1/2" Ice	5.09	4.09	0.07
						1" Ice	5.58	4.78	0.12
						2" Ice	6.59	6.23	0.22
						4" Ice	8.73	9.31	0.56
c									
ETW190VS12UB	C	From Leg	4.00 0' -1'	0.0000	178'	No Ice	0.66	0.37	0.01
						1/2" Ice	0.78	0.46	0.02
						1" Ice	0.90	0.56	0.03
						2" Ice	1.17	0.80	0.04
						4" Ice	1.82	1.36	0.11
RR90-17-02DP w/ Mount Pipe	C	From Leg	4.00 0' -1'	0.0000	178'	No Ice	4.59	3.32	0.03
						1/2" Ice	5.09	4.09	0.07
						1" Ice	5.58	4.78	0.12
						2" Ice	6.59	6.23	0.22
						4" Ice	8.73	9.31	0.56
p									
a									
ATBT-BOTTOM-24V	A	From Leg	4.00 0' -1'	0.0000	178'	No Ice	0.12	0.08	0.00
						1/2" Ice	0.17	0.12	0.00
						1" Ice	0.23	0.17	0.01
						2" Ice	0.38	0.30	0.01
						4" Ice	0.77	0.67	0.04
LNX-6515DS-VTM w/ Mount Pipe	A	From Leg	4.00 0' -1'	0.0000	178'	No Ice	11.68	9.84	0.08
						1/2" Ice	12.40	11.37	0.17
						1" Ice	13.14	12.91	0.27
						2" Ice	14.60	15.27	0.51
						4" Ice	17.87	20.14	1.15
b									
ATBT-BOTTOM-24V	B	From Leg	4.00 0' -1'	0.0000	178'	No Ice	0.12	0.08	0.00
						1/2" Ice	0.17	0.12	0.00
						1" Ice	0.23	0.17	0.01
							0.38	0.30	0.01

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						2" Ice	0.77	0.67	0.04
						4" Ice			
LNX-6515DS-VTM w/ Mount Pipe	B	From Leg	4.00 0' -1'	0.0000	178'	No Ice	11.68	9.84	0.08
						1/2" Ice	12.40	11.37	0.17
						1" Ice	13.14	12.91	0.27
						2" Ice	14.60	15.27	0.51
						4" Ice	17.87	20.14	1.15
c ATBT-BOTTOM-24V	C	From Leg	4.00 0' -1'	0.0000	178'	No Ice	0.12	0.08	0.00
						1/2" Ice	0.17	0.12	0.00
						1" Ice	0.23	0.17	0.01
						2" Ice	0.38	0.30	0.01
						4" Ice	0.77	0.67	0.04
LNX-6515DS-VTM w/ Mount Pipe	C	From Leg	4.00 0' -1'	0.0000	178'	No Ice	11.68	9.84	0.08
						1/2" Ice	12.40	11.37	0.17
						1" Ice	13.14	12.91	0.27
						2" Ice	14.60	15.27	0.51
						4" Ice	17.87	20.14	1.15
170 BXA-70063/6CF w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	170'	No Ice	7.98	5.41	0.04
						1/2" Ice	8.62	6.56	0.10
						1" Ice	9.23	7.42	0.17
						2" Ice	10.47	9.20	0.33
						4" Ice	13.08	12.95	0.79
(2) FD9R6004/2C-3L	A	From Leg	4.00 0' 0'	0.0000	170'	No Ice	0.37	0.08	0.00
						1/2" Ice	0.45	0.14	0.01
						1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
* BXA-70063/6CF w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	170'	No Ice	7.98	5.41	0.04
						1/2" Ice	8.62	6.56	0.10
						1" Ice	9.23	7.42	0.17
						2" Ice	10.47	9.20	0.33
						4" Ice	13.08	12.95	0.79
(2) FD9R6004/2C-3L	B	From Leg	4.00 0' 0'	0.0000	170'	No Ice	0.37	0.08	0.00
						1/2" Ice	0.45	0.14	0.01
						1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
* BXA-70063/6CF w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	170'	No Ice	7.98	5.41	0.04
						1/2" Ice	8.62	6.56	0.10
						1" Ice	9.23	7.42	0.17
						2" Ice	10.47	9.20	0.33
						4" Ice	13.08	12.95	0.79
(2) FD9R6004/2C-3L	C	From Leg	4.00 0' 0'	0.0000	170'	No Ice	0.37	0.08	0.00
						1/2" Ice	0.45	0.14	0.01
						1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
p *a* RRH2X60-AWS	A	From Leg	4.00 0' 0'	0.0000	170'	No Ice	3.96	1.82	0.06
						1/2" Ice	4.27	2.08	0.08
							4.60	2.36	0.11

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						1" Ice	5.27	2.96	0.17
						2" Ice	6.72	4.25	0.35
						4" Ice			
RRH2X60-PCS	A	From Leg	4.00 0' 0'	0.0000	170'	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
(2) HBXX-6517DS-A2M w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	170'	No Ice	8.98	6.96	0.07
						1/2" Ice	9.65	8.18	0.14
						1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
LNX-6514DS-A1M w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	170'	No Ice	8.65	7.08	0.06
						1/2" Ice	9.31	8.27	0.13
						1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
DB-T1-6Z-8AB-0Z	A	From Leg	4.00 0' 0'	0.0000	170'	No Ice	5.60	2.33	0.04
						1/2" Ice	5.92	2.56	0.08
						1" Ice	6.24	2.79	0.12
						2" Ice	6.91	3.28	0.21
						4" Ice	8.37	4.37	0.45
b RRH2X60-AWS	B	From Leg	4.00 0' 0'	0.0000	170'	No Ice	3.96	1.82	0.06
						1/2" Ice	4.27	2.08	0.08
						1" Ice	4.60	2.36	0.11
						2" Ice	5.27	2.96	0.17
						4" Ice	6.72	4.25	0.35
RRH2X60-PCS	B	From Leg	4.00 0' 0'	0.0000	170'	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
(2) HBXX-6517DS-A2M w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	170'	No Ice	8.98	6.96	0.07
						1/2" Ice	9.65	8.18	0.14
						1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
LNX-6514DS-A1M w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	170'	No Ice	8.65	7.08	0.06
						1/2" Ice	9.31	8.27	0.13
						1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
c RRH2X60-AWS	C	From Leg	4.00 0' 0'	0.0000	170'	No Ice	3.96	1.82	0.06
						1/2" Ice	4.27	2.08	0.08
						1" Ice	4.60	2.36	0.11
						2" Ice	5.27	2.96	0.17
						4" Ice	6.72	4.25	0.35
RRH2X60-PCS	C	From Leg	4.00 0' 0'	0.0000	170'	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(2) HBXX-6517DS-A2M w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	170'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	8.98 9.65 10.29 11.59 14.32	6.96 8.18 9.14 11.02 15.03	0.07 0.14 0.21 0.40 0.91
LNX-6514DS-A1M w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	170'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	8.65 9.31 9.93 11.20 13.87	7.08 8.27 9.18 11.02 15.06	0.06 0.13 0.21 0.39 0.90
160 (2) RRUS 11	A	From Leg	4.00 0' 0'	0.0000	160'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.25 3.49 3.74 4.27 5.43	1.37 1.55 1.74 2.14 3.04	0.05 0.07 0.10 0.15 0.31
AM-X-CD-17-65-00T-RET w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	160'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.55 12.27 13.00 14.45 17.71	8.94 10.45 11.99 14.31 19.14	0.09 0.18 0.27 0.50 1.12
(2) 219nn	A	From Leg	4.00 0' 0'	0.0000	160'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.27 0.34 0.43 0.62 1.10	0.18 0.25 0.32 0.49 0.94	0.01 0.01 0.01 0.02 0.07
(2) 7770.00 w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	160'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.35 6.95 7.51 8.65 11.06	4.43 5.37 6.12 7.66 11.10	0.06 0.11 0.17 0.30 0.70
(2) LGP21401	A	From Leg	4.00 0' 0'	0.0000	160'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.29 1.45 1.61 1.97 2.79	0.23 0.31 0.40 0.61 1.12	0.01 0.02 0.03 0.05 0.14
b (2) RRUS 11	B	From Leg	4.00 0' 0'	0.0000	160'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.25 3.49 3.74 4.27 5.43	1.37 1.55 1.74 2.14 3.04	0.05 0.07 0.10 0.15 0.31
AM-X-CD-17-65-00T-RET w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	160'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.55 12.27 13.00 14.45 17.71	8.94 10.45 11.99 14.31 19.14	0.09 0.18 0.27 0.50 1.12
(2) 219nn	B	From Leg	4.00 0' 0'	0.0000	160'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.27 0.34 0.43 0.62 1.10	0.18 0.25 0.32 0.49 0.94	0.01 0.01 0.01 0.02 0.07
(2) 7770.00 w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	160'	No Ice 1/2" Ice	6.35 6.95 7.51	4.43 5.37 6.12	0.06 0.11 0.17

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						1" Ice	8.65	7.66	0.30
						2" Ice	11.06	11.10	0.70
						4" Ice			
(2) LGP21401	B	From Leg	4.00 0' 0'	0.0000	160'	No Ice	1.29	0.23	0.01
						1/2" Ice	1.45	0.31	0.02
						1" Ice	1.61	0.40	0.03
						2" Ice	1.97	0.61	0.05
						4" Ice	2.79	1.12	0.14
c SBNH-1D6565C w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	160'	No Ice	11.68	9.84	0.09
						1/2" Ice	12.40	11.37	0.18
						1" Ice	13.14	12.91	0.28
						2" Ice	14.60	15.27	0.52
						4" Ice	17.87	20.14	1.16
(2) RRUS 11	C	From Leg	4.00 0' 0'	0.0000	160'	No Ice	3.25	1.37	0.05
						1/2" Ice	3.49	1.55	0.07
						1" Ice	3.74	1.74	0.10
						2" Ice	4.27	2.14	0.15
						4" Ice	5.43	3.04	0.31
(2) 219nn	C	From Leg	4.00 0' 0'	0.0000	160'	No Ice	0.27	0.18	0.01
						1/2" Ice	0.34	0.25	0.01
						1" Ice	0.43	0.32	0.01
						2" Ice	0.62	0.49	0.02
						4" Ice	1.10	0.94	0.07
(2) 7770.00 w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	160'	No Ice	6.35	4.43	0.06
						1/2" Ice	6.95	5.37	0.11
						1" Ice	7.51	6.12	0.17
						2" Ice	8.65	7.66	0.30
						4" Ice	11.06	11.10	0.70
(2) LGP21401	C	From Leg	4.00 0' 0'	0.0000	160'	No Ice	1.29	0.23	0.01
						1/2" Ice	1.45	0.31	0.02
						1" Ice	1.61	0.40	0.03
						2" Ice	1.97	0.61	0.05
						4" Ice	2.79	1.12	0.14
DC6-48-60-18-8F	C	From Leg	4.00 0' 0'	0.0000	160'	No Ice	1.27	1.27	0.02
						1/2" Ice	1.46	1.46	0.04
						1" Ice	1.66	1.66	0.05
						2" Ice	2.09	2.09	0.10
						4" Ice	3.10	3.10	0.21
150 742 213 w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	150'	No Ice	5.37	4.62	0.05
						1/2" Ice	5.95	6.00	0.09
						1" Ice	6.50	6.98	0.15
						2" Ice	7.61	8.85	0.28
						4" Ice	9.93	12.79	0.68
742 213 w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	150'	No Ice	5.37	4.62	0.05
						1/2" Ice	5.95	6.00	0.09
						1" Ice	6.50	6.98	0.15
						2" Ice	7.61	8.85	0.28
						4" Ice	9.93	12.79	0.68
742 213 w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	150'	No Ice	5.37	4.62	0.05
						1/2" Ice	5.95	6.00	0.09
						1" Ice	6.50	6.98	0.15
						2" Ice	7.61	8.85	0.28
						4" Ice	9.93	12.79	0.68

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
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	178 - 164.25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-9.51	-0.06	0.49
			Max. Mx	5	-4.30	-61.94	0.13
			Max. My	2	-4.27	-0.01	62.60
			Max. Vy	5	11.08	-61.94	0.13
			Max. Vx	2	-11.24	-0.01	62.60
			Max. Torque	11			-0.55
L2	164.25 - 129.667	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-20.66	-0.39	-0.09
			Max. Mx	5	-10.80	-638.91	-0.42
			Max. My	2	-10.77	0.38	645.57
			Max. Vy	5	20.41	-638.91	-0.42
			Max. Vx	8	20.60	-0.53	-645.48
			Max. Torque	11			-0.55

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L3	129.667 - 96	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-29.10	-1.16	-0.66
			Max. Mx	5	-17.39	-1366.12	-1.09
			Max. My	8	-17.37	-1.25	-1378.90
			Max. Vy	5	23.89	-1366.12	-1.09
			Max. Vx	8	24.08	-1.25	-1378.90
			Max. Torque	3			0.48
L4	96 - 63.1667	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-38.89	-2.04	-1.30
			Max. Mx	5	-25.27	-2186.10	-1.78
			Max. My	8	-25.25	-1.98	-2204.91
			Max. Vy	5	27.30	-2186.10	-1.78
			Max. Vx	8	27.49	-1.98	-2204.91
			Max. Torque	3			0.42
L5	63.1667 - 31.1667	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-49.82	-2.99	-2.00
			Max. Mx	5	-34.27	-3089.13	-2.46
			Max. My	8	-34.26	-2.73	-3113.80
			Max. Vy	5	30.37	-3089.13	-2.46
			Max. Vx	8	30.56	-2.73	-3113.80
			Max. Torque	3			0.36
L6	31.1667 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-64.31	-4.23	-2.90
			Max. Mx	5	-46.41	-4289.07	-3.29
			Max. My	8	-46.41	-3.65	-4320.59
			Max. Vy	5	33.72	-4289.07	-3.29
			Max. Vx	8	33.90	-3.65	-4320.59
			Max. Torque	2			0.31

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	21	64.31	-0.00	-8.18
	Max. H_x	11	46.43	33.69	0.02
	Max. H_z	2	46.43	0.02	33.88
	Max. M_x	2	4319.46	0.02	33.88
	Max. M_z	5	4289.07	-33.69	-0.02
	Max. Torsion	2	0.27	0.02	33.88
	Min. Vert	1	46.43	0.00	0.00
	Min. H_x	5	46.43	-33.69	-0.02
	Min. H_z	8	46.43	-0.02	-33.88
	Min. M_x	8	-4320.59	-0.02	-33.88
	Min. M_z	11	-4287.23	33.69	0.02
	Min. Torsion	8	-0.27	-0.02	-33.88

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	46.43	0.00	0.00	0.55	-0.90	0.00
Dead+Wind 0 deg - No Ice	46.43	-0.02	-33.88	-4319.46	1.79	-0.27
Dead+Wind 30 deg - No Ice	46.43	16.83	-29.33	-3739.37	-2142.62	-0.23
Dead+Wind 60 deg - No Ice	46.43	29.17	-16.92	-2157.14	-3713.20	-0.14
Dead+Wind 90 deg - No Ice	46.43	33.69	0.02	3.29	-4289.07	-0.00
Dead+Wind 120 deg - No Ice	46.43	29.19	16.95	2162.97	-3715.91	0.13
Dead+Wind 150 deg - No Ice	46.43	16.86	29.35	3743.20	-2147.32	0.23
Dead+Wind 180 deg - No Ice	46.43	0.02	33.88	4320.59	-3.65	0.27

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead+Wind 210 deg - No Ice	46.43	-16.83	29.33	3740.50	2140.76	0.23
Dead+Wind 240 deg - No Ice	46.43	-29.17	16.92	2158.28	3711.35	0.13
Dead+Wind 270 deg - No Ice	46.43	-33.69	-0.02	-2.15	4287.23	0.00
Dead+Wind 300 deg - No Ice	46.43	-29.19	-16.95	-2161.85	3714.06	-0.13
Dead+Wind 330 deg - No Ice	46.43	-16.86	-29.35	-3742.08	2145.46	-0.23
Dead+Ice+Temp	64.31	0.00	0.00	2.90	-4.23	0.00
Dead+Wind 0 deg+Ice+Temp	64.31	-0.00	-8.18	-1091.57	-3.91	-0.07
Dead+Wind 30 deg+Ice+Temp	64.31	4.07	-7.08	-944.64	-547.92	-0.03
Dead+Wind 60 deg+Ice+Temp	64.31	7.05	-4.09	-543.78	-946.32	0.02
Dead+Wind 90 deg+Ice+Temp	64.31	8.14	0.00	3.60	-1092.35	0.06
Dead+Wind 120 deg+Ice+Temp	64.31	7.05	4.09	550.84	-946.88	0.09
Dead+Wind 150 deg+Ice+Temp	64.31	4.07	7.08	951.29	-548.89	0.09
Dead+Wind 180 deg+Ice+Temp	64.31	0.00	8.18	1097.66	-5.02	0.07
Dead+Wind 210 deg+Ice+Temp	64.31	-4.07	7.08	950.74	538.99	0.03
Dead+Wind 240 deg+Ice+Temp	64.31	-7.05	4.09	549.87	937.39	-0.02
Dead+Wind 270 deg+Ice+Temp	64.31	-8.14	-0.00	2.49	1083.42	-0.06
Dead+Wind 300 deg+Ice+Temp	64.31	-7.05	-4.09	-544.75	937.95	-0.09
Dead+Wind 330 deg+Ice+Temp	64.31	-4.07	-7.08	-945.20	539.96	-0.09
Dead+Wind 0 deg - Service	46.43	-0.01	-11.72	-1496.30	0.02	-0.09
Dead+Wind 30 deg - Service	46.43	5.82	-10.15	-1295.29	-743.00	-0.08
Dead+Wind 60 deg - Service	46.43	10.09	-5.86	-747.06	-1287.18	-0.05
Dead+Wind 90 deg - Service	46.43	11.66	0.01	1.51	-1486.71	-0.00
Dead+Wind 120 deg - Service	46.43	10.10	5.87	749.82	-1288.12	0.05
Dead+Wind 150 deg - Service	46.43	5.83	10.15	1297.36	-744.63	0.08
Dead+Wind 180 deg - Service	46.43	0.01	11.72	1497.43	-1.87	0.09
Dead+Wind 210 deg - Service	46.43	-5.82	10.15	1296.42	741.15	0.08
Dead+Wind 240 deg - Service	46.43	-10.09	5.86	748.18	1285.33	0.05
Dead+Wind 270 deg - Service	46.43	-11.66	-0.01	-0.38	1484.86	0.00
Dead+Wind 300 deg - Service	46.43	-10.10	-5.87	-748.69	1286.27	-0.05
Dead+Wind 330 deg - Service	46.43	-5.83	-10.15	-1296.23	742.78	-0.08

Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.00	-46.43	0.00	0.00	46.43	0.00	0.000%
2	-0.02	-46.43	-33.88	0.02	46.43	33.88	0.000%
3	16.83	-46.43	-29.33	-16.83	46.43	29.33	0.000%
4	29.17	-46.43	-16.92	-29.17	46.43	16.92	0.000%
5	33.69	-46.43	0.02	-33.69	46.43	-0.02	0.000%
6	29.19	-46.43	16.95	-29.19	46.43	-16.95	0.000%
7	16.86	-46.43	29.35	-16.86	46.43	-29.35	0.000%
8	0.02	-46.43	33.88	-0.02	46.43	-33.88	0.000%
9	-16.83	-46.43	29.33	16.83	46.43	-29.33	0.000%
10	-29.17	-46.43	16.92	29.17	46.43	-16.92	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
11	-33.69	-46.43	-0.02	33.69	46.43	0.02	0.000%
12	-29.19	-46.43	-16.95	29.19	46.43	16.95	0.000%
13	-16.86	-46.43	-29.35	16.86	46.43	29.35	0.000%
14	0.00	-64.31	0.00	0.00	64.31	0.00	0.000%
15	-0.00	-64.31	-8.18	0.00	64.31	8.18	0.000%
16	4.07	-64.31	-7.08	-4.07	64.31	7.08	0.000%
17	7.05	-64.31	-4.09	-7.05	64.31	4.09	0.000%
18	8.14	-64.31	0.00	-8.14	64.31	-0.00	0.000%
19	7.05	-64.31	4.09	-7.05	64.31	-4.09	0.000%
20	4.07	-64.31	7.08	-4.07	64.31	-7.08	0.000%
21	0.00	-64.31	8.18	-0.00	64.31	-8.18	0.000%
22	-4.07	-64.31	7.08	4.07	64.31	-7.08	0.000%
23	-7.05	-64.31	4.09	7.05	64.31	-4.09	0.000%
24	-8.14	-64.31	-0.00	8.14	64.31	0.00	0.000%
25	-7.05	-64.31	-4.09	7.05	64.31	4.09	0.000%
26	-4.07	-64.31	-7.08	4.07	64.31	7.08	0.000%
27	-0.01	-46.43	-11.72	0.01	46.43	11.72	0.000%
28	5.82	-46.43	-10.15	-5.82	46.43	10.15	0.000%
29	10.09	-46.43	-5.86	-10.09	46.43	5.86	0.000%
30	11.66	-46.43	0.01	-11.66	46.43	-0.01	0.000%
31	10.10	-46.43	5.87	-10.10	46.43	-5.87	0.000%
32	5.83	-46.43	10.15	-5.83	46.43	-10.15	0.000%
33	0.01	-46.43	11.72	-0.01	46.43	-11.72	0.000%
34	-5.82	-46.43	10.15	5.82	46.43	-10.15	0.000%
35	-10.09	-46.43	5.86	10.09	46.43	-5.86	0.000%
36	-11.66	-46.43	-0.01	11.66	46.43	0.01	0.000%
37	-10.10	-46.43	-5.87	10.10	46.43	5.87	0.000%
38	-5.83	-46.43	-10.15	5.83	46.43	10.15	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00045905
3	Yes	6	0.00000001	0.00004862
4	Yes	6	0.00000001	0.00004908
5	Yes	4	0.00000001	0.00035387
6	Yes	6	0.00000001	0.00004900
7	Yes	6	0.00000001	0.00004887
8	Yes	4	0.00000001	0.00039789
9	Yes	6	0.00000001	0.00004919
10	Yes	6	0.00000001	0.00004860
11	Yes	4	0.00000001	0.00038503
12	Yes	6	0.00000001	0.00004890
13	Yes	6	0.00000001	0.00004916
14	Yes	4	0.00000001	0.00000001
15	Yes	5	0.00000001	0.00035358
16	Yes	5	0.00000001	0.00043247
17	Yes	5	0.00000001	0.00043186
18	Yes	5	0.00000001	0.00035327
19	Yes	5	0.00000001	0.00043452
20	Yes	5	0.00000001	0.00043510
21	Yes	5	0.00000001	0.00035516
22	Yes	5	0.00000001	0.00043177
23	Yes	5	0.00000001	0.00043026
24	Yes	5	0.00000001	0.00035066
25	Yes	5	0.00000001	0.00042890
26	Yes	5	0.00000001	0.00043044
27	Yes	4	0.00000001	0.00016473
28	Yes	5	0.00000001	0.00009424
29	Yes	5	0.00000001	0.00009587
30	Yes	4	0.00000001	0.00015783
31	Yes	5	0.00000001	0.00009555
32	Yes	5	0.00000001	0.00009516

33	Yes	4	0.00000001	0.00016310
34	Yes	5	0.00000001	0.00009636
35	Yes	5	0.00000001	0.00009399
36	Yes	4	0.00000001	0.00015844
37	Yes	5	0.00000001	0.00009503
38	Yes	5	0.00000001	0.00009618

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	178 - 164.25 (1)	TP26x12.75x0.25	13'9"	0'	0.0	39.000	18.2024	-4.27	709.89	0.006
L2	164.25 - 129.667 (2)	TP34.0625x22.6894x0.3125	37'6"	0'	0.0	39.000	32.3226	-10.77	1260.58	0.009
L3	129.667 - 96 (3)	TP41.75x32.2749x0.375	37'6"	0'	0.0	39.000	47.8431	-17.37	1865.88	0.009
L4	96 - 63.1667 (4)	TP49.0625x39.8209x0.375	37'6"	0'	0.0	39.000	56.3370	-25.25	2197.14	0.011
L5	63.1667 - 31.1667 (5)	TP56.125x46.9571x0.375	37'6"	0'	0.0	39.000	64.5378	-34.26	2516.97	0.014
L6	31.1667 - 0 (6)	TP62.9375x53.847x0.375	37'5-1/32"	0'	0.0	37.124	74.4650	-46.41	2764.41	0.017

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	178 - 164.25 (1)	TP26x12.75x0.25	62.60	7.313	39.000	0.188	0.00	0.000	39.000	0.000
L2	164.25 - 129.667 (2)	TP34.0625x22.6894x0.3125	645.58	29.857	39.000	0.766	0.00	0.000	39.000	0.000
L3	129.667 - 96 (3)	TP41.75x32.2749x0.375	1378.90	34.920	39.000	0.895	0.00	0.000	39.000	0.000
L4	96 - 63.1667 (4)	TP49.0625x39.8209x0.375	2204.92	40.214	39.000	1.031	0.00	0.000	39.000	0.000
L5	63.1667 - 31.1667 (5)	TP56.125x46.9571x0.375	3113.80	43.232	39.000	1.109	0.00	0.000	39.000	0.000
L6	31.1667 - 0 (6)	TP62.9375x53.847x0.375	4320.59	45.017	37.124	1.213	0.00	0.000	37.124	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	178 - 164.25 (1)	TP26x12.75x0.25	11.24	0.618	26.000	0.048	0.00	0.000	26.000	0.000
L2	164.25 - 129.667 (2)	TP34.0625x22.6894x0.3125	20.59	0.637	26.000	0.049	0.43	0.010	26.000	0.000
L3	129.667 - 96 (3)	TP41.75x32.2749x0.375	24.08	0.503	26.000	0.039	0.39	0.005	26.000	0.000
L4	96 - 63.1667 (4)	TP49.0625x39.8209x0.375	27.49	0.488	26.000	0.038	0.35	0.003	26.000	0.000
L5	63.1667 - 31.1667 (5)	TP56.125x46.9571x0.375	30.56	0.474	26.000	0.036	0.32	0.002	26.000	0.000
L6	31.1667 - 0 (6)	TP62.9375x53.847x0.375	33.90	0.455	26.000	0.035	0.27	0.001	26.000	0.000

Pole Interaction Design Data

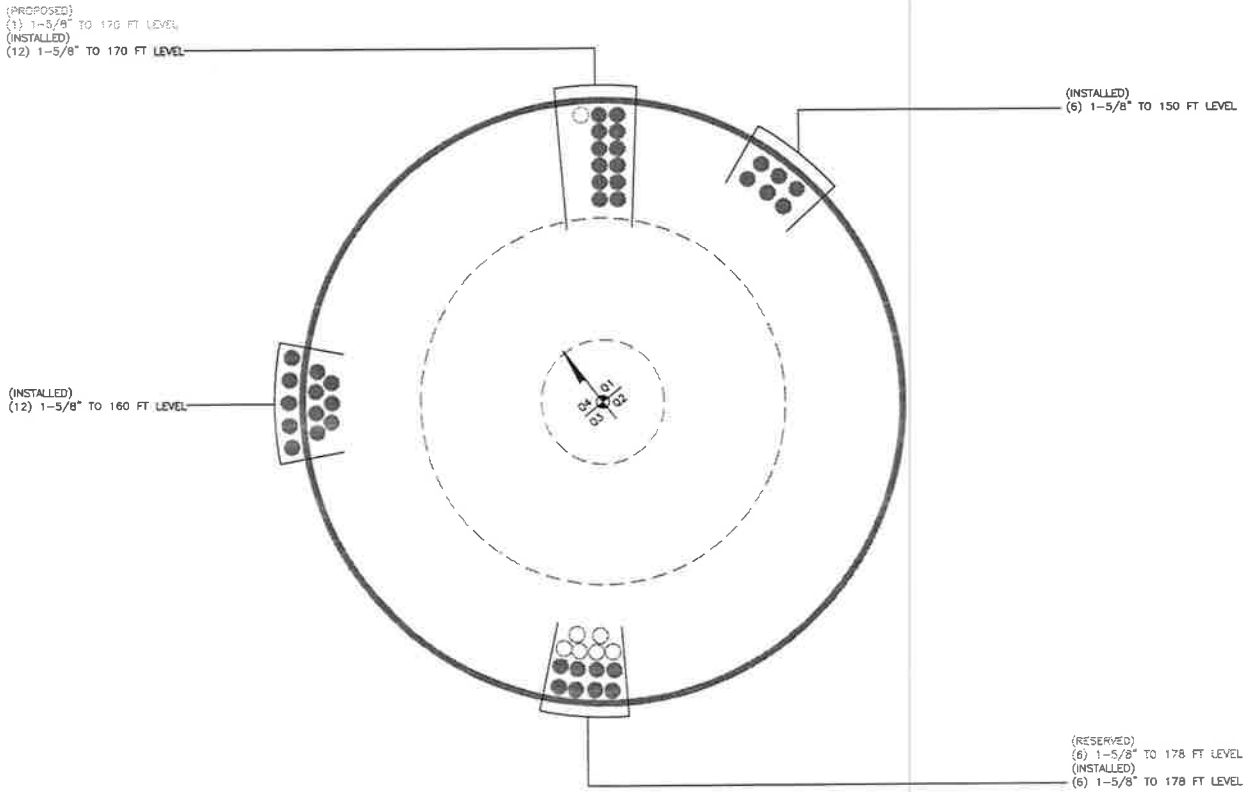
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	178 - 164.25 (1)	0.006	0.188	0.000	0.048	0.000	0.194 ✓	1.333	H1-3+VT ✓
L2	164.25 - 129.667 (2)	0.009	0.766	0.000	0.049	0.000	0.775 ✓	1.333	H1-3+VT ✓
L3	129.667 - 96 (3)	0.009	0.895	0.000	0.039	0.000	0.905 ✓	1.333	H1-3+VT ✓
L4	96 - 63.1667 (4)	0.011	1.031	0.000	0.038	0.000	1.043 ✓	1.333	H1-3+VT ✓
L5	63.1667 - 31.1667 (5)	0.014	1.109	0.000	0.036	0.000	1.122 ✓	1.333	H1-3+VT ✓
L6	31.1667 - 0 (6)	0.017	1.213	0.000	0.035	0.000	1.230 ✓	1.333	H1-3+VT ✓

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	178 - 164.25	Pole	TP26x12.75x0.25	1	-4.27	946.29	14.6	Pass
L2	164.25 - 129.667	Pole	TP34.0625x22.6894x0.3125	2	-10.77	1680.35	58.1	Pass
L3	129.667 - 96	Pole	TP41.75x32.2749x0.375	3	-17.37	2487.22	67.9	Pass
L4	96 - 63.1667	Pole	TP49.0625x39.8209x0.375	4	-25.25	2928.79	78.2	Pass
L5	63.1667 - 31.1667	Pole	TP56.125x46.9571x0.375	5	-34.26	3355.12	84.2	Pass
L6	31.1667 - 0	Pole	TP62.9375x53.847x0.375	6	-46.41	3684.96	92.3	Pass
							Summary	
						Pole (L6)	92.3	Pass
						RATING =	**92.3**	**Pass**

APPENDIX B

BASE LEVEL DRAWING



BUSINESS UNIT: 823666 TOWER ID: C_BASELEVEL

BASE LEVEL DRAWING 1" = 1'-0" 1

A1-0

CROWN REGION ADDRESS

USA

12/03/13	NEW BUILD PER WORK ORDER # 344335	KNL
27/09/13	AS-BUILT INFORMATION ADDED PER WORK ORDER # 345019	MAG
13/12/13	UPDATED PER WORK ORDER # 370978	CAK
03/04/14	UPDATED PER WORK ORDER # 740289	CMV
23/04/14	UPDATED PER WORK ORDER # 760787	CSG
30/05/14	UPDATED PER WORK ORDER # 771258	AJJ
06/08/14	UPDATED PER WORK ORDER # 808434 808451	SLM

DRAWN BY: CRM
CHECKED BY: KNL
DRAWING DATE: 11-03-2013

SITE NUMBER:
SITE NAME:

SITE NAME

DEEP RIVER/RT 9

BUSINESS UNIT NUMBER

823666

SITE ADDRESS

15 PENT RD
DEEP RIVER, CT 06417
MIDDLESEX COUNTY
USA

SHEET TITLE

BASE LEVEL

SHEET NUMBER

APPENDIX C

ADDITIONAL CALCULATIONS

Stiffened or Unstiffened, Ungrouted, Circular Base Plate - Any Rod Material

TIA Rev F

Site Data

BU#: *823666*
Site Name: *Deep River/Rt 9*
App #: *226400 Rev 8*

Pole Manufacturer:	*Pirod*

Reactions		
Moment:	4321	ft-kips
Axial:	46	kips
Shear:	34	kips

If No stiffeners, Criteria:	AISC ASD	<-Only Applcable to Unstiffened Cases

Anchor Rod Data		
Qty:	45	
Diam:	1.25	in
Rod Material:	Other	
Strength (Fu):	150	ksi
Yield (Fy):	105	ksi
Bolt Circle:	68	in

Plate Data		
Diam:	73	in
Thick:	1.5	in
Grade:	50	ksi
Single-Rod B-eff:	4.44	in

Stiffener Data (Welding at both sides)		
Config:	0	*
Weld Type:		
Groove Depth:		<-- Disregard
Groove Angle:		<-- Disregard
Fillet H. Weld:		in
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Diam:	62.9375	in
Thick:	0.375	in
Grade:	65	ksi
# of Sides:	18	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Anchor Rod Results

Maximum Rod Tension:	66.7 Kips	Rigid
Allowable Tension:	81.0 Kips	Service, ASD
Anchor Rod Stress Ratio:	82.4% Pass	Fty*ASIF

Base Plate Results

	Flexural Check	Rigid
Base Plate Stress:	Rohn/Pirod, OK	Service ASD
Allowable Plate Stress:	50.0 ksi	0.75*Fy*ASIF
Base Plate Stress Ratio:	Rohn/Pirod, OK	Y.L. Length: 25.75

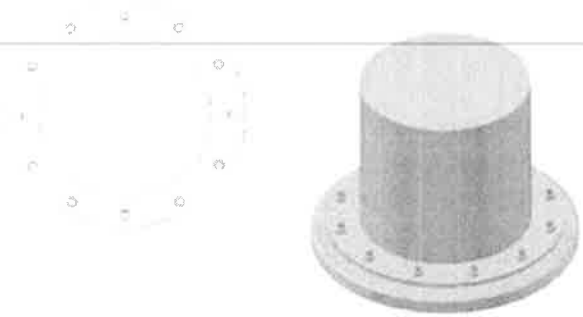
n/a

Stiffener Results N/A for Rohn / Pirod

Horizontal Weld :	N/A
Vertical Weld:	N/A
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	N/A
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	N/A
Plate Comp. (AISC Bracket):	N/A

Pole Results

Pole Punching Shear Check:	N/A



* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Version 1.0
Rev. Date: 4.9.2014

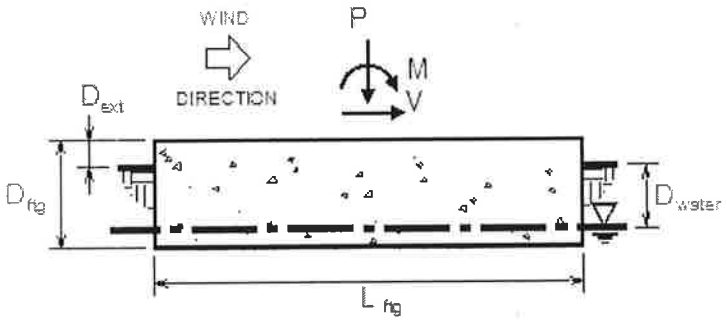
Project: BU823666
Site: Deep River/Rt 9

MP - SQUARE MAT ON GRADE
FOUNDATION ANALYSIS
TIA-222-F

Designed by: AJ
Checked by : AL
Date:4.1.2015

1.0 FOUNDATION GEOMETRY & MATERIALS:

L_{ftg}= Length of footing (parallel to wind direction)
L_{tower}= Centerline distance between tower legs
D_{ftg}= Depth of footing
D_{ext}= Height of pad above soil grade line
D_{offset}= Offset distance between center of footing and monopole
B_{ftg}= Width of footing (perpendicular to wind direction)
ρ_{conc}= Concrete density
A_{ftg} = Bearing area of spread footing
V_{ftg} = Volume of spread footing



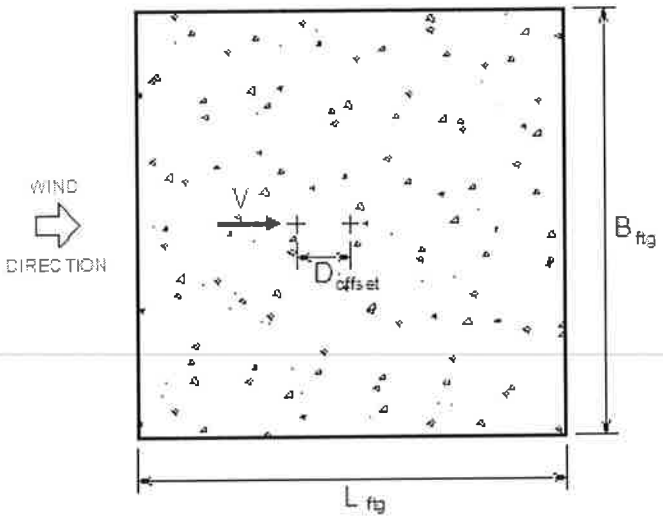
SECTION

$L_{ftg} := 29\,ft$ $B_{ftg} := L_{ftg} = 29\,ft$

$D_{ftg} := 4.0\,ft$ $D_{ext} := 0.5\,ft$ $D_{offset} := 0\,ft$

$\rho_{conc} := 150\,pcf$

$A_{ftg} := L_{ftg} \cdot B_{ftg} = 841\,ft^2$ $V_{ftg} := A_{ftg} \cdot D_{ftg} = 3364\,ft^3$



PLAN

2.0 SOIL PARAMETERS:

Data obtained from Geotechnical report
D_{water}= Depth of water table below soil grade line
ϕ= Angle of friction of soil
γ_{soil}= Moist density of soil
q_{brg_allow}= Allowable gross bearing capacity of soil
q_{brg_ult}= Ultimate gross bearing capacity of soil
FOS_{brg}= Factor of Safety for bearing
FOS_{coh}= Factor of Safety for cohesion
μ= Coefficient of friction - concrete & soil (sand)
c= Cohesion (clay)

$D_{water} := 99\,ft$ ☐ Check here if Groundwater is not present

$D_{neglect} := 3.5\,ft$

$\mu := 0.2$

$\phi := 0\,deg$

$K_p := \left(\tan\left(45 \cdot deg + \frac{\phi}{2}\right)\right)^2 = 1.00$

$c := 0\,psf$ If c is unknown, use 0

$FOS_{coh} := 1.0$

$\gamma_{soil} := 165\,pcf$

$q_{brg\_allow} := 12000\,psf$ $FOS_{lat} := 2.0$

3.0 LOADS:

Load combinations based on TIA-222-F Section 2.3.2 (1.0D + 1.0W):

P= Factored global axial load from tnxTower (1.0D)
V= Factored global shear load from tnxTower (1.0W)
M= Factored global moment from tnxTower (1.0W)

$P := 46 \cdot kip$

$V := 34 \cdot kip$

$M := 4321 \cdot kip \cdot ft$

γ'_{soil}= Density of soil considering ground water depth
ρ'_{conc_ftg}= Density of concrete footing considering ground water depth
WT_{ftg}= Weight of footing, including piers, considering ground water depth

$\gamma'_{soil} = 165 \cdot pcf$

$\rho'_{conc\_ftg} = 150 \cdot pcf$

$WT_{ftg} := \rho'_{conc\_ftg} \cdot V_{ftg} = 504.6 \cdot kip$

4.0 ANALYSIS

4.1 BEARING CHECK:

Considering 1.0D+1.0W TIA-222-F Load Combination:

M_{over}= Overturning moment due to wind
P_{tot}= Axial dead load, self-weight of footing, and weight of soil directly above footing
e_{brg}= Eccentricity in the direction of the wind (L_{ftg})
q_{min}= Minimum bearing pressure due to applied loads
q_{max}= Maximum bearing pressure due to applied loads

$M_{over} := M + V \cdot D_{ftg} + P \cdot D_{offset} = 4457 \cdot kip \cdot ft$

$P_{brg} := P + 1.0 \cdot WT_{ftg} = 550.6 \cdot kip$

$e := \frac{M_{over}}{P_{brg}} = 8.09\ ft \qquad \frac{L_{ftg}}{6} = 4.83\ ft \qquad \frac{L_{ftg}}{2} = 14.5\ ft$

$$q_{min} := if\left(e \le \frac{L_{ftg}}{6}, \frac{P_{brg}}{L_{ftg} \cdot B_{ftg}} - \frac{6 \cdot M_{over}}{B_{ftg} \cdot L_{ftg}^2}, if\left(e \ge \frac{L_{ftg}}{2}, "NO\ GOOD", 0 \cdot psf\right)\right) = 0 \cdot psf$$

$$q_{max} := if\left[e \le \frac{L_{ftg}}{6}, \frac{P_{brg}}{L_{ftg} \cdot B_{ftg}} + \frac{6 \cdot M_{over}}{B_{ftg} \cdot L_{ftg}^2}, if\left[e \ge \frac{L_{ftg}}{2}, "NO\ GOOD", \frac{2 \cdot P_{brg}}{3 \cdot B_{ftg} \cdot \left(\frac{L_{ftg}}{2} - e\right)}\right]\right] = 1976 \cdot psf$$

$$if\left(1.10 \cdot q_{brg\_allow} > q_{max}, "OK", "NO\ GOOD"\right) = "OK"$$

$$\frac{q_{max}}{q_{brg\_allow}} = 16.5 \cdot \%$$

4.2 OVERTURNING CHECK:

Considering 1.0D+1.0W Load Combination with Factor of Safety (FS) = 1.5 per TIA-222-F, Sect. 7.2.4.5:

L_{brg} = Length of soil bearing area due to applied factored loads

γ'_{soil} = Density of soil above top of footing considering ground water depth

WT_{soil1} = Weight of soil centered over centroid of footing (A)

WT_{soil2} = Weight of soil extending beyond sides of the half of the footing in uplift "tension" (B)

WT_{soil3} = Weight of soil extending beyond back edge of footing (C + D)

V_{coh} = Vertical shear resistance due to soil cohesion above "non-bearing" portion of footing

M_{resist} = Resisting moment due to axial dead load, footing self-weight and weight of soil above footing and extending beyond top of footing at $\phi°$

$$P_{over} := 1.0P + 1.0 \cdot WT_{ftg} = 551 \cdot kip$$

$$e_{OT} := \frac{M_{over}}{P_{over}} = 8.09\ ft$$

$$L_{ftg} = 29\ ft$$

$$\frac{L_{ftg}}{6} = 4.83\ ft \qquad L_{brg} := \begin{cases} L_{ftg} & \text{if } e_{OT} < \frac{L_{ftg}}{6} \\ 3 \cdot \left(\frac{L_{ftg}}{2} - e_{OT} \right) & \text{otherwise} \end{cases} = 19.22 \cdot ft$$

$$q_{min} = 0 \cdot psf$$

$$q_{max} = 1976 \cdot psf$$

$$M_{resist} := \left[1.0 \cdot P + 1.0 \cdot \left(WT_{ftg} \right) \right] \cdot \frac{L_{ftg}}{2} = 7984 \cdot kip \cdot ft$$

$$M_{over} = 4457 \cdot kip \cdot ft$$

$$\frac{1.5 M_{over}}{M_{resist}} = 83.7 \cdot \%$$

$$\frac{M_{resist}}{M_{over}} = 1.79$$

$$\text{if}\left[\left[1.10 \left(\frac{M_{resist}}{M_{over}} \right) \right] > 1.5, \text{"OK"}, \text{"NO GOOD"} \right] = \text{"OK"}$$

4.3 SLIDING RESISTANCE CHECK:

Considering 1.0D+1.0W Load Combination with Factor of Safety (FS) = 1.5 per TIA-222-F:

q_{lat_allow} = Allowable lateral bearing capacity of soil

$R_{s\_lat\_brg}$ = Nominal soil resistance to bearing

$R_{s\_lat\_sliding}$ = Nominal soil resistance to sliding

R_s = Total nominal soil resistance to resist sliding (bearing + sliding)

R_{s_allow} = Allowable strength of soil to resist sliding

$$q_{lat\_allow} := \frac{\left(K_p \cdot \gamma'_{soil}\right)}{FOS_{lat}} = 82.5 \cdot \frac{psf}{ft}$$

$$R_{s\_lat\_brg} := \underbrace{q_{lat\_allow} \cdot \left(\frac{D_{ftg} - D_{ext}}{2}\right) \cdot \left(D_{ftg} - D_{ext}\right) \cdot B_{ftg}}_{\text{Lateral Bearing - Soil Pressure (sand)}} + \underbrace{\left(2 \cdot c \cdot \sqrt{K_p}\right) \cdot \left(D_{ftg} - D_{ext}\right) \cdot \left(L_{ftg}\right)}_{\text{Lateral Bearing - Cohesion (clay)}} = 15 \cdot kip$$

$$R_{s\_lat\_sliding} := \underbrace{(\mu) \cdot \left(P_{over}\right)}_{\text{Lateral Sliding - Friction (sand)}} + \underbrace{(c) \cdot \left[A_{ftg} + 2 \cdot \left[\left(D_{ftg} - D_{ext}\right) \cdot L_{ftg}\right]\right]}_{\text{Lateral Sliding - Cohesion (clay)}} = 110 \cdot kip$$

$$R_{s\_allow} := R_{s\_lat\_brg} + R_{s\_lat\_sliding} = 125 \cdot kip$$

$$V = 34 \cdot kip$$

$$\frac{R_{s\_allow}}{V} = 3.67$$

$$if\left(1.10 \cdot \frac{R_{s\_allow}}{V} > 1.5, \text{"OK"}, \text{"NO GOOD"}\right) = \text{"OK"}$$

$$\frac{1.5 \cdot V}{R_{s\_allow}} = 40.9 \cdot \%$$

5.0 CONCRETE DESIGN (ACI 318-05):

Load Combinations from TIA-222-F (1.0D + 1.0W) factored to meet ACI 318-05 load combination (1.2D + 1.6W):

d = Distance from extreme compression fiber to center of longitudinal reinforcement
No_rebar = Number of longitudinal reinforcement at steel depth "d" in direction of wind
Size_rebar = (#) size of longitudinal reinforcement at steel depth "d" in direction of wind
dia_s = Diameter of single longitudinal reinforcement (in^2) at steel depth "d" in direction of wind
A_s = Total area of longitudinal reinforcement at steel depth "d" in direction of wind
f_y = Specified yield strength of reinforcement (psi)
f_c = Specified compressive strength of concrete (psi)
M_{over} = Overturning moment due to wind
P_{tot} = Axial dead load, self-weight of footing, and weight of soil directly above footing
e_{ult} = Eccentricity in the direction of the wind (L_{ftg}) caused by ultimate loads
L_{brg_ult} = Length of soil bearing area due to applied factored loads
q_{u_min} = Minimum bearing pressure due to factored loads
q_{u_max} = Maximum bearing pressure due to factored loads

$d := 44 \cdot in$ $f_y := 60000 \cdot psi$

$No\_rebar := 32$ $f_c := 4000 \cdot psi$

$Size\_rebar := 8$

$(dia_s) := 1.0 \cdot in$ $A_s := No\_rebar(dia_s)^2 \cdot \frac{\pi}{4} = 25.13 \cdot in^2$

$M_{u\_over} := 1.6 \cdot M_{over} = 7131 \cdot kip \cdot ft$

$P_{u\_tot} := 1.2 \cdot P_{over} = 661 \cdot kip$

$P_{ult} := 1.2 \cdot P = 55 \cdot kip$

$e_{ult} := \frac{M_{u\_over}}{P_{u\_tot}} = 10.79\ ft$ $\frac{L_{ftg}}{6} = 4.83\ ft$ $\frac{L_{ftg}}{2} = 14.5\ ft$ $L_{brg\_ult} := \begin{cases} L_{ftg} & \text{if } e_{ult} < \frac{L_{ftg}}{6} \\ 3 \cdot \left(\frac{L_{ftg}}{2} - e_{ult} \right) & \text{otherwise} \end{cases} = 11.12\ ft$

$q_{min} := \text{if}\left(e_{ult} \le \frac{L_{ftg}}{6}, \frac{P_{u\_tot}}{L_{ftg} \cdot B_{ftg}} - \frac{6 \cdot M_{u\_over}}{B_{ftg} \cdot L_{ftg}^2}, \text{if}\left(e_{ult} \ge \frac{L_{ftg}}{2}, \text{"NO GOOD"}, 0 \cdot psf \right) \right) = 0 \cdot psf$

$q_{max} := \text{if}\left[e_{ult} \le \frac{L_{ftg}}{6}, \frac{P_{u\_tot}}{L_{ftg} \cdot B_{ftg}} + \frac{6 \cdot M_{u\_over}}{B_{ftg} \cdot L_{ftg}^2}, \text{if}\left[e_{ult} \ge \frac{L_{ftg}}{2}, \text{"NO GOOD"}, \frac{2 \cdot P_{u\_tot}}{3 \cdot B_{ftg} \cdot \left(\frac{L_{ftg}}{2} - e_{ult} \right)} \right] \right] = 4097 \cdot psf$

$q_{min\_net} := q_{min} - \left(\rho'_{conc\_ftg} \cdot D_{ftg} \right) = -600 \cdot psf$

$q_{u\_min} := \begin{cases} 0 \cdot psf & \text{if } q_{min\_net} < 0 \cdot psf \\ q_{min\_net} & \text{otherwise} \end{cases} = 0 \cdot psf$

$q_{u\_max} := q_{max} - \left(\rho'_{conc\_ftg} \cdot D_{ftg} \right) = 3497 \cdot psf$

$L_{u\_brg} := \begin{cases} \frac{\left(q_{u\_max} \cdot L_{brg\_ult} \right)}{\left(q_{u\_max} - q_{min\_net} \right)} & \text{if } q_{min} = 0 \cdot psf \\ L_{brg\_ult} & \text{otherwise} \end{cases} = 9.49 \cdot ft$

Version 1.0
Rev. Date: 4.9.2014

Designed by: AJ
Checked by : AL
Date:4.1.2015

Project: BU823666
Site: Deep River/Rt 9

MP - SQUARE MAT ON GRADE
FOUNDATION ANALYSIS
TIA-222-F

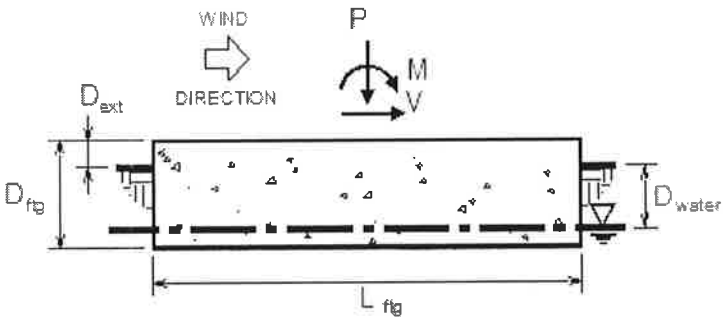
1.0 FOUNDATION GEOMETRY & MATERIALS:

$L_{ftg} = 29\,ft$ $B_{ftg} = 29\,ft$

$D_{ftg} = 4\,ft$ $D_{ext} = 0.5\,ft$ $D_{offset} = 0$

$d = 44 \cdot in$ No_rebar = 32 Size_rebar = 8

$f_y = 60000 \cdot psi$ $f_c = 4000 \cdot psi$



SECTION

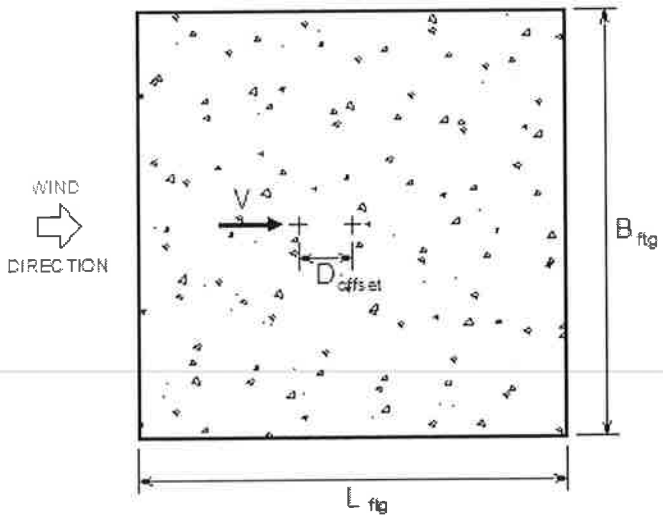
2.0 SOIL PARAMETERS:

$\phi = 0 \cdot deg$ $K_p = 1.00$

$\gamma_{soil} = 165 \cdot pcf$ $\mu = 0.2$ $c = 0 \cdot psf$

Groundwater = 99 ft

$q_{bro\_allow} = 12000 \cdot psf$



PLAN

3.0 LOADS:

Load combinations based on TIA-222-G (1.2D + 1.6W):

$P = 46 \cdot kip$

$V = 34 \cdot kip$

$M = 4321 \cdot kip \cdot ft$

4.0 ANALYSIS RESULTS:

		APPLIED	CAPACITY	CHECK
4.1	BEARING:	$B_{app} = 4097 \cdot psf$	$B_{cap} = 12000 \cdot psf$	B% = 34.1·%
4.2	OVERTURNING:	$M_{app} = 4457 \cdot kip \cdot ft$	$M_{cap} = 5322 \cdot kip \cdot ft$	M% = 83.7·%
4.3	SLIDING:	$V_{app} = 34 \cdot kip$	$V_{cap} = 83 \cdot kip$	V% = 40.9·%