Robinson+Cole

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Also admitted in Massachusetts

April 2, 2015

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

Re: **Notice of Exempt Modification – Facility Modification**
266 Center Street, Manchester, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains fifteen (15) wireless telecommunications antennas at the top of the 115-foot tower at 266 Center Street in Manchester (the "Property"). The tower is owned Crown Castle. Cellco's use of the tower was approved by the Council in 1990 (Docket No. 129). Cellco now intends to modify its facility by replacing nine (9) of its existing antennas with three (3) model LNX-6514DS-VTM, 700 MHz antennas; three (3) model HBXX-6517DS-VTM, 1900 MHz antennas; and three (3) model HBXX-6517DS-VTM, 2100 MHz antennas, all at the same level on the tower. Cellco also intends to install six (6) remote radio heads ("RRHs") behind its 700 MHz and 2100 MHz antennas. Included in Attachment 1 are specifications for Cellco's replacement antennas and RRHs.

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 Jay Moran, Mayor for the Town of Manchester. A copy of this letter is also being sent to M. Stephens Co. LLC, the owner 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. Cellco's replacement antennas and RRHs will be installed on its existing antenna platform at the 116-foot level on the tower.

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 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:
Jay Moran, Manchester Mayor
M. Stephens Co, LLC
Tim Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6514DS-VTM

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

- Great solution to maximize network coverage and capacity
- Excellent gain, VSWR, front-to-back ratio, and PIM specifications for robust network performance
- Ideal choice for site collocations and tough zoning restrictions
- Excellent solution for site sharing and maximizing capacity
- Fully compatible with Andrew remote electrical tilt system for greater OpEx savings
- The RF connectors are designed for IP67 rating and the radome for IP56 rating

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Gain, dBi	15.8	15.9
Beamwidth, Horizontal, degrees	65	64
Beamwidth, Vertical, degrees	12.4	11.2
Beam Tilt, degrees	0–10	0–10
USLS, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	23	23
CPR at Sector, dB	12	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°
Impedance	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	**698–806**	**806–896**
Gain by all Beam Tilts, average, dBi	15.6	15.7
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.5
Gain by Beam Tilt, average, dBi	0 ° | 15.7 5 ° | 15.7 10 ° | 15.3	0 ° | 15.9 5 ° | 15.8 10 ° | 15.3
Beamwidth, Horizontal Tolerance, degrees	±0.9	±1.4
Beamwidth, Vertical Tolerance, degrees	±0.8	±0.6
USLS, dB	18	20
Front-to-Back Total Power at 180° ± 30°, dB	25	23
CPR at Boresight, dB	25	24
CPR at Sector, dB	15	12

* 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®
Band	Single band
Brand	DualPol® | Teletilt®

Product Specifications

LNX-6514DS-VTM

Operating Frequency Band	698 – 896 MHz

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum
Radome Material	Fiberglass, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	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

Dimensions

Depth	181.0 mm | 7.1 in
Length	1847.0 mm | 72.7 in
Width	301.0 mm | 11.9 in
Net Weight	14.2 kg | 31.3 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 2.0 Actuator	LNX-6514DS-A1M
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

DB380 — Pipe Mounting Kit for 2.4"-4.5" (60-115mm) OD round members on wide panel antennas. Includes 2 clamp sets and double nuts.

DB5083 — Downtilt Mounting Kit for 2.4"-4.5" (60 - 115 mm) OD round members. Includes a heavy-duty, galvanized steel downtilt mounting bracket assembly and associated hardware. This kit is compatible with the DB380 pipe mount kit for panel antennas that are equipped with two mounting brackets.

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

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.

Alcatel-Lucent RRH2x40-07-U

REMOTE RADIO HEAD

The Alcatel-Lucent RRH2x40-07-U is a high-power, small form-factor Remote Radio Head (RRH) operating in the North American Digital Dividend / 700MHz frequency band (3GPP Band 13). The Alcatel-Lucent RRH2x40-07-U is designed with an eco-efficient approach, providing operators with the means to achieve high quality and capacity coverage with minimum site requirements.

A distributed eNodeB expands 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 an eNodeB to be installed separately, within the same site or several kilometres apart.

The Alcatel-Lucent RRH2x40-07-U 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. The Alcatel-Lucent RRH2x40-07-U has two transmit RF paths, 40 W RF output power per transmit path, and is designed to manage up to two-way receive diversity. The device is ideally suited to support macro coverage, with multiple-input multiple-output (MIMO) 2x2 operation in up to 10 MHz of bandwidth.

The Alcatel-Lucent RRH2x40-07-U is designed to make available all the benefits of a distributed eNodeB, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX). The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment or require costly cranes to be employed, leaving coverage holes. However, many of these sites can host an Alcatel-Lucent RRH2x40-07-U installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

Fast, low-cost installation and deployment

The Alcatel-Lucent RRH2x40-07-U is a zero-footprint solution and operates noise-free, simplifying negotiations with site property owners and minimizing environmental impacts. Installation can easily be done by a single person because the Alcatel-Lucent RRH2x40-07-U is compact and weights less than 23 kg (50 lb), 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 — a fraction of the time required for a traditional BTS.

Excellent RF performance

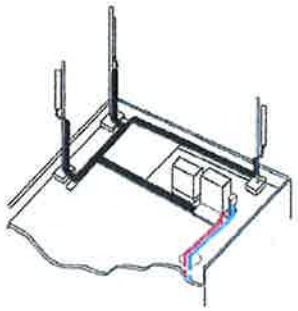
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation costs are reduced or eliminated, and there is no need for a Tower Mounted Amplifier (TMA) because losses introduced by the RF feeder are greatly reduced. The Alcatel-Lucent RRH2x40-07-U provides more RF power while at the same time consuming less electricity.

Features

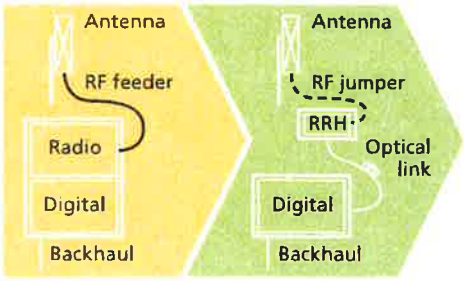
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

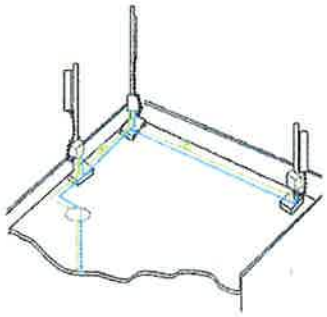
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility to network planning



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

- Height: 390 mm (15.4 in.)
- Width: 380 mm (15 in.)
- Depth: 210 mm (8.2 in.)
- Weight (without mounting kit): less than 23 kg (50 lb)

Power

- Power supply: -48V

Operating environment

- Outdoor temperature range:
  - ¬ With solar load: -40°C to +50°C (-40°F to +122°F)
  - ¬ Without solar load: -40°C to +55°C (-40°F to +131°F)
- Passive convection cooling (no fans)
- Enclosure protection
  - ¬ IP65 (International Protection rating)

RF characteristics

- Frequency band: 700 MHz; 3GPP Band 13
- Bandwidth: up to 10 MHz
- RF output power at antenna port:
  - ¬ 40 W nominal RF power for each Tx port
- Rx diversity: 2-way or 4-way
- Noise figure: below 2.5 dB typical
- ALD features
  - ¬ TMA
  - ¬ Remote electrical tilt (RET) support (AISG v2.0)

Optical characteristics

Type/number of fibers

- Up to 3.12 Gb/s line bit rate
- Single-mode variant
  - ¬ One SM fiber (9/125 µm) per RRH2x, carrying UL and DL using CWDM (at 1550/1310 nm)
- Multi-mode variant
  - ¬ Two MM fibers (50/125 µm) per RRH2x: one carrying UL, the other carrying DL (at 850 nm)

Optical fiber length

- Up to 500 m (0.31 mi), using MM fiber
- Up to 20 km (12.43 mi), using SM fiber

Alarms and ports

- Six external alarms
- Two optical ports to support daisy-chaining

Alcatel·Lucent

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.

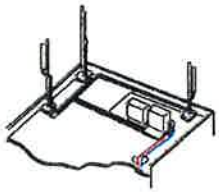
EASY INSTALLATION

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.

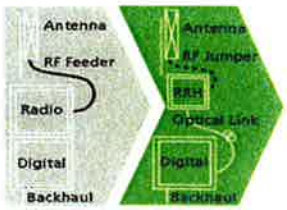
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation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

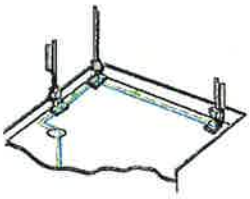
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



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™

ATTACHMENT 2

	General	Power	Density					
Site Name: Manchester								
Tower Height: 115Ft.								
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE	Total
*Clearwire	2	153	110	0.0091	2496	1.0000	0.91%	
*Clearwire	1	211	110	0.0063	18 GHz	1.0000	0.63%	
Verizon PCS	**11**	**442**	**116**	**0.1299**	**1970**	**1.0000**	**12.99%**	
Verizon Cellular	**9**	**406**	**116**	**0.0976**	**869**	**0.5793**	**16.85%**	
Verizon AWS	**1**	**1750**	**116**	**0.0468**	**2145**	**1.0000**	**4.68%**	
Verizon 700	**1**	**1050**	**116**	**0.0281**	**746**	**0.4973**	**5.64%**	
								41.70%
* Source: Siting Council								

ATTACHMENT 3

Date: **March 11, 2015**

Sean Dempsey
Crown Castle
3530 Toringdon Way Suite 300
Charlotte, NC 28277

FDH Engineering, Inc.
6521 Meridien Drive, Suite 107
Raleigh, North Carolina 27616
9197551012

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Number:	119713
	Carrier Site Name:	Manchester CT
Crown Castle Designation:	**Crown Castle BU Number:**	806372
	Crown Castle Site Name:	HRT 093 943228
	Crown Castle JDE Job Number:	325501
	Crown Castle Work Order Number:	1019874
	Crown Castle Application Number:	283950 Rev. 0
Engineering Firm Designation:	**FDH Engineering, Inc. Project Number:**	15BGJC1400
Site Data:	**CENTER & PINE STREET, MANCHESTER, Hartford County, CT** **Latitude *41° 46' 19"*, Longitude *-72° 31' 48.8"*** **115 Foot - Monopole Tower**	

Dear Sean Dempsey,

FDH Engineering, 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 763328, in accordance with application 283950, revision 0.

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:

LC5: Existing + 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 Connecticut State Building Code based upon a wind speed of 80 mph fastest mile.

All modifications and equipment proposed in this report shall be installed in accordance with the attached drawings for the determined available structural capacity to be effective.

We at *FDH Engineering, 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:

Respectfully submitted by:

Kelsey L Sargent

Kelsey Sargent
Project Engineer

Reviewed by:

Dennis D. Abel, PE
Director- Structural Engineering
CT PE License No. 23247

03-11-2015

tnxTower Report - version 6.1.4.1

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 115 ft Monopole tower designed by VALMONT in May of 1990. The tower was originally designed for a wind speed of 90 mph per EIA-222-D.

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 80 mph with no ice, 38 mph with 1 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
115.0	116.0	6	commscope	HBXX-6517DS-AM w/ Mount Pipe	-	-	-
		3	commscope	LNX-6514DS-A1M w/ Mount Pipe			
		3	alcatel lucent	RRH-2X40W-700 MHZ			
		3	alcatel lucent	RRH-2X60-AWS			

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
115.0	116.0	6	decibel	DB844G65ZAXY w/ Mount Pipe	18 1	1-5/8 1-1/4	1
		1	rfs/celwave	DB-T1-6Z-8AB-0Z			
	115.0	3	alcatel lucent	RRH2x40-AWS	-	-	2
		2	antel	BXA-171085-12BF-EDIN-2 w/ Mount Pipe			
		1	antel	BXA-171063-12BF w/ Mount Pipe			
		3	antel	BXA-185085-12CF-EDIN-2			
		2	antel	BXA-70063/6CFx4 w/ Mount Pipe			
		1	antel	BXA-70063/6CFx6 w/ Mount Pipe			
		1	crown mounts	Platform Mount [LP 1201-1]	-	-	1
		1	crown mounts	Miscellaneous [NA 510-1]			
105.0	108.0	2	andrew	VHLP1-23	6 5 5	2-1/2 5/16 1/4	1
		1	andrew	VHLP2-11-2GR			
		4	dragonwave	Horizon Compact			
	105.0	1	crown mounts	Platform Mount [LP 713-1]			
		3	samsung	WiMax DAP Head			

Notes:
1) Existing Equipment
2) Existing Equipment to be Removed, was not considered in this analysis.

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)
115.0	115.0	4	-	PD10017	-	-
106.0	106.0	12	-	PD1132	-	-

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	FDH Enginnering, Inc. (Mapping)	2668863	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Valmont	262172	CCISITES
4-GEOTECHNICAL REPORTS	Testwell Craig Laboratories of CT, Inc.	262174	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. FDH Engineering, 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	115 - 72.3333	Pole	TP30.45x21.91x0.219	1	-7.58	1015.72	65.1	Pass
L2	72.3333 - 29.3333	Pole	TP38.61x29.0779x0.313	2	-13.75	1947.22	72.8	Pass
L3	29.3333 - 0	Pole	TP43.85x36.8508x0.375	3	-21.37	2729.12	75.1	Pass
							Summary	
						Pole (L3)	75.1	Pass
						Rating =	75.1	Pass

Table 6 - Tower Component Stresses vs. Capacity – LC5

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	70.1	Pass
1	Base Plate	0	44.5	Pass
1	Base Foundation	0	71.7	Pass
1	Base Foundation Soil Interaction	0	89.7	Pass

Structure Rating (max from all components) =	89.7%

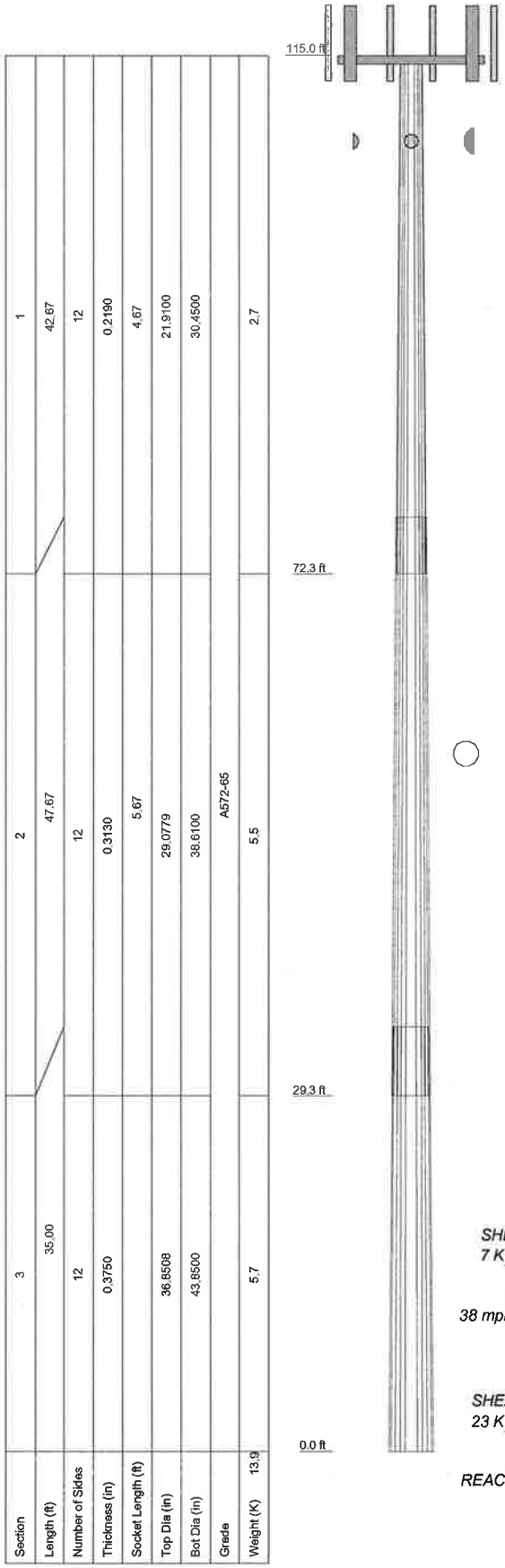
Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

4.1) Recommendations

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

APPENDIX A

TNXTOWER OUTPUT



Section	1	2	3
Length (ft)	42.67	47.67	35.00
Number of Sides	12	12	12
Thickness (in)	0.2190	0.3130	0.3750
Socket Length (ft)	4.67	5.67	
Top Dia (in)	21.9100	29.0779	36.8508
Bot Dia (in)	30.4500	38.6100	43.8500
Grade		A572-65	
Weight (K)	2.7	5.5	5.7

13.9

AXIAL
34 K

SHEAR
7 K

MOMENT
563 kip-ft

TORQUE 1 kip-ft
38 mph WIND - 1.0000 in ICE

AXIAL
21 K

SHEAR
23 K

MOMENT
1795 kip-ft

TORQUE 2 kip-ft
REACTIONS - 80 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) DB844G65ZAXY w/ Mount Pipe	115	RRH-2X40W-700-MHZ	115
(2) DB844G65ZAXY w/ Mount Pipe	115	RRH-2X40W-700-MHZ	115
(2) DB844G65ZAXY w/ Mount Pipe	115	RRH2X60-AWS	115
DB-T1-6Z-8AB-0Z	115	RRH2X60-AWS	115
Platform Mount [LP 1201-1]	115	RRH2X60-AWS	115
Miscellaneous [NA 510-1]	115	WIMAX DAP HEAD	105
(2) HBXX-6517DS-A2M w/ Mount Pipe	115	WIMAX DAP HEAD	105
(2) HBXX-6517DS-A2M w/ Mount Pipe	115	WIMAX DAP HEAD	105
(2) HBXX-6517DS-A2M w/ Mount Pipe	115	Horizon Compact	105
LNX-6514DS-AIM w/ Mount Pipe	115	Horizon Compact	105
LNX-6514DS-AIM w/ Mount Pipe	115	(2) Horizon Compact	105
LNX-6514DS-AIM w/ Mount Pipe	115	Platform Mount [LP 713-1]	105
Mount Pipe	115	VHLP1-23	105
Mount Pipe	115	VHLP1-23	105
Mount Pipe	115	VHLP2-11-2GR	105
RRH-2X40W-700-MHZ	115		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50 mph wind.

FDH Engineering, Inc.
6521 Meridien Drive, Suite 107
Raleigh, North Carolina 27616
Phone: 9197551012
FAX: 9197551031

Tower Analysis

Job: 806372 / HRT 093 943228		
Project: 15BGJC1400		
Client: Crown Castle	Drawn by: KSargent	App'd:
Code: TIA/EIA-222-F	Date: 03/11/15	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 Hartford County, Connecticut.
5) Basic wind speed of 80 mph.
6) Nominal ice thickness of 1.0000 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	115.00-72.33	42.67	4.67	12	21.9100	30.4500	0.2190	0.8760	A572-65 (65 ksi)
L2	72.33-29.33	47.67	5.67	12	29.0779	38.6100	0.3130	1.2520	A572-65 (65 ksi)
L3	29.33-0.00	35.00		12	36.8508	43.8500	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	22.6829	15.2961	918.5962	7.7654	11.3494	80.9380	1861.3250	7.5283	5.2850	24.132
	31.5242	21.3183	2486.8150	10.8227	15.7731	157.6618	5038.9614	10.4922	7.5737	34.583

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
L2	31.0698	28.9910	3061.7975	10.2978	15.0624	203.2746	6204.0318	14.2685	6.9540	22.217
	39.9720	38.5980	7225.7083	13.7103	20.0000	361.2858	14641.2440	18.9968	9.5086	30.379
L3	39.3239	44.0445	7479.7692	13.0583	19.0887	391.8423	15156.0403	21.6774	8.8710	23.656
	45.3969	52.4961	12664.6112	15.5641	22.7143	557.5611	25661.9358	25.8370	10.7468	28.658

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 115.00-72.33				1	1	1		
L2 72.33-29.33				1	1	1		
L3 29.33-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight plf
LDF7-50A(1-5/8")	A	Surface Ar (CaAa)	115.00 - 0.00	6	6	-0.100 0.000	1.9800		0.82
HB114-21U3M12-XXXF(1-1/4")	A	Surface Ar (CaAa)	115.00 - 0.00	1	1	0.000 0.000	1.5400		1.22

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
LDF7-50A(1-5/8")	A	No	Inside Pole	115.00 - 0.00	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
FSJ1-50A(1/4")	C	No	Inside Pole	105.00 - 0.00	5	No Ice	0.00	0.04
						1/2" Ice	0.00	0.04
						1" Ice	0.00	0.04
						2" Ice	0.00	0.04
						4" Ice	0.00	0.04
FSJ4-50B(1/2")	C	No	Inside Pole	105.00 - 0.00	6	No Ice	0.00	0.14
						1/2" Ice	0.00	0.14
						1" Ice	0.00	0.14
						2" Ice	0.00	0.14
						4" Ice	0.00	0.14
9207(5/16")	C	No	Inside Pole	105.00 - 0.00	5	No Ice	0.00	0.60
						1/2" Ice	0.00	0.60
						1" Ice	0.00	0.60
						2" Ice	0.00	0.60
						4" Ice	0.00	0.60

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	115.00-72.33	A	0.000	0.000	57.259	0.000	0.68
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.13
L2	72.33-29.33	A	0.000	0.000	57.706	0.000	0.69
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.17
L3	29.33-0.00	A	0.000	0.000	39.365	0.000	0.47
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.12

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	115.00-72.33	A	1.132	0.000	0.000	134.923	0.000	1.46
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.13
L2	72.33-29.33	A	1.053	0.000	0.000	135.977	0.000	1.48
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.17
L3	29.33-0.00	A	1.000	0.000	0.000	91.048	0.000	0.97
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.12

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	115.00-72.33	-1.2153	-0.5584	-1.5765	-0.7292
L2	72.33-29.33	-1.3141	-0.6039	-1.8109	-0.8377
L3	29.33-0.00	-1.3737	-0.6313	-1.9574	-0.9046

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(2) DB844G65ZAXY w/ Mount Pipe	A	From Face	4.00 0.00 1.00	0.0000	115.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.90 5.35 5.80 6.73 8.73	4.92 5.60 6.28 7.71 10.83	0.03 0.08 0.13 0.26 0.62
(2) DB844G65ZAXY w/ Mount Pipe	B	From Face	4.00 0.00 1.00	0.0000	115.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.90 5.35 5.80 6.73 8.73	4.92 5.60 6.28 7.71 10.83	0.03 0.08 0.13 0.26 0.62
(2) DB844G65ZAXY w/ Mount Pipe	C	From Face	4.00 0.00 1.00	0.0000	115.00	No Ice 1/2" Ice	4.90 5.35 5.80	4.92 5.60 6.28	0.03 0.08 0.13

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
							1" Ice	6.73	7.71	0.26
							2" Ice	8.73	10.83	0.62
							4" Ice			
DB-T1-6Z-8AB-0Z	C	From Face	4.00	0.00	0.0000	115.00	No Ice	5.60	2.33	0.04
			0.00	1.00			1/2" Ice	5.92	2.56	0.08
			1.00				1" Ice	6.24	2.79	0.12
							2" Ice	6.91	3.28	0.21
							4" Ice	8.37	4.37	0.45
Platform Mount [LP 1201-1]	C	None			0.0000	115.00	No Ice	23.10	23.10	2.10
							1/2" Ice	26.80	26.80	2.50
							1" Ice	30.50	30.50	2.90
							2" Ice	37.90	37.90	3.70
							4" Ice	52.70	52.70	5.30
Miscellaneous [NA 510-1]	C	None			0.0000	115.00	No Ice	6.00	6.00	0.26
							1/2" Ice	8.50	8.50	0.34
							1" Ice	11.00	11.00	0.42
							2" Ice	16.00	16.00	0.59
							4" Ice	26.00	26.00	0.93
**********										
(2) HBXX-6517DS-A2M w/ Mount Pipe	A	From Face	4.00	0.00	0.0000	115.00	No Ice	8.98	6.96	0.07
			0.00	1.00			1/2" Ice	9.65	8.18	0.14
			1.00				1" Ice	10.29	9.14	0.21
							2" Ice	11.59	11.02	0.40
							4" Ice	14.32	15.03	0.91
(2) HBXX-6517DS-A2M w/ Mount Pipe	B	From Face	4.00	0.00	0.0000	115.00	No Ice	8.98	6.96	0.07
			0.00	1.00			1/2" Ice	9.65	8.18	0.14
			1.00				1" Ice	10.29	9.14	0.21
							2" Ice	11.59	11.02	0.40
							4" Ice	14.32	15.03	0.91
(2) HBXX-6517DS-A2M w/ Mount Pipe	C	From Face	4.00	0.00	0.0000	115.00	No Ice	8.98	6.96	0.07
			0.00	1.00			1/2" Ice	9.65	8.18	0.14
			1.00				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-AIM w/ Mount Pipe	A	From Face	4.00	0.00	0.0000	115.00	No Ice	8.65	7.08	0.06
			0.00	1.00			1/2" Ice	9.31	8.27	0.13
			1.00				1" Ice	9.93	9.18	0.21
							2" Ice	11.20	11.02	0.39
							4" Ice	13.87	15.06	0.90
LNX-6514DS-AIM w/ Mount Pipe	B	From Face	4.00	0.00	0.0000	115.00	No Ice	8.65	7.08	0.06
			0.00	1.00			1/2" Ice	9.31	8.27	0.13
			1.00				1" Ice	9.93	9.18	0.21
							2" Ice	11.20	11.02	0.39
							4" Ice	13.87	15.06	0.90
LNX-6514DS-AIM w/ Mount Pipe	C	From Face	4.00	0.00	0.0000	115.00	No Ice	8.65	7.08	0.06
			0.00	1.00			1/2" Ice	9.31	8.27	0.13
			1.00				1" Ice	9.93	9.18	0.21
							2" Ice	11.20	11.02	0.39
							4" Ice	13.87	15.06	0.90
Mount Pipe	A	From Face	4.00	0.00	0.0000	115.00	No Ice	1.40	1.40	0.03
			0.00	1.00			1/2" Ice	2.13	2.13	0.04
			1.00				1" Ice	2.68	2.68	0.06
							2" Ice	3.56	3.56	0.10
							4" Ice	5.42	5.42	0.26
Mount Pipe	B	From Face	4.00	0.00	0.0000	115.00	No Ice	1.40	1.40	0.03

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00				1/2"	2.13	2.13	0.04
			1.00				Ice	2.68	2.68	0.06
							1" Ice	3.56	3.56	0.10
							2" Ice	5.42	5.42	0.26
							4" Ice			
Mount Pipe	C	From Face	4.00		0.0000	115.00	No Ice	1.40	1.40	0.03
			0.00				1/2"	2.13	2.13	0.04
			1.00				Ice	2.68	2.68	0.06
							1" Ice	3.56	3.56	0.10
							2" Ice	5.42	5.42	0.26
							4" Ice			
RRH-2X40W-700-MHZ	A	From Face	4.00		0.0000	115.00	No Ice	3.22	1.93	0.05
			0.00				1/2"	3.46	2.13	0.08
			1.00				Ice	3.71	2.34	0.10
							1" Ice	4.23	2.78	0.17
							2" Ice	5.39	3.76	0.35
							4" Ice			
RRH-2X40W-700-MHZ	B	From Face	4.00		0.0000	115.00	No Ice	3.22	1.93	0.05
			0.00				1/2"	3.46	2.13	0.08
			1.00				Ice	3.71	2.34	0.10
							1" Ice	4.23	2.78	0.17
							2" Ice	5.39	3.76	0.35
							4" Ice			
RRH-2X40W-700-MHZ	C	From Face	4.00		0.0000	115.00	No Ice	3.22	1.93	0.05
			0.00				1/2"	3.46	2.13	0.08
			1.00				Ice	3.71	2.34	0.10
							1" Ice	4.23	2.78	0.17
							2" Ice	5.39	3.76	0.35
							4" Ice			
RRH2X60-AWS	A	From Face	4.00		0.0000	115.00	No Ice	2.19	1.43	0.04
			0.00				1/2"	2.40	1.61	0.06
			1.00				Ice	2.61	1.80	0.08
							1" Ice	3.07	2.21	0.13
							2" Ice	4.09	3.13	0.26
							4" Ice			
RRH2X60-AWS	B	From Face	4.00		0.0000	115.00	No Ice	2.19	1.43	0.04
			0.00				1/2"	2.40	1.61	0.06
			1.00				Ice	2.61	1.80	0.08
							1" Ice	3.07	2.21	0.13
							2" Ice	4.09	3.13	0.26
							4" Ice			
RRH2X60-AWS	C	From Face	4.00		0.0000	115.00	No Ice	2.19	1.43	0.04
			0.00				1/2"	2.40	1.61	0.06
			1.00				Ice	2.61	1.80	0.08
							1" Ice	3.07	2.21	0.13
							2" Ice	4.09	3.13	0.26
							4" Ice			
***										
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WIMAX DAP HEAD	A	From Leg	4.00		0.0000	105.00	No Ice	1.80	0.78	0.03
			0.00				1/2"	1.99	0.92	0.04
			0.00				Ice	2.18	1.07	0.06
							1" Ice	2.59	1.39	0.09
							2" Ice	3.51	2.14	0.20
							4" Ice			
WIMAX DAP HEAD	B	From Leg	4.00		0.0000	105.00	No Ice	1.80	0.78	0.03
			0.00				1/2"	1.99	0.92	0.04
			0.00				Ice	2.18	1.07	0.06
							1" Ice	2.59	1.39	0.09
							2" Ice	3.51	2.14	0.20

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
						4" Ice			
WIMAX DAP HEAD	C	From Leg	4.00	0.0000	105.00	No Ice	1.80	0.78	0.03
			0.00			1/2" Ice	1.99	0.92	0.04
			0.00			1" Ice	2.18	1.07	0.06
						2" Ice	2.59	1.39	0.09
						4" Ice	3.51	2.14	0.20
Horizon Compact	A	From Leg	4.00	0.0000	105.00	No Ice	0.84	0.43	0.01
			0.00			1/2" Ice	0.97	0.52	0.02
			3.00			1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
Horizon Compact	B	From Leg	4.00	0.0000	105.00	No Ice	0.84	0.43	0.01
			0.00			1/2" Ice	0.97	0.52	0.02
			3.00			1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
(2) Horizon Compact	C	From Leg	4.00	0.0000	105.00	No Ice	0.84	0.43	0.01
			0.00			1/2" Ice	0.97	0.52	0.02
			3.00			1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
Platform Mount [LP 713-1]	A	None		0.0000	105.00	No Ice	31.27	31.27	1.51
						1/2" Ice	39.68	39.68	1.93
						1" Ice	48.09	48.09	2.35
						2" Ice	64.91	64.91	3.19
						4" Ice	98.55	98.55	4.86

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
VHLP1-23	A	Paraboloid w/o Radome	From Leg	4.00	0.0000		105.00	1.27	No Ice	1.28	0.01
				0.00					1/2" Ice	1.45	0.02
				3.00					1" Ice	1.62	0.03
									2" Ice	1.97	0.04
									4" Ice	2.66	0.07
VHLP1-23	C	Paraboloid w/o Radome	From Leg	4.00	0.0000		105.00	1.27	No Ice	1.28	0.01
				0.00					1/2" Ice	1.45	0.02
				3.00					1" Ice	1.62	0.03
									2" Ice	1.97	0.04
									4" Ice	2.66	0.07
VHLP2-11-2GR	B	Paraboloid w/o Radome	From Leg	4.00	0.0000		105.00	2.17	No Ice	3.72	0.03
				0.00					1/2" Ice	4.01	0.05
				3.00					1" Ice	4.30	0.07
									2" Ice	4.88	0.11
									4" Ice	6.04	0.20

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	115 - 72.3333	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-15.65	0.99	-0.40
			Max. Mx	11	-7.59	385.33	3.30
			Max. My	2	-7.58	3.96	389.93
			Max. Vy	11	-13.06	385.33	3.30
			Max. Vx	2	-13.19	3.96	389.93
			Max. Torque	13			0.66
L2	72.3333 - 29.3333	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-24.48	2.38	0.25
			Max. Mx	11	-13.76	1052.36	8.10
			Max. My	2	-13.75	9.36	1062.07
			Max. Vy	11	-18.60	1052.36	8.10
			Max. Vx	2	-18.72	9.36	1062.07
			Max. Torque	2			1.09
L3	29.3333 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-34.36	3.67	0.85
			Max. Mx	11	-21.37	1780.65	12.07
			Max. My	2	-21.37	13.85	1794.52
			Max. Vy	11	-23.00	1780.65	12.07
			Max. Vx	2	-23.12	13.85	1794.52

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Torque	2			1.63

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	15	34.36	0.03	7.16
	Max. H_x	11	21.38	22.99	0.11
	Max. H_z	2	21.38	0.12	23.11
	Max. M_x	2	1794.52	0.12	23.11
	Max. M_z	5	1773.96	-22.94	0.04
	Max. Torsion	2	1.63	0.12	23.11
	Min. Vert	1	21.38	0.00	0.00
	Min. H_x	5	21.38	-22.94	0.04
	Min. H_z	8	21.38	-0.01	-23.06
	Min. M_x	8	-1788.12	-0.01	-23.06
	Min. M_z	11	-1780.65	22.99	0.11
	Min. Torsion	8	-1.48	-0.01	-23.06

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	21.38	0.00	0.00	-0.16	0.88	0.00
Dead+Wind 0 deg - No Ice	21.38	-0.12	-23.11	-1794.52	13.85	-1.63
Dead+Wind 30 deg - No Ice	21.38	11.49	-19.92	-1543.29	-888.22	-1.43
Dead+Wind 60 deg - No Ice	21.38	19.87	-11.52	-893.46	-1536.48	-0.83
Dead+Wind 90 deg - No Ice	21.38	22.94	-0.04	-4.65	-1773.96	-0.04
Dead+Wind 120 deg - No Ice	21.38	19.91	11.55	896.47	-1540.28	0.65
Dead+Wind 150 deg - No Ice	21.38	11.44	19.99	1550.97	-882.64	1.16
Dead+Wind 180 deg - No Ice	21.38	0.01	23.06	1788.12	-0.09	1.48
Dead+Wind 210 deg - No Ice	21.38	-11.42	19.96	1547.32	882.49	1.43
Dead+Wind 240 deg - No Ice	21.38	-19.97	11.45	885.81	1549.52	0.98
Dead+Wind 270 deg - No Ice	21.38	-22.99	-0.11	-12.07	1780.65	0.27
Dead+Wind 300 deg - No Ice	21.38	-19.93	-11.57	-898.51	1545.05	-0.65
Dead+Wind 330 deg - No Ice	21.38	-11.59	-19.95	-1547.33	901.07	-1.39
Dead+Ice+Temp	34.36	-0.00	0.00	-0.85	3.67	-0.00
Dead+Wind 0 deg+Ice+Temp	34.36	-0.03	-7.16	-561.91	7.06	-0.71
Dead+Wind 30 deg+Ice+Temp	34.36	3.56	-6.17	-483.74	-274.90	-0.67
Dead+Wind 60 deg+Ice+Temp	34.36	6.16	-3.57	-280.35	-477.96	-0.45
Dead+Wind 90 deg+Ice+Temp	34.36	7.12	-0.01	-2.22	-552.32	-0.12
Dead+Wind 120 deg+Ice+Temp	34.36	6.17	3.58	279.51	-479.00	0.22
Dead+Wind 150 deg+Ice+Temp	34.36	3.55	6.19	484.25	-273.12	0.50
Dead+Wind 180 deg+Ice+Temp	34.36	0.00	7.14	558.54	3.49	0.67
Dead+Wind 210 deg+Ice+Temp	34.36	-3.54	6.18	483.32	280.11	0.67
Dead+Wind 240 deg+Ice+Temp	34.36	-6.19	3.55	276.79	488.40	0.49
Dead+Wind 270 deg+Ice+Temp	34.36	-7.13	-0.03	-4.10	561.05	0.18
Dead+Wind 300 deg+Ice+Temp	34.36	-6.18	-3.58	-281.64	487.17	-0.22

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 330 deg+Ice+Temp	34.36	-3.59	-6.18	-484.77	285.20	-0.56
Dead+Wind 0 deg - Service	21.38	-0.05	-9.03	-701.54	5.97	-0.64
Dead+Wind 30 deg - Service	21.38	4.49	-7.78	-603.34	-346.63	-0.56
Dead+Wind 60 deg - Service	21.38	7.76	-4.50	-349.33	-600.02	-0.32
Dead+Wind 90 deg - Service	21.38	8.96	-0.02	-1.92	-692.84	-0.02
Dead+Wind 120 deg - Service	21.38	7.78	4.51	350.31	-601.51	0.25
Dead+Wind 150 deg - Service	21.38	4.47	7.81	606.14	-344.45	0.45
Dead+Wind 180 deg - Service	21.38	0.00	9.01	698.84	0.52	0.58
Dead+Wind 210 deg - Service	21.38	-4.46	7.80	604.71	345.50	0.56
Dead+Wind 240 deg - Service	21.38	-7.80	4.47	346.15	606.23	0.39
Dead+Wind 270 deg - Service	21.38	-8.98	-0.04	-4.82	696.57	0.11
Dead+Wind 300 deg - Service	21.38	-7.79	-4.52	-351.31	604.48	-0.25
Dead+Wind 330 deg - Service	21.38	-4.53	-7.79	-604.92	352.77	-0.55

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	-21.38	0.00	0.00	21.38	0.00	0.000%
2	-0.12	-21.38	-23.11	0.12	21.38	23.11	0.000%
3	11.49	-21.38	-19.92	-11.49	21.38	19.92	0.000%
4	19.87	-21.38	-11.52	-19.87	21.38	11.52	0.000%
5	22.94	-21.38	-0.04	-22.94	21.38	0.04	0.000%
6	19.91	-21.38	11.55	-19.91	21.38	-11.55	0.000%
7	11.44	-21.38	19.99	-11.44	21.38	-19.99	0.000%
8	0.01	-21.38	23.06	-0.01	21.38	-23.06	0.000%
9	-11.42	-21.38	19.96	11.42	21.38	-19.96	0.000%
10	-19.97	-21.38	11.45	19.97	21.38	-11.45	0.000%
11	-22.99	-21.38	-0.11	22.99	21.38	0.11	0.000%
12	-19.93	-21.38	-11.57	19.93	21.38	11.57	0.000%
13	-11.59	-21.38	-19.95	11.59	21.38	19.95	0.000%
14	0.00	-34.36	0.00	0.00	34.36	-0.00	0.000%
15	-0.03	-34.36	-7.16	0.03	34.36	7.16	0.000%
16	3.56	-34.36	-6.17	-3.56	34.36	6.17	0.000%
17	6.16	-34.36	-3.57	-6.16	34.36	3.57	0.000%
18	7.12	-34.36	-0.01	-7.12	34.36	0.01	0.000%
19	6.17	-34.36	3.58	-6.17	34.36	-3.58	0.000%
20	3.55	-34.36	6.19	-3.55	34.36	-6.19	0.000%
21	0.00	-34.36	7.14	-0.00	34.36	-7.14	0.000%
22	-3.54	-34.36	6.18	3.54	34.36	-6.18	0.000%
23	-6.19	-34.36	3.55	6.19	34.36	-3.55	0.000%
24	-7.13	-34.36	-0.03	7.13	34.36	0.03	0.000%
25	-6.18	-34.36	-3.58	6.18	34.36	3.58	0.000%
26	-3.59	-34.36	-6.18	3.59	34.36	6.18	0.000%
27	-0.05	-21.38	-9.03	0.05	21.38	9.03	0.000%
28	4.49	-21.38	-7.78	-4.49	21.38	7.78	0.000%
29	7.76	-21.38	-4.50	-7.76	21.38	4.50	0.000%
30	8.96	-21.38	-0.02	-8.96	21.38	0.02	0.000%
31	7.78	-21.38	4.51	-7.78	21.38	-4.51	0.000%
32	4.47	-21.38	7.81	-4.47	21.38	-7.81	0.000%
33	0.00	-21.38	9.01	-0.00	21.38	-9.01	0.000%
34	-4.46	-21.38	7.80	4.46	21.38	-7.80	0.000%
35	-7.80	-21.38	4.47	7.80	21.38	-4.47	0.000%
36	-8.98	-21.38	-0.04	8.98	21.38	0.04	0.000%
37	-7.79	-21.38	-4.52	7.79	21.38	4.52	0.000%
38	-4.53	-21.38	-7.79	4.53	21.38	7.79	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	0.00022865
3	Yes	5	0.00000001	0.00007482
4	Yes	5	0.00000001	0.00007641
5	Yes	4	0.00000001	0.00007769
6	Yes	5	0.00000001	0.00007885
7	Yes	5	0.00000001	0.00007434
8	Yes	4	0.00000001	0.00013941
9	Yes	5	0.00000001	0.00007785
10	Yes	5	0.00000001	0.00007591
11	Yes	4	0.00000001	0.00004411
12	Yes	5	0.00000001	0.00007542
13	Yes	5	0.00000001	0.00008073
14	Yes	4	0.00000001	0.00000850
15	Yes	5	0.00000001	0.00006622
16	Yes	5	0.00000001	0.00007689
17	Yes	5	0.00000001	0.00007725
18	Yes	5	0.00000001	0.00006488
19	Yes	5	0.00000001	0.00007776
20	Yes	5	0.00000001	0.00007701
21	Yes	5	0.00000001	0.00006599
22	Yes	5	0.00000001	0.00007866
23	Yes	5	0.00000001	0.00007828
24	Yes	5	0.00000001	0.00006600
25	Yes	5	0.00000001	0.00007845
26	Yes	5	0.00000001	0.00007946
27	Yes	4	0.00000001	0.00004917
28	Yes	4	0.00000001	0.00026216
29	Yes	4	0.00000001	0.00027337
30	Yes	4	0.00000001	0.00002565
31	Yes	4	0.00000001	0.00029080
32	Yes	4	0.00000001	0.00025915
33	Yes	4	0.00000001	0.00003689
34	Yes	4	0.00000001	0.00028597
35	Yes	4	0.00000001	0.00027054
36	Yes	4	0.00000001	0.00001821
37	Yes	4	0.00000001	0.00026538
38	Yes	4	0.00000001	0.00030412

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	115 - 72.3333	21.279	27	1.6134	0.0027
L2	77 - 29.3333	9.687	27	1.1808	0.0013
L3	35 - 0	2.011	27	0.5135	0.0006

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
115.00	(2) DB844G65ZAXY w/ Mount Pipe	27	21.279	1.6134	0.0033	25651

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
108.00	VHLP1-23	27	18.991	1.5421	0.0030	18322
105.00	WIMAX DAP HEAD	27	18.018	1.5111	0.0028	12825

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	115 - 72.3333	54.397	2	4.1274	0.0069
L2	77 - 29.3333	24.768	2	3.0195	0.0034
L3	35 - 0	5.143	2	1.3135	0.0014

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
115.00	(2) DB844G65ZAXY w/ Mount Pipe	2	54.397	4.1274	0.0084	10104
108.00	VHLP1-23	2	48.550	3.9446	0.0076	7217
105.00	WIMAX DAP HEAD	2	46.064	3.8652	0.0072	5051

Compression Checks

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	115 - 72.3333 (1)	TP30.45x21.91x0.219	42.67	0.00	0.0	36.883	20.6596	-7.58	761.98	0.010
L2	72.3333 - 29.3333 (2)	TP38.61x29.0779x0.313	47.67	0.00	0.0	39.000	37.4559	-13.75	1460.78	0.009
L3	29.3333 - 0 (3)	TP43.85x36.8508x0.375	35.00	0.00	0.0	39.000	52.4961	-21.37	2047.35	0.010

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	115 - 72.3333 (1)	TP30.45x21.91x0.219	389.95	31.610	36.883	0.857	0.00	0.000	36.883	0.000
L2	72.3333 - 29.3333 (2)	TP38.61x29.0779x0.313	1062.11	37.471	39.000	0.961	0.00	0.000	39.000	0.000
L3	29.3333 - 0 (3)	TP43.85x36.8508x0.375	1794.57	38.623	39.000	0.990	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	115 - 72.3333 (1)	TP30.45x21.91x0.219	13.19	0.638	26.000	0.050	0.49	0.019	26.000	0.001
L2	72.3333 - 29.3333 (2)	TP38.61x29.0779x0.313	18.72	0.500	26.000	0.039	1.09	0.018	26.000	0.001
L3	29.3333 - 0 (3)	TP43.85x36.8508x0.375	23.12	0.440	26.000	0.034	1.63	0.017	26.000	0.001

Pole Interaction Design Data

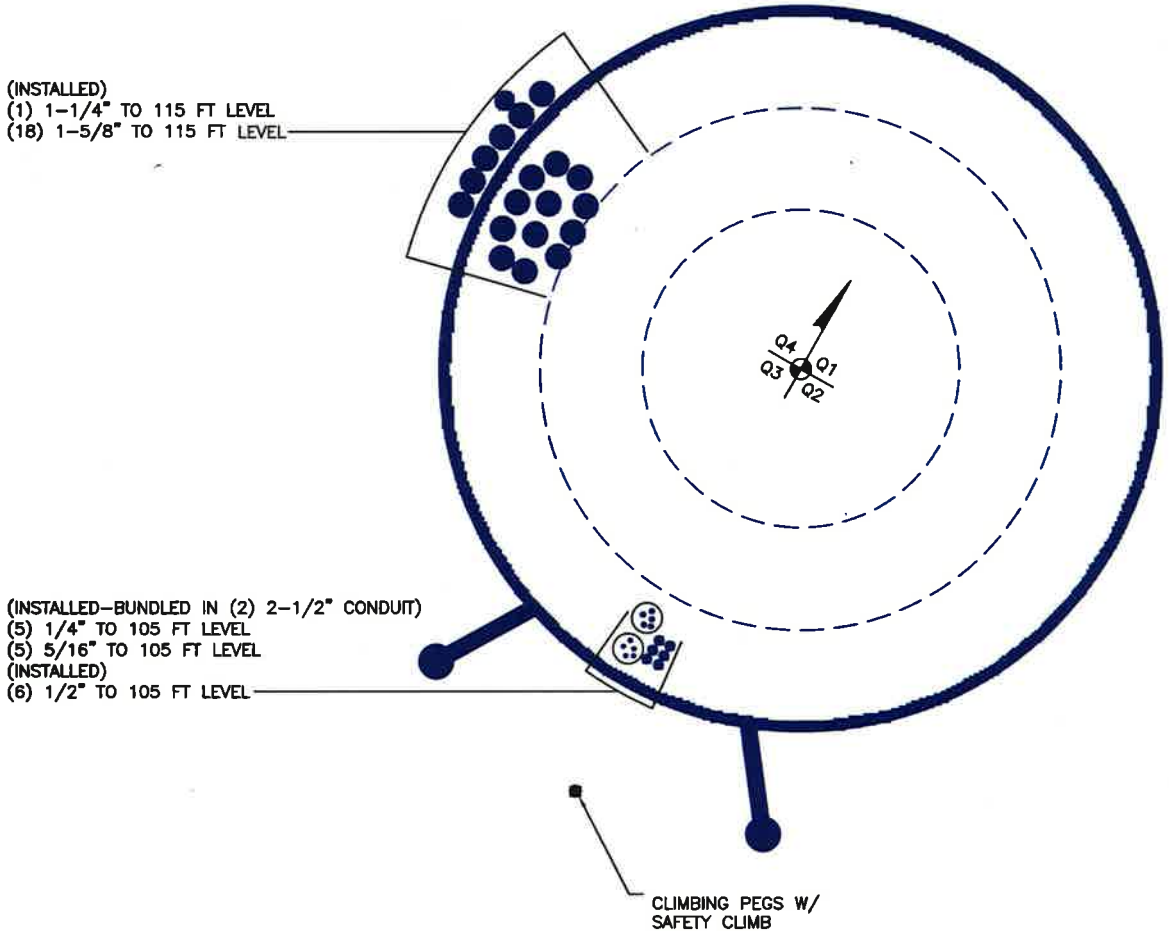
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	115 - 72.3333 (1)	0.010	0.857	0.000	0.050	0.001	0.868 ✔	1.333	H1-3+VT ✔
L2	72.3333 - 29.3333 (2)	0.009	0.961	0.000	0.039	0.001	0.971 ✔	1.333	H1-3+VT ✔
L3	29.3333 - 0 (3)	0.010	0.990	0.000	0.034	0.001	1.001 ✔	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	115 - 72.3333	Pole	TP30.45x21.91x0.219	1	-7.58	1015.72	65.1	Pass
L2	72.3333 - 29.3333	Pole	TP38.61x29.0779x0.313	2	-13.75	1947.22	72.8	Pass
L3	29.3333 - 0	Pole	TP43.85x36.8508x0.375	3	-21.37	2729.12	75.1	Pass
							Summary	
							Pole (L3) 75.1	Pass
							RATING = 75.1	**Pass**

APPENDIX B

BASE LEVEL DRAWING


(INSTALLED)
(1) 1-1/4" TO 115 FT LEVEL
(18) 1-5/8" TO 115 FT LEVEL
Q4
Q1
Q3
Q2
(INSTALLED-BUNDLED IN (2) 2-1/2" CONDUIT)
(5) 1/4" TO 105 FT LEVEL
(5) 5/16" TO 105 FT LEVEL
(INSTALLED)
(6) 1/2" TO 105 FT LEVEL
CLIMBING PEGS W/
SAFETY CLIMB

APPENDIX C

ADDITIONAL CALCULATIONS

CAISSON Version 10.61 4:53:42 PM Wednesday, March 11, 2015
FDH Engineering
****
* CAISSON - Pier Foundations Analysis and Design - Copyright Power Line Systems, Inc. 1993-2010 *
****

Project Title: HRT 093 943228
Project Notes:

Calculation Method: Full 8CD

******* I N P U T D A T A

Pier Properties

Diameter (ft)	Distance of Top of Pier above Ground (ft)	Concrete Strength (ksi)	Steel Yield Strength (ksi)
6.00	0.40	3.00	60.00

Soil Properties

Layer	Type	Thickness (ft)	Depth at Top of Layer (ft)	Density (lbs/ft^3)	CU (psf)	KP	PHI (deg)
1	Clay	3.33	0.00	105.0			
2	Sand	3.67	3.33	105.0		2.770	28.00
3	Sand	5.00	7.00	106.0		2.882	29.00
4	Sand	5.00	12.00	120.0		3.392	33.00
5	Sand	5.00	17.00	111.0		3.000	30.00

Design (Factored) Loads at Top of Pier

Moment (ft-k)	Axial Load (kips)	Shear Load (kips)	Additional Safety Factor Against Soil Failure	
1795.0	21.0	23.00	2.23	Soil Interaction= 2.0/2.23=.897

******* R E S U L T S

Calculated Pier Properties

Length (ft)	Weight (kips)	Pressure Due To Axial Load (psf)	Pressure Due To Weight (psf)	Total End-Bearing Pressure (psf)
21.500	91.185	742.7	3225.0	3967.7

Ultimate Resisting Forces Along Pier

Type	Distance of Top of Layer to Top of Pier (ft)	Thickness (ft)	Density (lbs/ft^3)	CU (psf)	KP	Force (kips)	Arm (ft)
Clay	0.40	3.33	105.0			0.00	2.06
Sand	3.73	3.67	105.0		2.770	99.24	5.78
Sand	7.40	5.00	106.0		2.882	259.38	10.12
Sand	12.40	3.52	120.0		3.392	317.18	14.24
Sand	15.92	1.48	120.0		3.392	-160.58	16.67
Sand	17.40	4.10	111.0		3.000	-463.29	19.52

Shear and Moments Along Pier

Distance below Top of Pier (ft)	Shear (with Safety Factor) (kips)	Moment (with Safety Factor) (ft-k)	Shear (without Safety Factor) (kips)	Moment (without Safety Factor) (ft-k)
0.00	51.9	4005.9	23.3	1796.4
2.15	51.9	4117.5	23.3	1846.4
4.30	41.1	4226.2	18.4	1895.1
6.45	-14.9	4258.8	-6.7	Max Moment= 1909.8
8.60	-97.0	4143.8	-43.5	1858.2
10.75	-205.9	3822.7	-92.3	1714.2
12.90	-346.2	3238.7	-155.3	1452.3
15.05	-537.1	2295.2	-240.8	1029.3
17.20	-485.9	1079.1	-217.9	483.9
19.35	-255.5	279.6	-114.6	125.4
21.50	-0.0	-0.0	-0.0	-0.0

Moment Capacity of Drilled Concrete Shaft (Caisson) for TIA Rev F or G

Note: Shaft assumed to have ties, not spiral, transverse reinforcing

Site Data

BU#:
Site Name:
App #:

Enter Load Factors Below:		
For M (WL)	1.3	<---- Enter Factor
For P (DL)	1.3	<---- Enter Factor

Pier Properties

Concrete:

Pier Diameter =	6.0	ft
Concrete Area =	4071.5	in^2

Reinforcement:

Clear Cover to **Tie**=	5.00	in
Horiz. **Tie** Bar Size=	4	
Vert. Cage Diameter =	4.98	ft
Vert. Cage Diameter =	59.73	in
Vertical Bar Size =	10	
Bar Diameter =	1.27	in
Bar Area =	1.27	in^2
Number of Bars =	21	
As Total=	26.67	in^2
A s/ Aconc, Rho:	0.0066	0.66%

ACI 10.5 , ACI 21.10.4, and IBC 1810.

Min As for Flexural, Tension Controlled, Shafts:

(3)*(Sqrt(f'c)/Fy:	0.0027
200 / Fy:	0.0033

Minimum Rho Check:

Actual Req'd Min. Rho:	0.33%	Flexural
Provided Rho:	0.66%	OK

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn.		
Pn per ACI 318 (10-2)	6195.55	kips
at Mu=(ϕ=0.65)Mn=	3165.33	ft-kips
Max Tu, (φ=0.9) Tn =	1440.18	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Maximum Shaft Superimposed Forces

TIA Revision:	F	
Max. Service Shaft M:	1909.8	ft-kips **(* Note)**
Max. Service Shaft P:	21	kips
Max Axial Force Type:	Comp.	

(*) Note: Max Shaft Superimposed Moment does not necessarily equal to the shaft top reaction moment

Load Factor	Shaft Factored Loads		
1.30	Mu:	2482.74	ft-kips
1.30	Pu:	27.3	kips

Material Properties

Concrete Comp. strength, f'c =	3000	psi
Reinforcement yield strength, Fy =	60	ksi
Reinforcing Modulus of Elasticity, E =	29000	ksi
Reinforcement yield strain =	0.00207	
Limiting compressive strain =	0.003	

ACI 318 Code

Select Analysis ACI Code= 2002

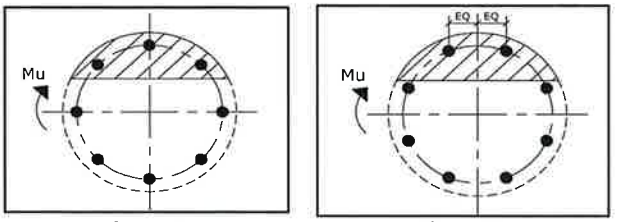
Seismic Properties

Seismic Design Category =	B
Seismic Risk =	**Low**

Solve (Run) <-- Press Upon Completing All Input

Results:

Governing Orientation Case: **1**



Case 1 Case 2

Dist. From Edge to Neutral Axis:	**12.94**	in
Extreme Steel Strain, εt:	**0.0122**	
εt > 0.0050, Tension Controlled		
Reduction Factor,φ:	**0.900**	

Output Note: Negative Pu=Tension

For Axial Compression, φ Pn = Pu:	27.30	kips
Drilled Shaft Moment Capacity, φMn:	**3463.28**	ft-kips
Drilled Shaft Superimposed Mu:	**2482.74**	ft-kips

(Mu/φMn, Drilled Shaft Flexure CSR:	**71.7%**

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

TIA Rev F

Site Data

BU#: *0*
Site Name: *0*
App #: *0*

Pole Manufacturer:	*Other*

Reactions		
Moment:	1795	ft-kips
Axial:	21	kips
Shear:	23	kips

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

Anchor Rod Data		
Qty:	12	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	51.9	in

Plate Data		
Diam:	57.9	in
Thick:	2.625	in
Grade:	60	ksi
Single-Rod B-eff:	11.75	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:	43.85	in
Thick:	0.375	in
Grade:	65	ksi
# of Sides:	12	"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:	136.6 Kips	Rigid
Allowable Tension:	195.0 Kips	Service, ASD
Anchor Rod Stress Ratio:	70.1% **Pass**	Fty*ASIF

Base Plate Results

Base Plate Results	Flexural Check	Rigid
Base Plate Stress:	26.7 ksi	Service ASD
Allowable Plate Stress:	60.0 ksi	0.75*Fy*ASIF
Base Plate Stress Ratio:	44.5% **Pass**	Y.L. Length: 27.76

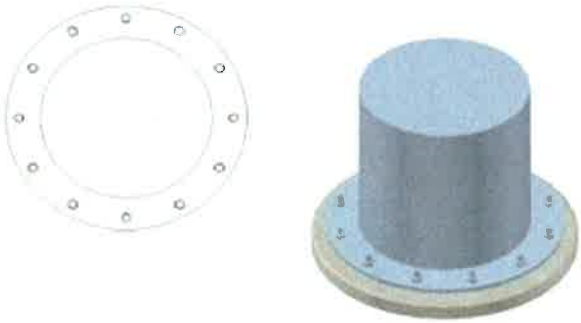
n/a

Stiffener Results

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