Robinson+Cole

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Also admitted in Massachusetts

December 11, 2014

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

Re: **Notice of Exempt Modification – Facility Modification**
56 Cosgrove Road, Willington, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) antennas at the top of the existing 140-foot tower at 56 Cosgrove Road in Willington, Connecticut (the Property"). The tower is owned by Crown Castle. The Council approved Cellco's use of this tower in 1986 (Docket No. 58). Cellco now intends to modify its facility by replacing all twelve (12) of its existing antennas with three (3) model LNX-6514DS-VTM, 700 MHz antennas; three (3) model LNX-8513DS-VTM, 850 MHZ antennas; three (3) model HBXX-6517DS-VTM, 1900 MHz antennas; and three (3) model HBXX-6517DS-VTM, 2100 MHz antennas, at the same level on the tower. Cellco also intends to install six (6) remote radio heads ("RRHs") behind its new 1900 MHz and 2100 MHz antennas and two (2) HYBRIFLEX™ antenna cables. Attached behind Tab 1 are the specifications for the replacement antennas, RRHs and HYBRIFLEX™ cables.

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 Christina B. Mailhos, First Selectwoman for the Town of Willington. A copy of this letter is also being sent to Laurel Pond Associates 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 139-foot level of the 140-foot 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.

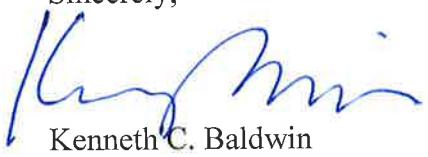
4. The operation of the replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. A cumulative General Power Density table for Cellco's modified facility is included in Attachment 2.

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:
Christina B. Mailhos, Willington First Selectwoman
Laurel Pond Associates LLC
Sandy M. Carter

ATTACHMENT 1

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, Horizontal Tolerance, degrees	±3	±3
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°

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	17.6 kg | 38.8 lb
Model with factory installed AISG 2.0 RET	LNX-6514DS-A1M

Product Specifications

COMMSCOPE®

LNX-8513DS-VTM

Andrew® Teletilt® Antenna, 698–896 MHz, 85° horizontal beamwidth, RET compatible

POWERED BY ANDREW.

Electrical Specifications

Frequency Band, MHz	698–806	806–896
Gain, dBi	14.6	15.3
Beamwidth, Horizontal, degrees	85	85
Beamwidth, Vertical, degrees	12.2	11.0
Beam Tilt, degrees	0–10	0–10
USLS, typical, dB	17	17
Front-to-Back Ratio at 180°, dB	25	26
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°

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	17.8 kg | 39.2 lb
Model with factory installed AISG 2.0 RET	LNX-8513DS-A1M

Product Specifications

COMMSCOPE®

HBXX-6517DS-VTM

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

POWERED BY ANDREW.

Electrical Specifications

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 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
Beam Tilt, degrees	0–6	0–6	0–6
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
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°

**Values calculated using NGMN Alliance N-P-BASTA v9.6*

Mechanical Specifications

Color | Radome Material	Light gray | PVC, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 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
Antenna Dimensions, L x W x D	1903.0 mm x 305.0 mm x 166.0 mm | 74.9 in x 12.0 in x 6.5 in
Net Weight	19.5 kg | 43.0 lb
Model with factory installed AISG 2.0 RET	HBXX-6517DS-A2M

PCS RF MODULES
RRH1900 2X60 - HW CHARACTERISTICS

LA6.0.1/13.3

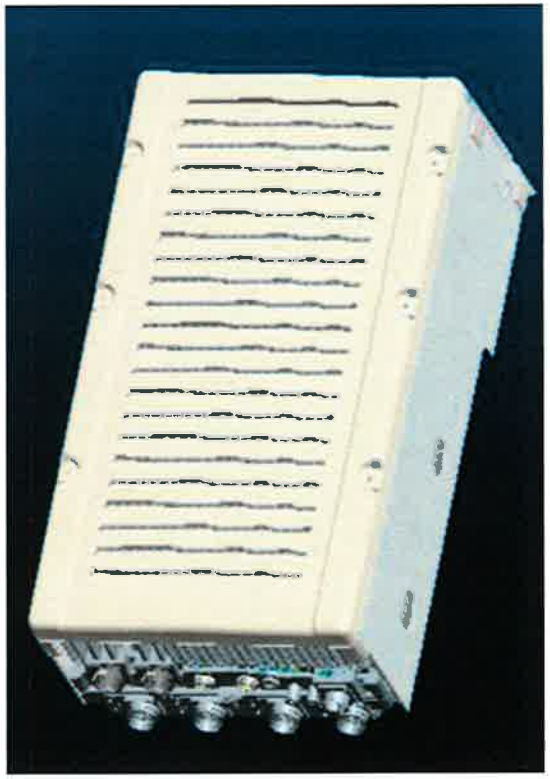
		RRH2x60
RF Output Power		2x60W
Instantaneous Bandwidth		20MHz
Transmitter		2 TX
Receiver	1900 HW version 1900A HW version	2 Branch RX – LA6.0.1 4 Branch RX – LR13.3
Features		AISG 2.0 for RET/TMA
		Internal Smart Bias-T
Power		-48VDC
CPRI Ports		2 CPRI Rate 3 Ports
External Alarms		4 External User Alarms
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**

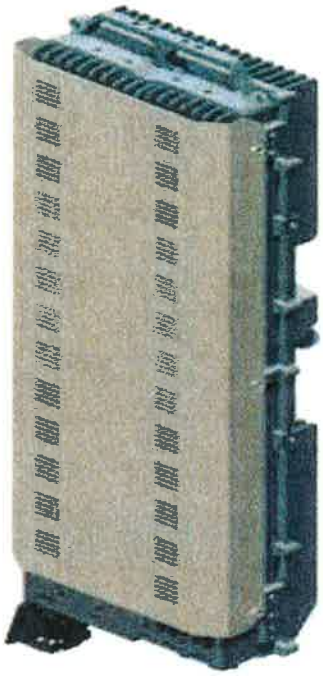


**- Includes solar shield but not mounting brackets (8 lbs.)

Alcatel·Lucent

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.

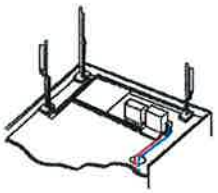
EASY INSTALLATION

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.

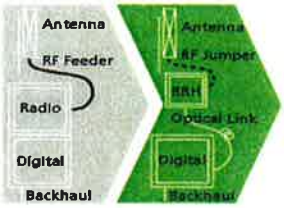
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation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

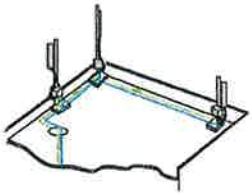
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



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.

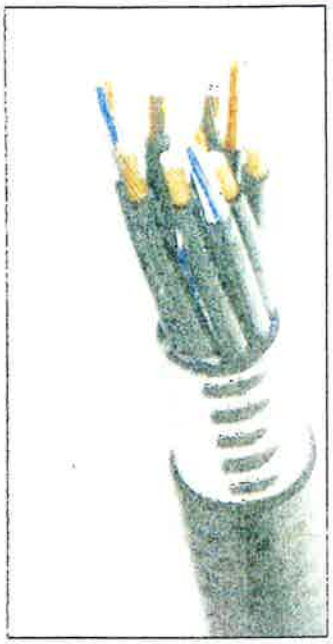


Figure 1: HYBRIFLEX Series

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)

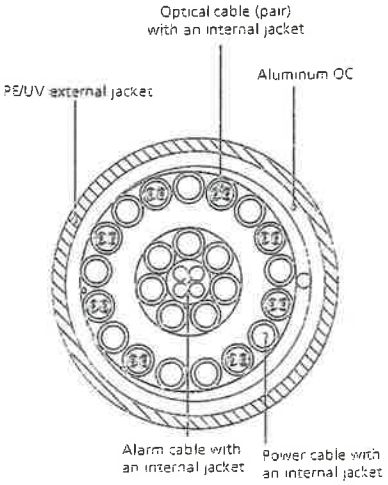


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

	General	Power	Density					
Site Name: Willington								
Tower Height: Verizon @ 140'								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*Omnipoint	1	288	101.5	0.0101	1930	1.0000	1.01%	
*Willington FD	1	61	141	0.0011	33.44	0.2000	0.55%	
*Willington FD	1	61	147	0.0010	452.4	0.3016	0.34%	
*Pocket (now MetroPCS)	3	631	90	0.0840	2130	1.0000	8.40%	
*Nextel			115	0.0136	851	0.5673	2.40%	
*Sprint			125	0.0250	1960	1.0000	2.50%	
Verizon PCS	**11**	**420**	**139**	**0.0860**	**1970**	**1.0000**	**8.60%**	
Verizon Cellular	**9**	**393**	**139**	**0.0658**	**869**	**0.5793**	**11.36%**	
Verizon AWS	**1**	**1750**	**139**	**0.0326**	**2145**	**1.0000**	**3.26%**	
Verizon 700	**1**	**1050**	**139**	**0.0195**	**746**	**0.4973**	**3.93%**	
								42.3%
* Source: Siting Council								

ATTACHMENT 3

Date: **November 07, 2014**

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 Name:	Willington, CT
Crown Castle Designation:	**Crown Castle BU Number:**	806383
	Crown Castle Site Name:	HRT 087 943325
	Crown Castle JDE Job Number:	313328
	Crown Castle Work Order Number:	959070
	Crown Castle Application Number:	271027 Rev. 1
Engineering Firm Designation:	**FDH Engineering, Inc. Project Number:**	146GCJ1400

Site Data: **COSGROVE ROADWHIFFORD HILL, WEST WILLINGTON, Tolland County, CT**
Latitude *41° 53' 32.92"*, Longitude *-72° 15' 38.15"*
140 Foot - Self Support 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 725234, in accordance with application 271027, revision 1.

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 the 2005 CT State Building Code based upon a wind speed of 85 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.

Respectfully submitted by:

Anne E. Vago, EI
Project Engineer

Reviewed by:

Bradley R. Newman, PE
Senior Project Engineer
CT PE License No. 29630

STATE OF CONNECTICUT
BRADLEY R. NEWMAN
20630
LICENSED
PROFESSIONAL ENGINEER
11/7/14

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 140 ft Self Support tower designed by ROHN in December of 1986. The tower's original design wind speed and code are unknown.

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 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
137.0	139.0	3	alcatel lucent	RRH2X60-AWS	2	1-5/8	-
		3	alcatel lucent	RRH2X60-PCS			
		6	andrew	HBXX-6517DS-VTM w/ Mount Pipe			
		3	andrew	LNX-6514DS-VTM w/ Mount Pipe			
		3	andrew	LNX-8513DS-A1M w/ Mount Pipe			
		2	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
137.0	139.0	3	antel	BXA-185063/12CF w/ Mount Pipe	-	-	2
		6	antel	LPA-80080/6CF w/Mount Pipe			
		3	powerwave technologies	P65.16.XL.2 w/ Mount Pipe			
	137.0	6	rfs celwave	FD9R6004/2C-3L	12	1-5/8	1
		1	crown mounts	Sector Mount [SM 506-3]			
124.0	125.0	6	decibel	DB980H90E-M w/ Mount Pipe	6	1-5/8	1
	124.0	1	tower mounts	Sector Mount [SM 502-3]			
112.0	114.0	12	swedcom	ALP 9212-N w/ Mount Pipe	12	1-1/4	3
		9	decibel	DB844H90E-XY w/ Mount Pipe	9	7/8	2
	112.0	1	crown mounts	Sector Mount [SM 201-3]			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
101.0	101.0	-	-	-	6	7/8	3
		1	crown mounts	Side Arm Mount [SO 304-3]	6	1-1/4	1
		6	ems wireless	RV90-17-02DP w/ Mount Pipe			
		6	ericsson	KRY 112 13/1			
60.0	60.0	1	crown mounts	Side Arm Mount [SO 305-1]	1	1/2	1
		1	gps	GPS_A			
50.0	50.0	1	crown mounts	Side Arm Mount [SO 201-1]	1	1/2	1
		1	unknown	GPS			

Notes:
1) Existing Equipment
2) Equipment To Be Removed; Not Considered in this Analysis
3) SLA Equipment; 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)
140	140	4	-	PD10017 Antennas	-	-
131	131	6	-	PD1132 antennas	-	-
121	121	2	-	6' Std dishes	-	-
100	100	1	-	PD1109 Antenna	-	-

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	JGI Eastern	1069386	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Rohn	1069383	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Rohn	1069394	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.
5) The loading at the 112' level will be removed before installation of proposed loading.

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
T1	140 - 120	Leg	ROHN 2 STD	2	-20.29	32.30	62.8	Pass
T2	120 - 100	Leg	ROHN 2.5 EH	38	-44.65	65.60	68.1	Pass
T3	100 - 80	Leg	ROHN 3 EH	68	-66.21	83.78	79.0	Pass
T4	80 - 60	Leg	ROHN 3.5 EH	90	-87.35	110.27	79.2	Pass
T5	60 - 40	Leg	ROHN 4 X-STR	111	-107.73	139.07	77.5	Pass
T6	40 - 20	Leg	ROHN 5 EH	130	-126.17	177.46	71.1	Pass
T7	20 - 0	Leg	ROHN 5 X-STR	145	-151.43	177.86	85.1	Pass
T1	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	7	-3.54	7.71	45.8 67.8 (b)	Pass
T2	120 - 100	Diagonal	L1 3/4x1 3/4x3/16	44	-3.08	4.45	69.2	Pass
T3	100 - 80	Diagonal	L2x2x3/16	74	-3.76	4.18	89.9	Pass
T4	80 - 60	Diagonal	L2 1/2x2 1/2x3/16	95	-4.05	6.39	63.4 73.7 (b)	Pass
T5	60 - 40	Diagonal	L3x3x3/16	116	-4.43	8.74	50.7 80.6 (b)	Pass
T6	40 - 20	Diagonal	L3x3x3/16	137	-5.41	5.99	90.3	Pass
T7	20 - 0	Diagonal	L3x3x1/4	152	-5.78	6.57	87.9	Pass
T1	140 - 120	Top Girt	L2x2x1/8	6	-0.52	2.83	18.2	Pass
T2	120 - 100	Top Girt	L2x2x1/8	41	-0.09	2.79	3.3	Pass
							Summary	
						Leg (T7)	85.1	Pass
						Diagonal (T6)	90.3	Pass
						Top Girt (T1)	18.2	Pass
						Bolt Checks	80.6	Pass
						Rating =	**90.3**	**Pass**

Table 6 - Tower Component Stresses vs. Capacity – LC5

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	77.6	Pass
1	Base Foundation	0	23.5	Pass
1	Base Foundation Soil Interactions	0	80.6	Pass

Structure Rating (max from all components) =	90.3%

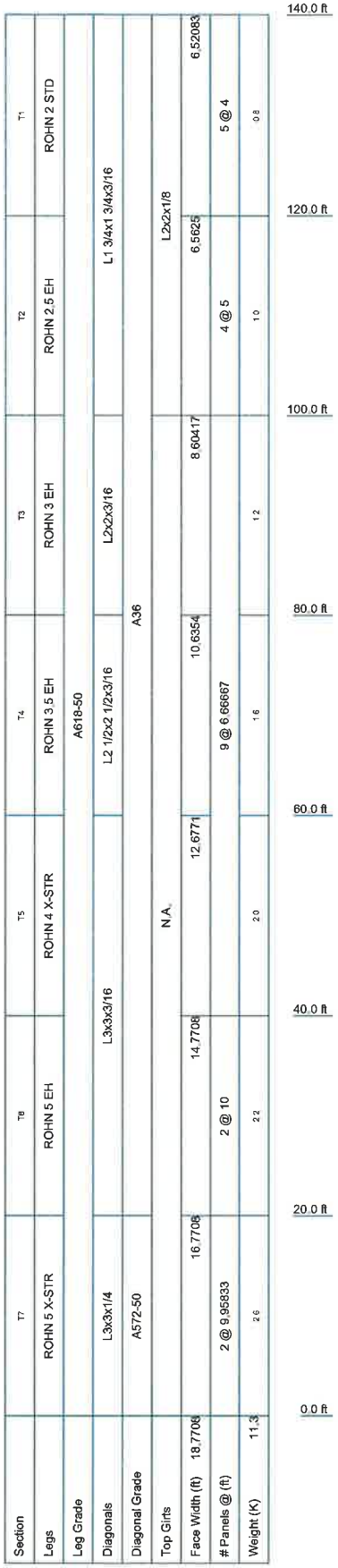
Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

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



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod	140	DB-T1-6Z-8AB-0Z	137
(2) FD9R6004/2C-3L	137	DB-T1-6Z-8AB-0Z	137
(2) FD9R6004/2C-3L	137	(2) DB980H90E-M w/ Mount Pipe	124
(2) FD9R6004/2C-3L	137	(2) DB980H90E-M w/ Mount Pipe	124
Sector Mount [SM 506-3]	137	(2) DB980H90E-M w/ Mount Pipe	124
(2) HBXX-6517DS-VTM w/ Mount Pipe	137	Sector Mount [SM 502-3]	124
(2) HBXX-6517DS-VTM w/ Mount Pipe	137	7'x2" Antenna Mount Pipe	124
(2) HBXX-6517DS-VTM w/ Mount Pipe	137	7'x2" Antenna Mount Pipe	124
LNX-6514DS-VTM w/ Mount Pipe	137	7'x2" Antenna Mount Pipe	124
LNX-6514DS-VTM w/ Mount Pipe	137	(2) RV90-17-02DP w/ Mount Pipe	101
LNX-6514DS-VTM w/ Mount Pipe	137	(2) RV90-17-02DP w/ Mount Pipe	101
LNX-8513DS-A1M w/ Mount Pipe	137	(2) RV90-17-02DP w/ Mount Pipe	101
LNX-8513DS-A1M w/ Mount Pipe	137	(2) KRY 112 13/1	101
LNX-8513DS-A1M w/ Mount Pipe	137	(2) KRY 112 13/1	101
RRH2X60-AWS	137	(2) KRY 112 13/1	101
RRH2X60-AWS	137	Side Arm Mount [SO 304-3]	101
RRH2X60-AWS	137	GPS_A	60
RRH2X60-PCS	137	Side Arm Mount [SO 305-1]	60
RRH2X60-PCS	137	GPS	50
RRH2X60-PCS	137	Side Arm Mount [SO 201-1]	50

MATERIAL STRENGTH

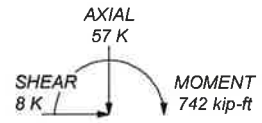
GRADE	Fy	Fu	GRADE	Fy	Fu
A618-50	50 ksi	70 ksi	A572-50	50 ksi	65 ksi
A36	36 ksi	58 ksi			

TOWER DESIGN NOTES

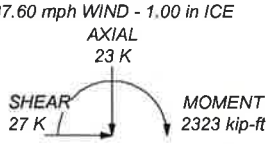
1. Tower is located in Tolland County, Connecticut.
2. Tower designed for a 85.00 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 37.60 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50.00 mph wind.
5. TOWER RATING: 90.3%

MAX. CORNER REACTIONS AT BASE:
DOWN: 151 K
SHEAR: 16 K

UPLIFT: -128 K
SHEAR: 14 K



TORQUE 3 kip-ft
37.60 mph WIND - 1.00 in ICE



TORQUE 11 kip-ft
REACTIONS - 85.00 mph WIND

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

Job: HRT 087 943325 (BU 806383)			
Project: 146GCJ1400			
Client: Crown Castle	Drawn by: AVago	App'd:	
Code: TIA/EIA-222-F	Date: 11/07/14	Scale: NTS	
Path:		Dwg No. E-1	

tnxTower	Job	Page
	HRT 087 943325 (BU 806383)	1 of 21
FDH Engineering, Inc. 6521 Meridien Drive, Suite 107 Raleigh, North Carolina 27616 Phone: 9197551012 FAX: 9197551031	Project 146GCJ1400	Date 15:01:20 11/07/14
	Client Crown Castle	Designed by AVago

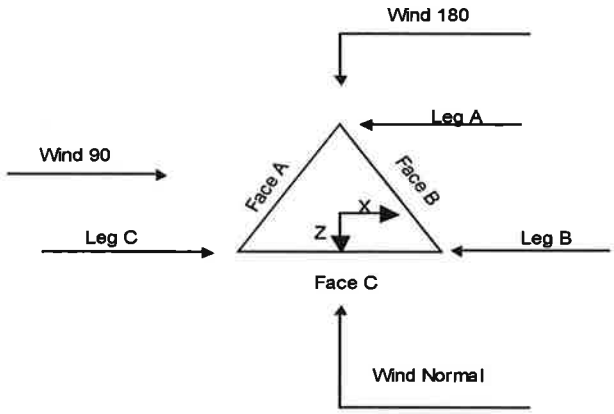
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 140' above the ground line.
The base of the tower is set at an elevation of 0' above the ground line.
The face width of the tower is 6'6-1/4" at the top and 18'9-1/4" at the base.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

- Tower is located in Tolland County, Connecticut.
- Basic wind speed of 85.00 mph.
- Nominal ice thickness of 1.00 in.
- Ice thickness is considered to increase with height.
- Ice density of 56 pcf.
- A wind speed of 37.60 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 50.00 mph.
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in tower member design is 1.333.
- 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	



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	140'-120'			6'6-1/4"	1	20'
T2	120'-100'		08N087	6'6-23/32"	1	20'
T3	100'-80'		09N006	8'7-3/16"	1	20'
T4	80'-60'		10N007	10'7-11/16"	1	20'
T5	60'-40'		11N007	12'8-5/32"	1	20'
T6	40'-20'		12N004	14'9-1/4"	1	20'
T7	20'-0'		13N003	16'9-1/4"	1	20'

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation	Diagonal Spacing	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset	Bottom Girt Offset
	ft	ft				in	in
T1	140'-120'	4'	X Brace	No	No	0.00	0.00
T2	120'-100'	5'	X Brace	No	No	0.00	0.00
T3	100'-80'	6'8-1/32"	X Brace	No	No	0.00	0.00
T4	80'-60'	6'8-1/32"	X Brace	No	No	0.00	0.00
T5	60'-40'	6'8-1/32"	X Brace	No	No	0.00	0.00
T6	40'-20'	10'	X Brace	No	No	0.00	0.00
T7	20'-0'	9'11-17/32"	X Brace	No	No	0.00	1.00

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 140'-120'	Pipe	ROHN 2 STD	A618-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T2 120'-100'	Pipe	ROHN 2.5 EH	A618-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T3 100'-80'	Pipe	ROHN 3 EH	A618-50 (50 ksi)	Single Angle	L2x2x3/16	A36 (36 ksi)
T4 80'-60'	Pipe	ROHN 3.5 EH	A618-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 60'-40'	Pipe	ROHN 4 X-STR	A618-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T6 40'-20'	Pipe	ROHN 5 EH	A618-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T7 20'-0'	Pipe	ROHN 5 X-STR	A618-50 (50 ksi)	Single Angle	L3x3x1/4	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 140'-120'	Equal Angle	L2x2x1/8	A36 (36 ksi)	Single Angle		A36 (36 ksi)
T2 120'-100'	Single Angle	L2x2x1/8	A36 (36 ksi)	Single Angle		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

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
T1 140'-120'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T2 120'-100'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T3 100'-80'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T4 80'-60'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T5 60'-40'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T6 40'-20'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T7 20'-0'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Legs	K Factors[1] X Brace Diags X	K Factors[1] X Brace Diags Y	K Factors[1] Single Diags X	K Factors[1] Single Diags Y	K Factors[1] Girts X	K Factors[1] Girts Y	K Factors[1] Horiz. X	K Factors[1] Horiz. Y	K Factors[1] Sec. Horiz. X	K Factors[1] Sec. Horiz. Y	K Factors[1] Inner Brace X	K Factors[1] Inner Brace Y
T1 140'-120'	Yes	No	1	1	1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1	1
T2 120'-100'	Yes	No	1	1	1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1	1
T3 100'-80'	Yes	No	1	1	1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1	1
T4 80'-60'	Yes	No	1	1	1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1	1
T5 60'-40'	Yes	No	1	1	1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1	1
T6 40'-20'	Yes	No	1	1	1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1	1
T7 20'-0'	Yes	No	1	1	1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1	1

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Net Width Deduct in	Leg U	Diagonal Net Width Deduct in	Diagonal U	Top Girt Net Width Deduct in	Top Girt U	Bottom Girt Net Width Deduct in	Bottom Girt U	Mid Girt Net Width Deduct in	Mid Girt U	Long Horizontal Net Width Deduct in	Long Horizontal U	Short Horizontal Net Width Deduct in	Short Horizontal U
T1 140'-120'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T2 120'-100'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T3 100'-80'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T4 80'-60'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T5 60'-40'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T6 40'-20'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T7 20'-0'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg Bolt Size in	Leg No.	Diagonal Bolt Size in	Diagonal No.	Top Girt Bolt Size in	Top Girt No.	Bottom Girt Bolt Size in	Bottom Girt No.	Mid Girt Bolt Size in	Mid Girt No.	Long Horizontal Bolt Size in	Long Horizontal No.	Short Horizontal Bolt Size in	Short Horizontal No.
T1 140'-120'	Flange	0.63 A325N	4	0.50 A325N	1	0.50 A325N	1	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T2 120'-100'	Flange	0.75 A325N	4	0.50 A325N	1	0.50 A325N	1	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T3 100'-80'	Flange	0.88 A325N	4	0.50 A325N	1	0.50 A325N	0	0.00 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0
T4 80'-60'	Flange	0.88 A325N	4	0.50 A325N	1	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0
T5 60'-40'	Flange	1.00 A325N	4	0.50 A325N	1	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T6 40'-20'	Flange	1.00 A325N	4	0.63 A325N	1	0.63 A325N	0	0.00 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T7 20'-0'	Flange	1.00 A449	4	0.63 A325N	1	0.63 A325N	0	0.00 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
LDF6-50A(1-1/4") ***	A	Yes	Ar (CfAe)	101' - 8'	0.00	0.3	6	6	1.00	1.55		0.66
LDF4-50A(1/2") ***	C	Yes	Ar (CfAe)	60' - 8'	0.00	0.45	1	1	0.63	0.63		0.15
LDF7-50A(1-5/8")	B	Yes	Ar (CfAe)	124' - 8'	0.00	-0.05	6	6	1.00	1.98		0.82
LDF4-50A(1/2") ***	B	Yes	Ar (CfAe)	50' - 8'	0.00	-0.15	1	1	0.63	0.63		0.15
HB158-1-08U8-S8J18(1-5/8)	C	Yes	Ar (CfAe)	137' - 8'	0.00	0.455	1	1	1.00	1.98		1.30
HB158-1-08U8-S8J18(1-5/8)	C	Yes	Ar (CfAe)	137' - 8'	0.00	0.4	1	1	1.00	1.98		1.30
LDF7-50A(1-5/8") *** ***	C	Yes	Ar (CfAe)	137' - 8'	0.00	0.42	12	6	1.00	1.98		0.82
Feedline Ladder (Af)	A	Yes	Af (CfAe)	101' - 8'	0.00	0.3	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af)	A	Yes	Af (CfAe)	60' - 8'	0.00	-0.45	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af)	B	Yes	Af (CfAe)	124' - 8'	0.00	-0.15	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af)	C	Yes	Af (CfAe)	137' - 8'	0.00	0.42	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af) ***	C	Yes	Af (CfAe)	112' - 8'	0.00	-0.4	1	1	3.00	3.00	12.00	8.40
Safety Line 3/8	A	Yes	Ar (CfAe)	140' - 0'	0.00	0	1	1	0.38	0.38		0.22

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
T1	140'-120'	A	0.625	0.000	0.000	0.000	0.00
		B	3.960	1.000	0.000	0.000	0.05
		C	22.440	4.250	0.000	0.000	0.35
T2	120'-100'	A	1.400	0.250	0.000	0.000	0.02
		B	19.800	5.000	0.000	0.000	0.27
		C	26.400	8.000	0.000	0.000	0.52
T3	100'-80'	A	16.125	5.000	0.000	0.000	0.25
		B	19.800	5.000	0.000	0.000	0.27
		C	26.400	10.000	0.000	0.000	0.58
T4	80'-60'	A	16.125	5.000	0.000	0.000	0.25
		B	19.800	5.000	0.000	0.000	0.27
		C	26.400	10.000	0.000	0.000	0.58
T5	60'-40'	A	16.125	10.000	0.000	0.000	0.42
		B	20.325	5.000	0.000	0.000	0.27
		C	27.450	10.000	0.000	0.000	0.59
T6	40'-20'	A	16.125	10.000	0.000	0.000	0.42
		B	20.850	5.000	0.000	0.000	0.27
		C	27.450	10.000	0.000	0.000	0.59
T7	20'-0'	A	9.925	6.000	0.000	0.000	0.25
		B	12.510	3.000	0.000	0.000	0.16
		C	16.470	6.000	0.000	0.000	0.35

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
T1	140'-120'	A	1.179	4.554	0.000	0.000	0.000	0.05
		B		1.446	6.491	0.000	0.000	0.18
		C		18.435	27.585	0.000	0.000	1.30
T2	120'-100'	A	1.155	4.798	1.441	0.000	0.000	0.09
		B		7.151	32.401	0.000	0.000	0.88
		C		21.454	36.942	0.000	0.000	1.70
T3	100'-80'	A	1.128	10.728	28.757	0.000	0.000	0.81
		B		7.060	32.340	0.000	0.000	0.87
		C		21.179	39.846	0.000	0.000	1.80
T4	80'-60'	A	1.094	10.505	28.682	0.000	0.000	0.80
		B		6.948	32.265	0.000	0.000	0.85
		C		20.844	39.697	0.000	0.000	1.77
T5	60'-40'	A	1.051	10.216	35.922	0.000	0.000	1.07
		B		9.081	32.169	0.000	0.000	0.85
		C		24.965	39.505	0.000	0.000	1.78
T6	40'-20'	A	1.000	9.875	35.694	0.000	0.000	1.04
		B		11.017	32.056	0.000	0.000	0.85
		C		24.283	39.278	0.000	0.000	1.73
T7	20'-0'	A	1.000	7.508	21.417	0.000	0.000	0.64
		B		6.610	19.233	0.000	0.000	0.51
		C		14.570	23.567	0.000	0.000	1.04

Feed Line Shielding

Section	Elevation ft	Face	A_R ft^2	A_R Ice ft^2	A_F ft^2	A_F Ice ft^2
T1	140'-120'	A	0.000	0.569	0.059	0.427
		B	0.000	1.025	0.465	0.769
		C	0.000	5.890	2.504	4.421
T2	120'-100'	A	0.000	0.644	0.129	0.494
		B	0.000	4.170	1.943	3.200
		C	0.000	6.172	2.696	4.737
T3	100'-80'	A	0.000	2.799	1.287	2.482
		B	0.000	2.793	1.511	2.476
		C	0.000	4.365	2.217	3.870
T4	80'-60'	A	0.000	2.549	1.522	2.911
		B	0.000	2.551	1.787	2.913
		C	0.000	3.973	2.623	4.537
T5	60'-40'	A	0.000	2.834	2.179	4.044
		B	0.000	2.480	2.113	3.538
		C	0.000	3.905	3.124	5.573
T6	40'-20'	A	0.000	1.887	1.547	2.830
		B	0.000	1.744	1.531	2.617
		C	0.000	2.597	2.218	3.896
T7	20'-0'	A	0.000	1.157	0.913	1.735
		B	0.000	1.013	0.889	1.520
		C	0.000	1.509	1.288	2.263

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	140'-120'	-8.15	5.74	-5.47	3.41
T2	120'-100'	-4.66	3.44	-3.99	2.56
T3	100'-80'	-5.92	-1.87	-5.31	-1.01
T4	80'-60'	-6.27	-2.03	-5.82	-1.18
T5	60'-40'	-8.39	-1.01	-8.24	-0.18
T6	40'-20'	-9.79	-1.35	-9.86	-0.69
T7	20'-0'	-7.65	-1.10	-7.96	-0.73

Discrete Tower Loads

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
Lightning Rod	C	From Leg	0.00 0' 2'	0.000	140'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.25 0.66 0.97 1.49 2.68	0.25 0.66 0.97 1.49 2.68	0.03 0.03 0.04 0.06 0.14
***									
(2) FD9R6004/2C-3L	A	From Leg	4.00	0.000	137'	No Ice	0.37	0.08	0.00

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
			0'			1/2" Ice	0.45	0.14	0.01
			0'			1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
(2) FD9R6004/2C-3L	B	From Leg	4.00	0.000	137'	No Ice	0.37	0.08	0.00
			0'			1/2" Ice	0.45	0.14	0.01
			0'			1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
(2) FD9R6004/2C-3L	C	From Leg	4.00	0.000	137'	No Ice	0.37	0.08	0.00
			0'			1/2" Ice	0.45	0.14	0.01
			0'			1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
Sector Mount [SM 506-3]	C	None		0.000	137'	No Ice	35.47	35.47	1.74
						1/2" Ice	50.60	50.60	2.35
						1" Ice	65.73	65.73	2.95
						2" Ice	95.99	95.99	4.16
						4" Ice	156.51	156.51	6.59
(2) HBXX-6517DS-VTM w/ Mount Pipe	A	From Leg	4.00	0.000	137'	No Ice	8.98	6.96	0.07
			0'			1/2" Ice	9.65	8.18	0.14
			2'			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-VTM w/ Mount Pipe	B	From Leg	4.00	0.000	137'	No Ice	8.98	6.96	0.07
			0'			1/2" Ice	9.65	8.18	0.14
			2'			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-VTM w/ Mount Pipe	C	From Leg	4.00	0.000	137'	No Ice	8.98	6.96	0.07
			0'			1/2" Ice	9.65	8.18	0.14
			2'			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-VTM w/ Mount Pipe	A	From Leg	4.00	0.000	137'	No Ice	8.57	7.00	0.06
			0'			1/2" Ice	9.22	8.19	0.13
			2'			1" Ice	9.84	9.08	0.20
						2" Ice	11.10	10.90	0.38
						4" Ice	13.75	14.93	0.89
LNX-6514DS-VTM w/ Mount Pipe	B	From Leg	4.00	0.000	137'	No Ice	8.57	7.00	0.06
			0'			1/2" Ice	9.22	8.19	0.13
			2'			1" Ice	9.84	9.08	0.20
						2" Ice	11.10	10.90	0.38
						4" Ice	13.75	14.93	0.89
LNX-6514DS-VTM w/ Mount Pipe	C	From Leg	4.00	0.000	137'	No Ice	8.57	7.00	0.06
			0'			1/2" Ice	9.22	8.19	0.13
			2'			1" Ice	9.84	9.08	0.20
						2" Ice	11.10	10.90	0.38
						4" Ice	13.75	14.93	0.89
LNX-8513DS-A1M w/ Mount Pipe	A	From Leg	4.00	0.000	137'	No Ice	8.65	7.08	0.06
			0'			1/2" Ice	9.31	8.27	0.13
			2'			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-8513DS-A1M w/ Mount Pipe	B	From Leg	4.00	0.000	137'	No Ice	8.65	7.08	0.06
			0'			1/2" Ice	9.31	8.27	0.13
			2'			1" Ice	9.93	9.18	0.21

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	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
LNX-8513DS-A1M w/ Mount Pipe	C	From Leg	4.00 0' 2'	0.000	137'	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
RRH2X60-AWS	C	From Leg	4.00 0' 2'	0.000	137'	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-AWS	B	From Leg	4.00 0' 2'	0.000	137'	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-AWS	A	From Leg	4.00 0' 2'	0.000	137'	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	A	From Leg	4.00 0' 2'	0.000	137'	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
RRH2X60-PCS	B	From Leg	4.00 0' 2'	0.000	137'	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
RRH2X60-PCS	C	From Leg	4.00 0' 2'	0.000	137'	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
DB-T1-6Z-8AB-0Z	A	From Leg	4.00 0' 2'	0.000	137'	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
DB-T1-6Z-8AB-0Z	B	From Leg	4.00 0' 2'	0.000	137'	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
***									
(2) DB980H90E-M w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.000	124'	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.07
						1" Ice	4.95	5.22	0.11
						2" Ice	5.87	6.74	0.22
						4" Ice	8.05	10.00	0.55
(2) DB980H90E-M w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.000	124'	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.07
						1" Ice	4.95	5.22	0.11
						2" Ice	5.87	6.74	0.22

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	8.05	10.00	0.55
(2) DB980H90E-M w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.04 4.50 4.95 5.87 8.05	3.62 4.48 5.22 6.74 10.00	0.03 0.07 0.11 0.22 0.55
Sector Mount [SM 502-3]	C	None		0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	33.02 47.36 61.70 90.38 147.74	33.02 47.36 61.70 90.38 147.74	1.67 2.22 2.77 3.88 6.08
7'x2" Antenna Mount Pipe	A	From Face	4.00 0' 0'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.66 2.39 2.83 3.71 5.58	1.66 2.39 2.83 3.71 5.58	0.03 0.04 0.06 0.10 0.27
7'x2" Antenna Mount Pipe	B	From Face	4.00 0' 0'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.66 2.39 2.83 3.71 5.58	1.66 2.39 2.83 3.71 5.58	0.03 0.04 0.06 0.10 0.27
7'x2" Antenna Mount Pipe	C	From Face	4.00 0' 0'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.66 2.39 2.83 3.71 5.58	1.66 2.39 2.83 3.71 5.58	0.03 0.04 0.06 0.10 0.27
*** ***									
(2) RV90-17-02DP w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.59 5.09 5.58 6.59 8.73	3.32 4.09 4.78 6.23 9.31	0.04 0.08 0.12 0.23 0.56
(2) RV90-17-02DP w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.59 5.09 5.58 6.59 8.73	3.32 4.09 4.78 6.23 9.31	0.04 0.08 0.12 0.23 0.56
(2) RV90-17-02DP w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.59 5.09 5.58 6.59 8.73	3.32 4.09 4.78 6.23 9.31	0.04 0.08 0.12 0.23 0.56
(2) KRY 112 13/1	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.33 0.42 0.51 0.72 1.25	0.24 0.32 0.40 0.60 1.09	0.00 0.01 0.01 0.02 0.07
(2) KRY 112 13/1	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.33 0.42 0.51 0.72 1.25	0.24 0.32 0.40 0.60 1.09	0.00 0.01 0.01 0.02 0.07
(2) KRY 112 13/1	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice	0.33 0.42 0.51 0.72	0.24 0.32 0.40 0.60	0.00 0.01 0.01 0.02

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	1.25	1.09	0.07
Side Arm Mount [SO 304-3]	C	None		0.000	101'	No Ice	1.76	1.76	0.07
						1/2" Ice	2.75	2.75	0.10
						1" Ice	3.74	3.74	0.12
						2" Ice	5.72	5.72	0.18
						4" Ice	9.68	9.68	0.28
***									
GPS_A	A	From Leg	2.00 0' 0'	0.000	60'	No Ice	0.30	0.30	0.00
						1/2" Ice	0.37	0.37	0.00
						1" Ice	0.46	0.46	0.01
						2" Ice	0.65	0.65	0.02
						4" Ice	1.15	1.15	0.08
Side Arm Mount [SO 305-1]	A	From Leg	1.00 0' 0'	0.000	60'	No Ice	0.94	1.41	0.03
						1/2" Ice	1.48	2.17	0.04
						1" Ice	2.02	2.93	0.06
						2" Ice	3.10	4.45	0.08
						4" Ice	5.26	7.49	0.14
***									
GPS	A	From Leg	2.00 0' 0'	0.000	50'	No Ice	0.17	0.17	0.00
						1/2" Ice	0.24	0.24	0.00
						1" Ice	0.31	0.31	0.00
						2" Ice	0.48	0.48	0.01
						4" Ice	0.92	0.92	0.05
Side Arm Mount [SO 201-1]	A	From Leg	1.00 0' 0'	0.000	50'	No Ice	2.96	2.11	0.10
						1/2" Ice	4.10	2.93	0.12
						1" Ice	5.24	3.75	0.14
						2" Ice	7.52	5.39	0.18
						4" Ice	12.08	8.67	0.26
***									

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

Comb. No.	Description
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
T1	140 - 120	Leg	Max Tension	8	16.81	0.01	-0.01
			Max. Compression	6	-20.29	0.08	-0.01
			Max. Mx	6	-2.28	-0.82	0.01
			Max. My	9	-1.03	0.01	-0.87
			Max. Vy	6	-1.42	0.60	0.01
			Max. Vx	9	-1.39	0.01	0.52
		Diagonal	Max Tension	5	3.44	0.00	0.00
			Max. Compression	11	-3.54	0.00	0.00
			Max. Mx	23	0.80	0.02	-0.00
			Max. My	7	-2.40	0.00	0.01
			Max. Vy	23	-0.02	0.02	-0.00
			Max. Vx	7	-0.00	0.00	0.00
		Top Girt	Max Tension	8	0.55	0.00	0.00
			Max. Compression	6	-0.52	0.00	0.00
			Max. Mx	14	0.01	-0.04	0.00
			Max. My	26	0.01	0.00	0.00
			Max. Vy	14	0.02	0.00	0.00
			Max. Vx	26	-0.00	0.00	0.00
T2	120 - 100	Leg	Max Tension	8	38.69	-0.09	-0.01
			Max. Compression	6	-44.65	0.21	-0.01
			Max. Mx	6	-44.65	0.21	-0.01
			Max. My	7	-2.95	0.00	-0.17
			Max. Vy	4	0.26	-0.21	0.00
			Max. Vx	7	0.25	0.00	-0.17
		Diagonal	Max Tension	5	3.08	0.00	0.00
			Max. Compression	5	-3.09	0.00	0.00
			Max. Mx	23	0.83	0.02	0.00
			Max. My	11	-3.05	-0.00	0.00
			Max. Vy	21	0.02	0.02	0.00
			Max. Vx	19	0.00	0.00	0.00
		Top Girt	Max Tension	4	0.07	0.00	0.00
			Max. Compression	10	-0.09	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Mx	14	-0.01	-0.04	0.00
			Max. My	15	0.00	0.00	0.00
			Max. Vy	14	0.02	0.00	0.00
			Max. Vx	15	-0.00	0.00	0.00
T3	100 - 80	Leg	Max Tension	8	57.96	-0.13	-0.01
			Max. Compression	6	-66.21	0.14	-0.00
			Max. Mx	6	-51.12	0.21	-0.01
			Max. My	7	-3.69	-0.01	-0.20
			Max. Vy	4	-0.05	-0.21	0.00
			Max. Vx	7	0.05	-0.01	-0.20
		Diagonal	Max Tension	3	3.68	0.00	0.00
			Max. Compression	3	-3.76	0.00	0.00
			Max. Mx	25	0.91	0.03	-0.00
			Max. My	26	-0.50	0.03	0.00
			Max. Vy	25	0.03	0.03	-0.00
			Max. Vx	26	0.00	0.00	0.00
T4	80 - 60	Leg	Max Tension	12	76.21	-0.14	0.00
			Max. Compression	2	-87.35	0.23	0.02
			Max. Mx	6	-87.30	0.23	-0.01
			Max. My	13	-4.31	-0.01	0.23
			Max. Vy	19	-0.05	0.22	-0.00
			Max. Vx	13	-0.06	-0.01	0.23
		Diagonal	Max Tension	3	3.97	0.00	0.00
			Max. Compression	3	-4.05	0.00	0.00
			Max. Mx	23	0.97	0.06	0.01
			Max. My	15	-0.17	0.06	0.01
			Max. Vy	25	0.04	0.06	-0.01
			Max. Vx	15	0.00	0.00	0.00
T5	60 - 40	Leg	Max Tension	12	93.12	-0.20	-0.01
			Max. Compression	2	-107.73	0.32	0.02
			Max. Mx	17	13.84	-0.54	0.00
			Max. My	11	-4.84	-0.01	-0.27
			Max. Vy	17	0.14	-0.54	0.00
			Max. Vx	2	0.07	-0.12	0.25
		Diagonal	Max Tension	3	4.36	0.00	0.00
			Max. Compression	3	-4.43	0.00	0.00
			Max. Mx	23	0.93	0.09	0.01
			Max. My	21	-0.64	0.05	-0.01
			Max. Vy	25	0.05	0.09	-0.01
			Max. Vx	21	-0.00	0.00	0.00
T6	40 - 20	Leg	Max Tension	12	108.30	-0.33	0.01
			Max. Compression	10	-126.17	0.53	-0.02
			Max. Mx	17	15.48	-0.96	0.00
			Max. My	13	-6.47	-0.04	0.65
			Max. Vy	17	0.18	-0.96	0.00
			Max. Vx	13	0.13	-0.04	0.65
		Diagonal	Max Tension	3	5.25	0.00	0.00
			Max. Compression	3	-5.41	0.00	0.00
			Max. Mx	25	0.62	0.11	0.01
			Max. My	21	-1.64	0.09	-0.01
			Max. Vy	25	0.05	0.09	-0.01
			Max. Vx	21	0.00	0.00	0.00
T7	20 - 0	Leg	Max Tension	12	128.73	0.57	-0.01
			Max. Compression	10	-151.43	0.00	0.00
			Max. Mx	17	18.61	-0.96	0.00
			Max. My	13	-7.68	-0.05	0.93
			Max. Vy	6	-8.01	0.00	0.00
			Max. Vx	7	2.18	0.00	0.00
		Diagonal	Max Tension	3	5.58	0.00	0.00
			Max. Compression	3	-5.78	0.00	0.00
			Max. Mx	25	0.27	0.16	0.02

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	21	-2.20	0.15	-0.02
			Max. Vy	25	0.07	0.16	0.02
			Max. Vx	21	0.00	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	10	150.74	14.18	-8.42
	Max. H_x	10	150.74	14.18	-8.42
	Max. H_z	3	-109.98	-10.21	7.33
	Min. Vert	4	-126.41	-12.25	7.29
	Min. H_x	4	-126.41	-12.25	7.29
	Min. H_z	10	150.74	14.18	-8.42
Leg B	Max. Vert	6	150.38	-14.38	-8.13
	Max. H_x	12	-128.11	12.47	7.06
	Max. H_z	12	-128.11	12.47	7.06
	Min. Vert	12	-128.11	12.47	7.06
	Min. H_x	6	150.38	-14.38	-8.13
	Min. H_z	6	150.38	-14.38	-8.13
Leg A	Max. Vert	2	150.70	-0.35	16.53
	Max. H_x	10	-63.49	1.96	-7.40
	Max. H_z	2	150.70	-0.35	16.53
	Min. Vert	8	-127.81	0.30	-14.32
	Min. H_x	5	7.29	-1.96	0.52
	Min. H_z	8	-127.81	0.30	-14.32

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	23.46	-0.00	0.00	2.21	9.67	-0.00
Dead+Wind 0 deg - No Ice	23.46	-0.04	-27.03	-2322.69	15.98	-11.29
Dead+Wind 30 deg - No Ice	23.46	12.74	-22.16	-1928.68	-1097.64	-9.54
Dead+Wind 60 deg - No Ice	23.46	21.70	-12.53	-1093.65	-1888.13	-5.96
Dead+Wind 90 deg - No Ice	23.46	25.55	0.05	8.55	-2215.96	-1.03
Dead+Wind 120 deg - No Ice	23.46	23.38	13.55	1170.12	-2000.34	4.74
Dead+Wind 150 deg - No Ice	23.46	12.82	22.20	1939.34	-1108.59	8.51
Dead+Wind 180 deg - No Ice	23.46	0.04	25.14	2204.80	3.45	10.14
Dead+Wind 210 deg - No Ice	23.46	-12.74	22.16	1933.05	1117.16	9.54
Dead+Wind 240 deg - No Ice	23.46	-23.33	13.47	1159.25	2013.47	6.55
Dead+Wind 270 deg - No Ice	23.46	-25.55	-0.04	-3.98	2235.34	1.03
Dead+Wind 300 deg - No Ice	23.46	-21.74	-12.61	-1104.48	1913.79	-4.18
Dead+Wind 330 deg - No Ice	23.46	-12.81	-22.21	-1934.93	1127.91	-8.51
Dead+Ice+Temp	56.97	0.00	-0.00	7.22	36.05	-0.00
Dead+Wind 0 deg+Ice+Temp	56.97	-0.01	-8.08	-701.59	37.45	-3.17
Dead+Wind 30 deg+Ice+Temp	56.97	3.78	-6.56	-575.74	-298.90	-2.62
Dead+Wind 60 deg+Ice+Temp	56.97	6.41	-3.70	-322.76	-535.39	-1.61
Dead+Wind 90 deg+Ice+Temp	56.97	7.57	0.01	8.57	-636.21	-0.24
Dead+Wind 120 deg+Ice+Temp	56.97	6.99	4.05	362.81	-577.01	1.38
Dead+Wind 150 deg+Ice+Temp	56.97	3.79	6.57	591.56	-301.18	2.38

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 180 deg+Ice+Temp	56.97	0.01	7.42	669.55	34.83	2.79
Dead+Wind 210 deg+Ice+Temp	56.97	-3.78	6.56	590.25	371.17	2.62
Dead+Wind 240 deg+Ice+Temp	56.97	-6.99	4.03	360.53	647.97	1.78
Dead+Wind 270 deg+Ice+Temp	56.97	-7.57	-0.01	5.94	708.48	0.24
Dead+Wind 300 deg+Ice+Temp	56.97	-6.42	-3.72	-325.03	608.98	-1.18
Dead+Wind 330 deg+Ice+Temp	56.97	-3.79	-6.57	-577.06	373.44	-2.38
Dead+Wind 0 deg - Service	23.46	-0.02	-9.35	-802.24	11.86	-3.91
Dead+Wind 30 deg - Service	23.46	4.41	-7.67	-665.91	-373.49	-3.30
Dead+Wind 60 deg - Service	23.46	7.51	-4.34	-376.98	-647.01	-2.06
Dead+Wind 90 deg - Service	23.46	8.84	0.02	4.40	-760.44	-0.36
Dead+Wind 120 deg - Service	23.46	8.09	4.69	406.34	-685.82	1.64
Dead+Wind 150 deg - Service	23.46	4.43	7.68	672.52	-377.25	2.95
Dead+Wind 180 deg - Service	23.46	0.02	8.70	764.38	7.53	3.51
Dead+Wind 210 deg - Service	23.46	-4.41	7.67	670.35	392.89	3.30
Dead+Wind 240 deg - Service	23.46	-8.07	4.66	402.58	703.04	2.27
Dead+Wind 270 deg - Service	23.46	-8.84	-0.02	0.06	779.82	0.36
Dead+Wind 300 deg - Service	23.46	-7.52	-4.36	-380.73	668.57	-1.45
Dead+Wind 330 deg - Service	23.46	-4.43	-7.68	-668.08	396.63	-2.95

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-23.46	0.00	0.00	23.46	-0.00	0.000%
2	-0.04	-23.46	-27.03	0.04	23.46	27.03	0.014%
3	12.74	-23.46	-22.17	-12.74	23.46	22.16	0.022%
4	21.71	-23.46	-12.54	-21.70	23.46	12.53	0.028%
5	25.56	-23.46	0.04	-25.55	23.46	-0.05	0.022%
6	23.38	-23.46	13.55	-23.38	23.46	-13.55	0.014%
7	12.82	-23.46	22.21	-12.82	23.46	-22.20	0.022%
8	0.04	-23.46	25.15	-0.04	23.46	-25.14	0.028%
9	-12.74	-23.46	22.17	12.74	23.46	-22.16	0.022%
10	-23.34	-23.46	13.48	23.33	23.46	-13.47	0.014%
11	-25.56	-23.46	-0.04	25.55	23.46	0.04	0.022%
12	-21.75	-23.46	-12.61	21.74	23.46	12.61	0.028%
13	-12.82	-23.46	-22.21	12.81	23.46	22.21	0.022%
14	0.00	-56.97	0.00	-0.00	56.97	0.00	0.001%
15	-0.01	-56.97	-8.09	0.01	56.97	8.08	0.002%
16	3.78	-56.97	-6.56	-3.78	56.97	6.56	0.002%
17	6.41	-56.97	-3.70	-6.41	56.97	3.70	0.002%
18	7.57	-56.97	0.01	-7.57	56.97	-0.01	0.002%
19	7.00	-56.97	4.05	-6.99	56.97	-4.05	0.002%
20	3.79	-56.97	6.57	-3.79	56.97	-6.57	0.002%
21	0.01	-56.97	7.42	-0.01	56.97	-7.42	0.002%
22	-3.78	-56.97	6.56	3.78	56.97	-6.56	0.002%
23	-6.99	-56.97	4.03	6.99	56.97	-4.03	0.002%
24	-7.57	-56.97	-0.01	7.57	56.97	0.01	0.002%
25	-6.42	-56.97	-3.72	6.42	56.97	3.72	0.002%
26	-3.79	-56.97	-6.57	3.79	56.97	6.57	0.002%
27	-0.02	-23.46	-9.35	0.02	23.46	9.35	0.009%
28	4.41	-23.46	-7.67	-4.41	23.46	7.67	0.010%
29	7.51	-23.46	-4.34	-7.51	23.46	4.34	0.011%
30	8.84	-23.46	0.02	-8.84	23.46	-0.02	0.010%
31	8.09	-23.46	4.69	-8.09	23.46	-4.69	0.009%
32	4.44	-23.46	7.69	-4.43	23.46	-7.68	0.010%
33	0.02	-23.46	8.70	-0.02	23.46	-8.70	0.011%
34	-4.41	-23.46	7.67	4.41	23.46	-7.67	0.010%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
35	-8.07	-23.46	4.66	8.07	23.46	-4.66	0.009%
36	-8.84	-23.46	-0.02	8.84	23.46	0.02	0.010%
37	-7.53	-23.46	-4.36	7.52	23.46	4.36	0.011%
38	-4.44	-23.46	-7.69	4.43	23.46	7.68	0.010%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	7	0.00026353	0.00060163
3	Yes	7	0.00028632	0.00065323
4	Yes	7	0.00030689	0.00069953
5	Yes	7	0.00028639	0.00065352
6	Yes	7	0.00026355	0.00060185
7	Yes	7	0.00028769	0.00065546
8	Yes	7	0.00030740	0.00070085
9	Yes	7	0.00028695	0.00065461
10	Yes	7	0.00026353	0.00060140
11	Yes	7	0.00028695	0.00065452
12	Yes	7	0.00030731	0.00070047
13	Yes	7	0.00028762	0.00065509
14	Yes	6	0.00000001	0.00024080
15	Yes	8	0.00000001	0.00059953
16	Yes	8	0.00000001	0.00059358
17	Yes	8	0.00000001	0.00059404
18	Yes	8	0.00000001	0.00059269
19	Yes	8	0.00000001	0.00059825
20	Yes	8	0.00000001	0.00060525
21	Yes	8	0.00000001	0.00061318
22	Yes	8	0.00000001	0.00061235
23	Yes	8	0.00000001	0.00061235
24	Yes	8	0.00000001	0.00061296
25	Yes	8	0.00000001	0.00061422
26	Yes	8	0.00000001	0.00060662
27	Yes	7	0.00000001	0.00062132
28	Yes	7	0.00000001	0.00063825
29	Yes	7	0.00000001	0.00065451
30	Yes	7	0.00000001	0.00063877
31	Yes	7	0.00000001	0.00062202
32	Yes	7	0.00000001	0.00064106
33	Yes	7	0.00000001	0.00065677
34	Yes	7	0.00000001	0.00063998
35	Yes	7	0.00000001	0.00062161
36	Yes	7	0.00000001	0.00063960
37	Yes	7	0.00000001	0.00065594
38	Yes	7	0.00000001	0.00064017

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	140 - 120	3.76	35	0.254	0.016
T2	120 - 100	2.71	35	0.224	0.015
T3	100 - 80	1.83	35	0.179	0.012
T4	80 - 60	1.14	35	0.135	0.009
T5	60 - 40	0.63	35	0.093	0.006
T6	40 - 20	0.29	35	0.056	0.004
T7	20 - 0	0.08	35	0.029	0.002

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
140'	Lightning Rod	35	3.76	0.254	0.016	93145
137'	(2) FD9R6004/2C-3L	35	3.60	0.250	0.016	93145
124'	(2) DB980H90E-M w/ Mount Pipe	35	2.91	0.231	0.015	29121
101'	(2) RV90-17-02DP w/ Mount Pipe	35	1.87	0.181	0.012	25659
60'	GPS_A	35	0.63	0.093	0.006	28648
50'	GPS	35	0.44	0.074	0.005	33130

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	140 - 120	10.79	2	0.727	0.046
T2	120 - 100	7.79	2	0.642	0.043
T3	100 - 80	5.26	2	0.514	0.034
T4	80 - 60	3.27	2	0.387	0.025
T5	60 - 40	1.82	2	0.268	0.018
T6	40 - 20	0.84	2	0.162	0.011
T7	20 - 0	0.24	2	0.083	0.005

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
140'	Lightning Rod	2	10.79	0.727	0.046	32661
137'	(2) FD9R6004/2C-3L	2	10.33	0.716	0.046	32661
124'	(2) DB980H90E-M w/ Mount Pipe	2	8.36	0.662	0.044	10211
101'	(2) RV90-17-02DP w/ Mount Pipe	2	5.37	0.520	0.034	8953
60'	GPS_A	2	1.82	0.268	0.018	9965
50'	GPS	2	1.28	0.212	0.015	11537

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	140	Leg	A325N	0.63	4	4.08	13.50	0.302 ✓	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	3.44	3.81	0.903 ✓	1.333	Member Block Shear
		Top Girt	A325N	0.50	1	0.55	2.72	0.201 ✓	1.333	Member Bearing
T2	120	Leg	A325N	0.75	4	9.67	19.44	0.498 ✓	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	3.08	3.81	0.808 ✓	1.333	Member Block Shear
		Top Girt	A325N	0.50	1	0.07	2.72	0.025 ✓	1.333	Member Bearing
T3	100	Leg	A325N	0.88	4	14.49	26.46	0.548 ✓	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	3.76	4.12	0.911 ✓	1.333	Bolt Shear
T4	80	Leg	A325N	0.88	4	19.05	26.46	0.720 ✓	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	4.05	4.12	0.983 ✓	1.333	Bolt Shear
T5	60	Leg	A325N	1.00	4	23.28	34.56	0.674 ✓	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	4.43	4.12	1.074 ✓	1.333	Bolt Shear
T6	40	Leg	A325N	1.00	4	27.07	34.56	0.783 ✓	1.333	Bolt Tension
		Diagonal	A325N	0.63	1	5.25	5.10	1.029 ✓	1.333	Member Bearing
T7	20	Leg	A449	1.00	4	32.18	31.10	1.035 ✓	1.333	Bolt Tension
		Diagonal	A325N	0.63	1	5.78	6.44	0.896 ✓	1.333	Bolt Shear

Compression Checks

Leg Design Data (Compression)

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 $\frac{P}{P_a}$
T1	140 - 120	ROHN 2 STD	20'	4'	61.0 K=1.00	22.55	1.07	-20.29	24.23	0.838 ✓
T2	120 - 100	ROHN 2.5 EH	20'3/8"	5'1/8"	65.0 K=1.00	21.84	2.25	-44.65	49.21	0.907 ✓
T3	100 - 80	ROHN 3 EH	20'3/8"	6'8-5/32"	70.5 K=1.00	20.84	3.02	-66.21	62.85	1.053 ✓
T4	80 - 60	ROHN 3.5 EH	20'3/8"	6'8-5/32"	61.3 K=1.00	22.49	3.68	-87.35	82.72	1.056 ✓
T5	60 - 40	ROHN 4 X-STR	20'15/32"	6'8-5/32"	54.3 K=1.00	23.67	4.41	-107.73	104.33	1.033 ✓
T6	40 - 20	ROHN 5 EH	20'3/8"	10'1/4"	65.4 K=1.00	21.78	6.11	-126.17	133.13	0.948 ✓
T7	20 - 0	ROHN 5 X-STR	20'3/8"	9'11-5/8"	65.1 K=1.00	21.83	6.11	-151.43	133.43	1.135 ✓

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 $\frac{P}{P_a}$

Diagonal Design Data (Compression)

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 $\frac{P}{P_a}$
T1	140 - 120	L1 3/4x1 3/4x3/16	7'8-5/32"	3'7-7/16"	126.6 K=1.00	9.32	0.62	-3.54	5.79	0.611 ✔
T2	120 - 100	L1 3/4x1 3/4x3/16	9'8-3/4"	4'9-1/4"	166.7 K=1.00	5.37	0.62	-3.08	3.34	0.923 ✔
T3	100 - 80	L2x2x3/16	12'3-1/4"	6'23/32"	184.5 K=1.00	4.39	0.71	-3.76	3.14	1.198 ✔
T4	80 - 60	L2 1/2x2 1/2x3/16	14'1/4"	6'10-29/32"	167.6 K=1.00	5.32	0.90	-4.05	4.80	0.845 ✔
T5	60 - 40	L3x3x3/16	15'10-11/16"	7'9-31/32"	157.6 K=1.00	6.01	1.09	-4.43	6.56	0.675 ✔
T6	40 - 20	L3x3x3/16	19'1-3/16"	9'5-13/32"	190.3 K=1.00	4.12	1.09	-5.41	4.49	1.203 ✔
T7	20 - 0	L3x3x1/4	20'9-19/32"	10'3-19/32"	208.8 K=1.00	3.42	1.44	-5.78	4.93	1.171 ✔
		KL/R > 200 (C) - 152								

Top Girt Design Data (Compression)

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 $\frac{P}{P_a}$
T1	140 - 120	L2x2x1/8	6'6-1/4"	6'1-5/16"	184.6 K=1.00	4.38	0.48	-0.52	2.12	0.243 ✔
T2	120 - 100	L2x2x1/8	6'6-23/32"	6'1-29/32"	185.8 K=1.00	4.32	0.48	-0.09	2.09	0.044 ✔

Tension Checks

Leg Design Data (Tension)

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 $\frac{P}{P_a}$
T1	140 - 120	ROHN 2 STD	20'	4'	61.0	30.00	1.07	16.30	32.24	0.506 ✔
T2	120 - 100	ROHN 2.5 EH	20'3/8"	5'1/8"	65.0	30.00	2.25	38.69	67.61	0.572 ✔

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 $\frac{P}{P_a}$
T3	100 - 80	ROHN 3 EH	20'3/8"	6'8-5/32"	70.5	30.00	3.02	57.96	90.48	0.641 ✔
T4	80 - 60	ROHN 3.5 EH	20'3/8"	6'8-5/32"	61.3	30.00	3.68	76.21	110.35	0.691 ✔
T5	60 - 40	ROHN 4 X-STR	20'15/32"	6'8-5/32"	54.3	30.00	4.41	93.12	132.22	0.704 ✔
T6	40 - 20	ROHN 5 EH	20'3/8"	10'1/4"	65.4	30.00	6.11	108.30	183.36	0.591 ✔
T7	20 - 0	ROHN 5 X-STR	20'3/8"	9'11-5/8"	65.1	30.00	6.11	128.73	183.36	0.702 ✔

Diagonal Design Data (Tension)

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 $\frac{P}{P_a}$
T1	140 - 120	L1 3/4x1 3/4x3/16	7'8-5/32"	3'7-7/16"	83.3	29.00	0.38	3.44	10.96	0.314 ✔
T2	120 - 100	L1 3/4x1 3/4x3/16	9'8-3/4"	4'9-1/4"	109.0	29.00	0.38	3.08	10.96	0.281 ✔
T3	100 - 80	L2x2x3/16	12'3-1/4"	6'23/32"	119.8	29.00	0.45	3.68	13.00	0.283 ✔
T4	80 - 60	L2 1/2x2 1/2x3/16	14'1/4"	6'10-29/32"	108.2	29.00	0.59	3.97	17.07	0.232 ✔
T5	60 - 40	L3x3x3/16	15'10-11/16"	7'9-31/32"	101.3	29.00	0.73	4.36	21.16	0.206 ✔
T6	40 - 20	L3x3x3/16	19'1-3/16"	9'5-13/32"	122.3	29.00	0.71	5.25	20.65	0.254 ✔
T7	20 - 0	L3x3x1/4	20'9-19/32"	10'3-19/32"	134.5	32.50	0.94	5.58	30.53	0.183 ✔

Top Girt Design Data (Tension)

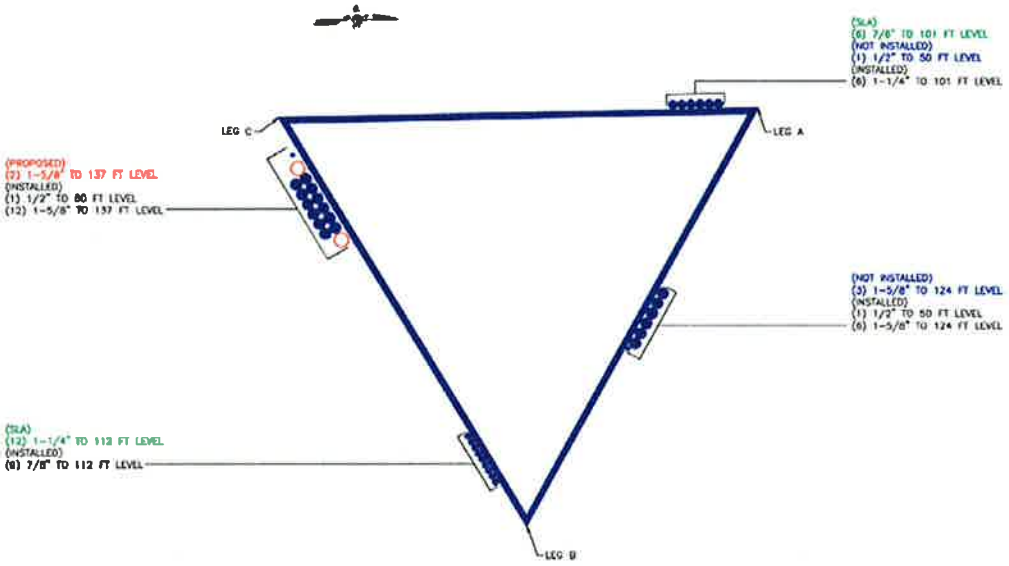
Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	L2x2x1/8	6'6-1/4"	6'1-5/16"	121.2	29.00	0.30	0.55	8.84	0.062 ✔
T2	120 - 100	L2x2x1/8	6'6-23/32"	6'1-29/32"	122.0	29.00	0.30	0.07	8.84	0.008 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	SF*P_{allow} K	% Capacity	Pass Fail
T1	140 - 120	Leg	ROHN 2 STD	2	-20.29	32.30	62.8	Pass
T2	120 - 100	Leg	ROHN 2.5 EH	38	-44.65	65.60	68.1	Pass
T3	100 - 80	Leg	ROHN 3 EH	68	-66.21	83.78	79.0	Pass
T4	80 - 60	Leg	ROHN 3.5 EH	90	-87.35	110.27	79.2	Pass
T5	60 - 40	Leg	ROHN 4 X-STR	111	-107.73	139.07	77.5	Pass
T6	40 - 20	Leg	ROHN 5 EH	130	-126.17	177.46	71.1	Pass
T7	20 - 0	Leg	ROHN 5 X-STR	145	-151.43	177.86	85.1	Pass
T1	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	7	-3.54	7.71	45.8 67.8 (b)	Pass
T2	120 - 100	Diagonal	L1 3/4x1 3/4x3/16	44	-3.08	4.45	69.2	Pass
T3	100 - 80	Diagonal	L2x2x3/16	74	-3.76	4.18	89.9	Pass
T4	80 - 60	Diagonal	L2 1/2x2 1/2x3/16	95	-4.05	6.39	63.4 73.7 (b)	Pass
T5	60 - 40	Diagonal	L3x3x3/16	116	-4.43	8.74	50.7 80.6 (b)	Pass
T6	40 - 20	Diagonal	L3x3x3/16	137	-5.41	5.99	90.3	Pass
T7	20 - 0	Diagonal	L3x3x1/4	152	-5.78	6.57	87.9	Pass
T1	140 - 120	Top Girt	L2x2x1/8	6	-0.52	2.83	18.2	Pass
T2	120 - 100	Top Girt	L2x2x1/8	41	-0.09	2.79	3.3	Pass
							Summary	
						Leg (T7)	85.1	Pass
						Diagonal (T6)	90.3	Pass
						Top Girt (T1)	18.2	Pass
						Bolt Checks	80.6	Pass
						RATING =	**90.3**	**Pass**

APPENDIX B

BASE LEVEL DRAWING


(SLA)
(6) 7/8" TO 101 FT LEVEL
(NOT INSTALLED)
(1) 1/2" TO 50 FT LEVEL
(INSTALLED)
(6) 1-1/4" TO 101 FT LEVEL
LEG C
LEG A
(PROPOSED)
(2) 1-5/8" TO 137 FT LEVEL
(INSTALLED)
(1) 1/2" TO 80 FT LEVEL
(12) 1-5/8" TO 137 FT LEVEL
(NOT INSTALLED)
(3) 1-5/8" TO 124 FT LEVEL
(INSTALLED)
(1) 1/2" TO 50 FT LEVEL
(6) 1-5/8" TO 124 FT LEVEL
(SLA)
(12) 1-1/4" TO 112 FT LEVEL
(INSTALLED)
(8) 7/8" TO 112 FT LEVEL
LEG B

APPENDIX C

ADDITIONAL CALCULATIONS

SST(PAD-PIER) FOUNDATION CALCULATOR (VERSION 1)

Updated: [redacted]

FDH ENGINEERING INNOVATION

PROJECT INFORMATION

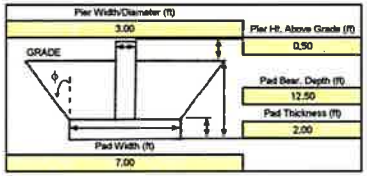
FDH Project No:	146GCJ1400
Client Project Name:	HRT 087 943325
Client Project No:	806383
Date:	11/7/2014
Code (F or G):	F

FOUNDATION INFORMATION

Density Concrete (pcf):**	150
Pier Type (S or R):	R
Pier Width/Diameter (ft):	3.00
Pier Cross. Sect. Area (ft^2):	7.069
Pier Height Above Grade (ft):	0.50
Pad Width (ft):	7.00
Pad Thickness (ft):	2.00
Pad Bearing Depth (ft):	12.50
Frost Depth (ft):	3.00
Water Table Depth (ft):	50.00

SOIL INFORMATION

# of Layers Above Pad:	3	Must Be Int. >=1,<=5
# of Layers Adjacent Pad:	1	Must Be Int. >=1,<=5
Total # of Layers:	4	Must Be Int. >=2,<=6
# of Layers Check	OK	If "OK" then cont. — Checks if # of Layers is within appropriate range
Frost Depth Check	OK	If "OK" then cont. — Checks if the frost depth is between layers
Water Table Check	OK	If "OK" then cont. — Checks if the water table is between layers
Pad Check	OK	If "OK" then cont. — Checks if the top of the pad is between soil layers



LEGEND

Input	
Output	
Notes	
Factors & N/A	
Pass/Fail	PASS/FAIL

BEARING CAPACITY INFORMATION

Gross/Net (G/N):	G
Gross Ws (kip):	261.95
Gross Wc (kip):	26.36
Net Wc (kip):	N/A

FACTORS

FACTORS	Rev-F	Rev-G
Weight Resist.	N/A	0.9
Weight Acting	N/A	1.2
Bearing Resist.	0.5	0.75
Up. Resist. Conc.	0.8	N/A
Up. Resist. Soil	0.50	N/A
Up. Resist. Comb.	0.67	0.75

UPLIFT CHECK

Resistance Forces	(Ultimate)	(Allowable)	Acting Forces		Working %
Wt. Concrete (kip):	26.36	21.09	Tower Uplift (kip):	128	80.57%
Wt. Soil (kip):	261.95	130.97			Pass/Fail
Friction (kip):	13.62	6.81			PASS

COMPRESSION CHECK

Resistance Forces	(Ultimate)	(Allowable)	Acting Forces		Working %
Bear. Cap. (ksf):	40.00	20.00	Tower Comp. (kip):	151	44.52%
Friction (kip):	13.62	6.81	Wt. Conc. (kip):	26.36	Pass/Fail
			Wt. Soil (kip):	261.95	PASS

HELPFUL TIPS

*Enter all resistance forces as ultimate values.

**Enter "# of Layers" prior to entering indiv. layer info.

***The frost depth, water table depth, and top of anchor must fall between two soil layers. If any fall within a soil layer, be sure to split the layer into two layers.

****Do not reduce a soil layer's unit weight to account for bouyancy. This will be calculated and accounted for automatically.

*****Do not enter soil data beyond the depth of the bottom of the pad. Only the soil data from the layers above and adjacent to the pad are required.

Soil Profile							Frustum Calculations						Friction Calculations	
Layer	Depth at Bot. (ft)	Soil Type (C/S)	Unit Wt. (pcf)	Thickness (ft)	Frict. Angle (°)	Cohesion (psf)	Bot. Area (ft^2)	Top Area (ft^2)	Vol. of Soil (ft^3)	Net Vol. of Soil (ft^3)	Net Soil Wt. (kip)	Net Conc. Wt. (kip)	Total Up. (kip)	Total Comp. (kip)
1	3.00	S	115	3.00	35	0	306.36	471.08	1157.33	1136.13	130.65	0.74	0.00	0.00
2	7.80	S	115	4.80	35	0	116.23	306.36	978.07	944.14	108.58	1.19	0.00	0.00
3	10.50	S	115	2.70	35	0	49.00	116.23	216.63	197.55	22.72	0.67	0.00	0.00
4	12.50	S	115	2.00	35	0	N/A	N/A	N/A	N/A	N/A	3.43	13.62	13.62
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Notes	Calc depth at bot. of soil layer given layer thicknesses	Soil Profile Data Input					Calcs area of bottom of frustum	Calcs area of top of frustum	Calcs volume of soil above pad	Calcs net volume of soil above pad	Calcs net weight of soil above pad	Calcs wt. conc. - wt. soil within foundation volume	Sum of all frictional uplift forces for each soil layer	Sum of all frictional compression forces for each soil layer
Equation	Depth above + Layer Thickness						W*L Anch. or TA(bel.)	TW*TL	(1/3)*t*((TA+BA) +sqrt(TA+BA))	Vs-Apier*t	Vs*ys	If Pier:Apier*t*(yc-ys) If Pad:4*W*t*(yc-ys)	Sum(S to S & S to P)	S to P

Pad Locator		Friction Calculations				Universal Calculations							
Layer	Pad? (Y/N)	Soil to Soil (kip)	Soil to Pad (kip)	Adhesion (psf)	Friction Coeff.	Frost Depth? (Y/ N)	Water Table? (Y/ N)	Bouy. Unit Wt. (pcf)	Bouy. Wt. Soil (kip)	Ko	Vert. Press. (ksf)	Rest Press. (ksf)	Rest Resist. (kip)
1	N	0.00	0.00	N/A	0.43	Y	N	115.00	130.65	0.43	0.35	0.07	1.54
2	N	0.00	0.00	N/A	0.43	N	N	115.00	108.58	0.43	0.90	0.26	8.90
3	N	0.00	0.00	N/A	0.43	N	N	115.00	22.72	0.43	1.21	0.45	8.48
4	Y	N/A	13.62	N/A	0.43	N	N	115.00	N/A	0.43	1.44	0.56	7.90
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Notes	Determines location of anchor in soil profile	Calcs soil plug cohesional resistance	Calcs frict. on pad sides	Calcs adhesion based on cohesion	Calcs friction coefficient	Determines if soil layer is within the frost depth	Determines if soil layer is beneath the water table	Calculates bouyant unit weight	Calculates net bouyant weight of soil above pad	Calcs resting earth pressure coefficient	Calcs vertical pressure at bottom of each soil layer	Calcs average resting pressure on each soil layer	Calcs resting force acting on sides of each soil layer
Equation	N/A	0.5*Cu*4*W*t	Adh*(4*SAas) or 4*RPF*FC	(0.31+(0.34/Cu))*Cu	tan((2/3)*φ)	N/A	N/A	ys-yw	(ys-yw)*Vs	1-sin(φ)	Ptop+ys*t	(PVtop+PVbot)*0.5* Ko	RPavg*t*L

SERIES IDENTIFIER & SERIES DEPENDENT CALCULATIONS

Tot., # Adj. Anchor	True/False	Water Table Count,	% Pad Bel. WT	Water Table Count,	% Pier Bel. WT	% Total Bel. WT	Pad Check
6,1	FALSE	0	0.00%	0	0.00%	0.00%	0
6,2	FALSE	0	0.00%	0	0.00%	0.00%	0
6,3	FALSE	0	0.00%	0	0.00%	0.00%	0
6,4	FALSE	0	0.00%	0	0.00%	0.00%	0
6,5	FALSE	0	0.00%	0	0.00%	0.00%	0
5,1	FALSE	0	0.00%	0	0.00%	0.00%	0
5,2	FALSE	0	0.00%	0	0.00%	0.00%	0
5,3	FALSE	0	0.00%	0	0.00%	0.00%	0
5,4	FALSE	0	0.00%	0	0.00%	0.00%	0
4,1	TRUE	0	0.00%	0	0.00%	0.00%	1
4,2	FALSE	0	0.00%	0	0.00%	0.00%	0
4,3	FALSE	0	0.00%	0	0.00%	0.00%	0
3,1	FALSE	0	0.00%	0	0.00%	0.00%	0
3,2	FALSE	0	0.00%	0	0.00%	0.00%	0
2,1	FALSE	0	0.00%	0	0.00%	0.00%	0

SYMBOL KEY

Name	Symbol	Name	Symbol
Pad Width	W	Avg. Rest. Press.	RPavg
Anchor Width	L	Vert. Press. at Top	PVtop
Volume of Soil	Vs	Vert. Press. at Bot.	PVbot
Unit Weight Soil	ys	Side Area Anchor	SAas
Unit Weight Water	yw	Weight of Soil	Ws
Unit Weight Conc.	yc	Weight of Concrete	Wc
Friction Angle	φ	Friction Coefficient	FC
Layer Thickness	t	Rest. Press. Force	RPF
Soil to Soil	S to S	Cohesion	Cu
Soil to Pad	S to P	Adhesion	Adh
Area of Pier	Apier		

Revision Date: 8/30/2013

Steel Check		Legend:
Site Name:	HRT 087 943325	Input
Site ID:	806383	Output
FDH Job Number:	146GCJ1400	Notes

TIA Revision:	F

Enter Load Factors Below:	
For P,V, and M (WL)	1.35
Pad Rebar Info Known?	Yes
One Way Shear Check	
ACI 318 Eqn 11-3	
Shear Area 1 (ft^2)	2.041666667
Shear Area 2 (ft^2)	2.041666667
Controlling b_w (ft)	7
Vu (k)	9.076908136
Vc (k)	188.6356488
ϕVc (k)	141.4767366
Vu/ϕVc	6.42%
OK	
Two Way Shear Check	
ACI 318 Eqn 11-33	
Factored Axial Force (k):	203.85
Wc Pier (k):	11.66316273
Total Factored Load (k):	217.8457953
Useable Bearing (ksf):	4.445832557
Soil Resistance (k):	77.40649213
Vu (k):	140.4393031
f'c (psi):	3000
Clear Cover in Pad (in):	3
Rebar #:	8
D rebar (in):	1
d(in):	20.5
bo (in):	177.4999849
Vc (k):	797.2101148
ϕVc (k):	597.9075861
Vu/ϕVc	23.49%
OK	

Applied Forces	
Axial Force (tnx) (k):	151
Axial Force (P+Wc) (k):	157.5578482
Actual Bearing Stress (ksf):	3.21546629